

Consumer Responses to a Legal Alternative to File Sharing

Michel Clement
Arvind Rangaswamy
Srikant Vadali

February 2010

The authors contributed equally to the study. Michel Clement is Professor of Marketing and Media Management at the University of Hamburg, Arvind Rangaswamy is the Senior Associate Dean and Anchel Professor of Marketing at Penn State University, and Srikant Vadali is Assistant Professor of Marketing at the University of Massachusetts, Lowell. The authors thank Bruce Friedman of Napster, Chris Lawson of Ruckus, and Samuel K. Haldeman and Michael J. Gilpatrick of Penn State University for their help in making data available for this study and Gerrit van Bruggen, Ujwal Kayande, and Dominik Papies for their valuable comments on prior versions of this paper. The authors also thank Christian Ringle for his help with running the PLS models reported in the paper. Corresponding author: Arvind Rangaswamy, The Smeal College of Business, Penn State University, 210E Business Building, University Park, PA 1680. Email: arvindr@psu.edu

Consumer Responses to a Legal Alternative to File-Sharing

Abstract

In recent years, several free and legal alternatives have become available to college students to download music files. These services may be viewed as “service interventions” that could change the mental models of students toward illegal file sharing, and result in lower downloads of illegal music files. Using the theory of planned behavior to represent mental models, we use cognitive dissonance theory to articulate the hypothesized changes to mental models. We collected data via natural field experiments at a US University and use partial least squares estimation to test our hypotheses

We find that service interventions reduce the extent of favorable attitudes toward illegal file sharing and weaken the relationship between attitude and intent, whereby favorable attitudes toward illegal file sharing do not necessarily translate into a stronger intent to engage in file sharing. However, the interventions also strengthen the relationship between perceived benefits and attitudes toward illegal file sharing, and reinforce the positive impact on intent to file share for those who had engaged in higher levels of file sharing behavior before the interventions.

Keywords

Music Industry
Consumer Acceptance of IT
IT Impacts on Industry and Market Structure
Field Experiment
Theory of Planned Behavior
Cognitive Dissonance Theory

Background and Introduction

In recent years, illegal downloading of media files over the Internet has grown considerably (Bhattacharjee et al. 2007), especially with the advent of peer-to-peer (p2p) networks.¹ These new technologies lead to innovative applications and services (e.g., filesharing) which can have substantial effects on consumer behavior (e.g., Chellappa and Shivendu 2005; Sundararajan 2004). Many consumers rely on these services to find and exchange all kinds of digital products, such as music and movie files on a massive scale (Asvanund et al. 2004) and, in most cases, without appropriate compensation to the copyright owners.(see, for example, bigchampgne.com).

Illegal file sharing through p2p networks has affected sales of albums adversely; the International Federation of the Phonographic Industry (IFPI) and the Recording Industry Association of America (RIAA) record substantial declines in global sales of music albums in the past few years (IFPI 2009; RIAA 2010). Liebowitz (2005) considers various potential explanations for the decline in sales in the music industry and concludes that the most plausible reason is the increasing use of file sharing. Although some authors report only limited empirical support for the negative effects of file sharing on music sales (e.g., Bhattacharjee et al. 2007), there is no doubt that the music industry faces significant challenges due to piracy. Consumers in the 18–35 year age group, particularly college students, have the highest incidence of illegal file sharing (IFPI 2009). For marketers of digital products, this growth of illegal file sharing represents a major challenge for realizing revenue, because when consumers themselves “produce the product,” their marginal cost of production is close to zero. In competitive markets,

this would lead to the situation of price (i.e., marginal revenue) being close to zero. One way to address this challenge is to attempt to change people's attitudes and behaviors so they have a higher willingness to pay for the legal version of the product. Sinha and Mandel (2008) propose that marketers could attempt to increase consumers' willingness to pay by using either positive or negative incentives that lower piracy.

A negative incentive approach would be to actively use the judicial system to enforce copyright laws (IFPI 2009). This involves identifying users of p2p networks and suing them for breach of copyright laws. However, it is not always possible to identify p2p users because of technical and privacy issues. Moreover, changing the behavior of students with lawsuits alone is particularly challenging, because the younger generation has grown up with a different value system when it comes to intellectual property and copyright protection (Sinha and Mandel 2008; Chellappa and Shivendu 2005). Although this approach has reduced piracy to some extent, negative incentives appear to intensify the tendency of some consumers to pirate music (IFPI 2009, Sinha and Mandel, 2008)

An alternative way to reduce illegal file sharing is to use positive incentives. Sinha and Mandel (2008) show that positive incentives encourage all consumers to reduce piracy. One example of a positive incentive is to relax digital rights management (DRM) restrictions on purchased song tracks (Sinha, Machado, and Sellman 2010). The presence of DRM that limits their freedom to share purchased song tracks with other consumers has been a major stumbling block for consumers in purchasing legal versions of music files.

In this paper, we explore the effectiveness of a different type of positive incentive to encourage students to use legal alternatives to illegal file sharing. Our approach is based on the

fact that music is increasingly being offered as a service via subscriptions or advertising (e.g., Napster 2.0 Ruckus, Rhapsody), rather than as a product purchased by consumers (with or without DRM). In fact, in several countries (e.g., Germany) there are Government-level discussions underway to consider establishing “content flat rates” (e.g., the “Berlin Declaration” in 2004). Content flat rates are based on the idea of a trusted data gathering society that oversees the measurement of transfers of protected works over the Internet and then compensating the rights holders based on the actual demand for their work by end users. The funds for compensating the rights owners can come from various sources, including taxes. Would subscription or advertising based “service” interventions change the attitudes of consumers and reduce their use of illegal file sharing? How should we conceptualize and measure potential changes to attitudes and behaviors caused by digital services? These are the important research questions we explore in this paper. Answers to these questions will help owners of digital content in designing effective legal service alternatives to illegal file sharing.

In January 2004, Pennsylvania State University (PSU) became the first university in the world to offer its students legal music access by providing them with free subscriptions to Napster 2.0 service.² The subscription was free to students (via an Information Technology fee, which is comparable to the notion of content flatrate mentioned above) was available to students as long as they were directly affiliated with the university. In the fall of 2007, PSU terminated the Napster services and signed a contract with Ruckus for providing its students access to the nearly 3 million songs available from Ruckus, which was supported by an advertising model. By offering legal music services, such as the Napster 2.0 and Ruckus, PSU hoped to reduce its legal liabilities and reduce network congestion while also enabling students to learn about and respect

the rights of copyright owners, and change their attitudes toward file sharing³. From the perspective of a student using illegal file sharing programs, the availability of a free and legal alternative reduces potential exposure to lawsuits and decreases vulnerability to computer viruses. The students also have the additional positive incentives of saving money and engaging in behaviors considered appropriate by society at large. The above two service interventions, namely, Napster 2.0 and Ruckus provided us the context and opportunity to do before-after field experiments to assess whether and how these interventions influenced student attitudes and behaviors toward illegal file sharing.

In both settings, we explore two research questions: (1) Do the service interventions reduce students' intent and self-reported use of file-sharing programs? The availability of a free legal alternative to music piracy would reduce network congestion only if students start using the legal alternative instead of illegal file-sharing programs. (2) What changes to music consumption attitudes and behavior are induced by the availability of legal music services? We study these two research questions by framing them within the theory of planned behavior (TPB; Ajzen 1991) and test our propositions in field experiments using both survey data and unobtrusive measurements of actual service usage.

Our research method differs in important ways from other research in the nascent literature on music piracy: First, we conduct natural field experiments using realistic interventions, namely, the provision of legal music systems to counter the use of illegal file sharing. Unlike prior studies that rely on surveys of selected subjects, our experimental approach reduces several threats to the internal validity of the results. Second, we study two different service interventions, which allow us to assess the validity and reliability of our results. Finally,

we were also able to obtain partial data on actual behavior of our subjects (i.e., music consumption through the legal channel) to help assess whether model predictions about intent to engage in illegal file sharing is correlated with actual behaviors.

We find that the service interventions have mixed effects on file sharing behavior. Although the interventions brought several favorable changes in the mental models of those who used the legal file service (i.e., changes that could lead to lower levels of illegal file sharing), not all the effects were favorable. For example, even though the interventions decreased the students' favorable attitudes towards file sharing programs, they also reinforced the perceived benefits and costs of illegal music files (as compared to the legal alternative). In other words, those students who continued to believe that file sharing programs offer greater benefits than legal alternatives were likely to develop more favorable attitudes towards file sharing programs as a result of the intervention. Finally, we find a marginally significant negative correlation between intent to use illegal file sharing and the number of legal files downloaded by our subjects. Our results suggest that even with free service interventions, mental model changes are modest (though favorable), and therefore, firms would need to provide effective alternatives to illegal files sharing in order to dampen such activities online.

In the next section, we articulate the theoretical framework underlying our study. Subsequently, we summarize the structure of the field experiments we conducted to evaluate the effects of the alternative legal services for music downloading. We then summarize the results, and on the basis of these results, offer some implications for theory and practice.

Theoretical Framework and Propositions

Modeling the Influence of Service Interventions

Our study is based on a simple premise. People have mental models to help them determine and execute the appropriate behaviors in various situations they encounter in their lives. Our focus here is on mental models associated with illegal music file sharing, and specifically, in understanding whether and how the availability of *legal* download services can change mental models associated with *illegal* file sharing in a manner that leads to lower incidence of illegal file sharing.

A mental model can be described as the internal image in the mind of a human being about how the world (real or perceived) works (e.g., Senge 2006, p.8). For example, a baseball catcher has a mental model of how a baseball traverses through space under different conditions, and instinctively relies on that mental model when playing on the field. Mental models help people interpret or understand their environments and predict the potential results of explicit behaviors (Jacob and Shaw, 1998). Thus, baseball players use their mental models to predict where a ball is going to land and to estimate at what speed and in which direction they must run to catch the ball. Note, however, that a player is unlikely to be able to articulate the mental model that implicitly represents the physics of how a ball traverses space. Instead, based on years of practice and training, the player develops a well-refined intuitive model of the behavior of balls as they travel through space and uses that mental model when playing a game. Thus, mental models exert subtle but powerful influence on our behaviors, and studying behaviors can help us infer the mental models that people have.

People have different types of mental models for different aspects of their lives. For perceptions about self, the mental model may be termed as self-schema (Fiske and Taylor 1984). Each one of us has a self schema that governs perceptions determining the types of activities we will be involved in and how we react to the actions of others. Likewise, for people to engage in certain kinds of behavior consistently over a period of time, we propose that the theory of planned behavior (TPB) offers a useful representation of the mental model that drives such behavior⁴. TPB is the best known and most extensively studied model for predicting behavior, especially those that are deliberative and under the volitional control of the subject, as is the case with illegal file sharing behavior (Ajzen 1991, Beck and Ajzen 1991, Lwin and Williams 2003, Mathieson, 1991)⁵. A meta analysis of numerous studies shows that a substantial portion of the variance in behavioral intentions and actual behaviors can be explained by the constructs introduced in the TPB theory (Armitage & Conner, 2001).

The TPB posits that knowledge or beliefs (here, the beliefs pertain to potential Costs (C) and Benefits (BEN) of file sharing) alone do not drive behavior (here, file sharing and music consumption). Between knowledge and behavior lie several psychological constructs, such as Attitudes (AT) about the specific behavior, the Subjective Norms (SN) that promote or deter such behavior (e.g., social pressures), and Perceived Behavioral Control (PBC) which refers to the perception of control the subject has about exercising a specific behavior (Figure 1). These constructs together determine a person's Behavioral Intent (BI) regarding the behavior of interest, which drives his or her actual Behavior (B).

We follow Bamberg, Ajzen, and Schmidt (2003), and add a link from Past Behavior (PB) to Intent (BI), which enables us to control for past behavior, and to assess whether past behavior

(habit) alone is enough to explain intent or actual behavior in the case of file sharing. According to TPB, past behavior alone cannot explain intent or future behavior, especially if the behavior is under volitional control. Furthermore, the TPB model suggests that changes in behavior are unlikely to occur without changes in the underlying attitudes, norms, or perceived control. Figure 1 provides an overview of the version of TPB that we think is the most appropriate mental model for representing how people understand and respond to file sharing options (see, also, d'Astous, Colbert, and Montpetit 2005; Wang 2005).

[Insert Figure 1 about here]

Our concern in this study is not about mental models per se, but about how service interventions might change mental models. Specifically, we wish to explore whether the availability of a legal music alternative (a service intervention) has the potential to change the mental model that a group of target customers has about illegal file downloading. To change people's behavior (e.g., to reduce illegal file downloading), it makes sense to first attempt to change their mental models about illegal file sharing. This is one of the strategies being followed by the media industry in their various campaigns against illegal downloading. However, mental models are difficult to change, even if they are related to faulty behavior (Dorner 1996). We need careful studies to understand and assess the efficacy of a "change the mental model" strategy.

While people resist changes to their mental models and the corresponding behaviors, changes do occur gradually or radically depending on an individual's motivation and external interventions they encounter. An external intervention in this study is a service intervention in the form of a "free" online legal music service. When students engaged in illegal file sharing use

the new legal file sharing option, this is likely to create cognitive dissonance (a discord between beliefs and behavior), because their behavior is *inconsistent* with their attitudes, which is still favorable toward illegal file sharing. According to cognitive dissonance theory (see, for example, Festinger 1957), people will try to minimize dissonance through various means, such as by changing their attitudes (e.g., their beliefs about the costs or benefits associated with illegal file sharing), their behavior (e.g., go back to illegal file downloading), or they may reduce the importance of the dissonant beliefs (e.g., “forgetting,” “bolstering,” or “trivializing”). For example, as a result of the free service intervention, people might believe that the economic and moral costs associated with illegal file downloading have gone up (i.e., a change to the level of a construct), or they might alter the strength of the relationship between favorable attitudes to illegal file sharing and their actual illegal downloading behavior (i.e., a change in the degree of construct relationship).

We recognize that changes to mental models, especially changes to the strengths of the relationships between constructs, are likely to occur gradually, which is why we allow for several months in which our subjects are exposed to an intervention before we measure a change in the structure of the mental model. The expected gradual change in mental model structure is similar to the “bookkeeping model for stereotype change” proposed by Weber and Crocker (1983). When an intervention has effects that take time to play out fully, or if the effects are non-uniform in a target population, it is sensible to evaluate that intervention using a “formative” approach rather than a “summative” approach. The program evaluation literature distinguishes between the summative approach, where the interest is mainly in understanding the outcomes associated with an intervention, and the formative approach, where the interest is in understanding the

processes and conditions under which the effects of an intervention are observed (Rossi, Lipsey, and Freeman 2004). The TPB model offers a formative approach to evaluate the changes that result from an intervention.

To summarize, the conceptual framework guiding our study encompasses the following three ideas: (1) The theory of planned behavior is an appropriate framework for representing the mental model of how people think and act when choosing to download illegal music files; (2) Legal music downloading services are service interventions that can alter mental models, thereby leading to changes in attitudes and behaviors with respect to illegal file sharing; (3) A quasi field experiment provides us a realistic, yet controlled, mechanism to study and measure the changes to mental models that result from an IT-intervention.

A few other studies have examined the drivers of intent to file share but they rely on frameworks that seem ad hoc compared with the TPB model. For example, Gopal et al. (2004) find that the intent to file share correlates negatively with an index they develop to measure a person's ethical and moral dispositions. Kwong et al. (2003) survey Hong Kong consumers and report that the perceived social benefit of dissemination and anti-big business attitudes are associated with favorable intent toward purchasing pirated CDs, whereas the social cost of piracy and ethical beliefs have negative influences on that intent. There have also been a few studies of illegal file sharing within a laboratory setting. d'Astous, Colbert, and Montpetit (2005) conducted a laboratory experiment with college students to assess the relative efficacies of three different types of antipiracy arguments that stress: (1) the negative personal consequences of pirating music, (2) the negative consequences for the artists, and (3) the unethical nature of piracy behavior. Their results indicate that attitudes, prior piracy behavior, social norms, and

perceived control influence file-sharing intent, but none of the three antipiracy interventions had any effect on intent. In essence, d'Astous, Colbert, Montpetit (2005) used antipiracy arguments as an intervention to study their impact on file sharing. In contrast, our study investigates the impact of an actual IT-based service intervention designed to change the attitudes and behavior of students.

Within the marketing area, Sinha and Mandel (2008) conduct three separate laboratory studies to model student's willingness to pirate music. They find that the tendency to pirate depends on positive incentives (e.g., service quality of a legal service), negative incentives (e.g., perceived risks associated with law suits), and consumer characteristics. They conclude that negative incentives are a strong deterrent on some consumers, but can increase piracy tendency among other consumers, but positive incentives reduce piracy tendency among all consumers. Sinha, Machado, and Sellman (2010) conduct two laboratory studies that provide evidence that removing digital rights management (DRM) from song tracks has the potential to influence student attitudes and behavior towards illegal file sharing programs and lower pirating tendencies among students, while also benefiting the digital rights owners by increasing student's willingness to pay. Unlike the current study, neither of the above two studies specifically tested for the effects of an actual service intervention on piracy tendency, or changes to subjects' mental models that result from a service intervention.

Research Hypotheses

In this section, we propose specific hypotheses to articulate how mental models of illegal file sharing change as a result of the availability of a legal file downloading service. As discussed earlier, based on the theory of cognitive dissonance, we expect three types of effects,

namely, (1) changes in beliefs, as captured by changes to the levels of the TPB constructs, (2) changes in the importances attached to different cognitions, i.e., to the relationships between the constructs of the TPB model, and (3) change in actual behavior related to illegal file sharing. We elaborate on these three types of effects and offer specific hypotheses. Figure 1 offers a graphical summary of what we expect to find in our experiments.

Changes in beliefs. As compared to the control groups, we expect the treatment groups to have lower intent to engage in file-sharing behavior (i.e., a change in beliefs), as well as have lower levels of stated past use of illegal file sharing (i.e., a change in behavior). We also propose that, as compared to the control groups, the treatment groups would have less favorable attitudes toward illegal file sharing (i.e., lower perceived benefits and higher perceived costs) and lower perceived behavioral control with respect to illegal file sharing. One reason for expecting a change in attitudes is that subjects who are favorably disposed toward illegal file sharing would engage in counter-attitudinal behavior (i.e., use the new legal service), which in turn, would trigger cognitive dissonance that leads to attitude change. With respect to Subjective Norms, we do not have a priori expectation about what effect an intervention would have, because norms emerge over time as a result of numerous interactions between a focal individual and members of the society, and is less likely to be influenced directly by an intervention.

Changes in importance of beliefs. The second category of effects pertains to changes in path coefficients of the TPB model as a result of an intervention. We now offer specific hypotheses regarding changes to the path coefficients that we expect from cognitive dissonance theory.

H1a (BEN-AT): The service intervention will intensify the positive effects of perceived benefits on favorable attitudes toward illegal file sharing.

H1b (C-AT): The service intervention will intensify the negative effects of perceived costs on favorable attitudes toward illegal file sharing.

The rationale for both hypotheses is that the participants in our study will adjust the importance of the BEN-AT and C-AT relationships to reduce cognitive dissonance. Specifically, those who continue to perceive the benefits of illegal file sharing, even after experiencing the legal music system, will increase the importance of those benefits in forming their attitudes, which will serve to reduce dissonance. And, those who perceive fewer benefits of illegal file sharing (e.g., no difference in price between the “free” legal and illegal alternative) after experiencing the legal music service will reduce the importance of Benefits in forming their Attitudes. Thus, the relationship between perceived Benefits and Attitudes will be intensified (i.e., magnified) as a result of the intervention. A similar set of arguments applies to explaining the relationship between Cost and Attitude. Although H1a and H1b may seem counter-intuitive from a common sense perspective, they are a consequence of the cognitive dissonance theory.

H2 (AT-BI): The service intervention will weaken the positive effects of favorable **Attitudes** towards file sharing on the **Intent** to use file sharing in the future.

The rationale for H2 is that those who continue to have favorable AT and stronger BI after the intervention do not experience any cognitive dissonance. Likewise, those who have unfavorable AT and weaker BI after the intervention also do not experience cognitive dissonance. The situation where someone has unfavorable AT but strong BI is unlikely (unless the service intervention is truly a poor service). Thus, cognitive dissonance is likely only among

those who have favorable attitude toward file sharing but have decreased intent toward file sharing as a result of the service intervention. To reduce dissonance, these individuals will have a weaker positive relationship between AT and BI. Thus, overall, Attitude should have weaker influence on Behavioral Intent after the service intervention.

H3 (PB – BI): The service intervention will weaken the positive effect of **Past Behavior** with respect to file sharing on **Intent** to use file sharing in the future.

The rationale for H3 is similar to that of H2. Those who engage in illegal file sharing even when an intervention reduces their intent, experience cognitive dissonance, which is reduced by weakening the relationship between PB and BI. Thus, overall, we expect a weaker relationship between Past Behavior and future Behavior Intent as a result of the intervention.

Regarding the relationships between PBC-BI and SN-BI, these are not constructs of cognitive dissonance theory which is focused mainly on explaining how individuals handle the discrepancies between their attitudes, behavior intent, and behaviors. Nevertheless, if one views PBC and SN as constructs that are akin to attitudes held by individuals, then we might expect that the importance of the PBC-BI and SN-BI links should decrease after our subjects experience the legal music service. Thus, we propose:

H4 (SN-BI): The service intervention will weaken the effects of favorable **Subjective Norms** on the **Intent** to use file sharing in the future.

H5 (PBC-BI): The service intervention will weaken the effects of **Perceived Behavioral Control** of file sharing activities on the **Intent** to use file sharing in the future.

Change in actual behavior. We expect that as a result of the service intervention, actual levels of illegal file downloading will decrease in the treatment group, as compared to the control

group. However, it is extremely difficult to monitor the incidence of illegal file sharing activities of our subjects, particularly because they are unlikely to give us permission to monitor such activities. Instead, we obtained permission to observe their usage levels of legal music services, and assume that the higher levels of legal music consumption indicate lower levels of illegal file sharing behavior, other things equal. Therefore, we hypothesize that the intervention will increase the use of the legal music service by those who express lower intent to engage in illegal file sharing.

Method

Research Design

We employ a two-group (treatment and control group) before-after design for both the Napster and Ruckus studies. We summarize our research design in Figures 2a and 2b using standard notation (e.g., Bernard 2000). In the Napster study, we were able to execute a between-subjects design. Because the service was initially only available to students in residence halls, the differential availability of the service afforded us the opportunity to conduct a natural field experiment to study the effects of the new service intervention. In the Ruckus study, we executed a within-subjects design. Only a sub-group of the students randomly selected for our study chose to subscribe to the Ruckus service, which allowed us to estimate the TPB model for subscribers (treatment) and non-subscribers (control) groups in our sample.

[Insert Figures 2a and 2b here]

Napster 2.0 service intervention. During the trial phase (January–September 2004), the PSU-Napster service was available to PSU students in residence halls (RH). Such students represent approximately 20% of the total student body of 85,000 students. This restriction on service availability enabled us to divide the student population into suitable control and treatment groups. Off-campus (OC) students did not have access to the service, and therefore, belong to the control group, whereas RH students were exposed to the treatment and belong to the treatment group. For both the OC and the RH groups, we measured the TPB variables before the launch of the Napster service, and again after about 15 weeks after launch. In addition to the self-reported TPB measures, we also measured the actual usage of the PSU-Napster service for RH students from January 11 to December 15, 2004 (approximately 48 weeks).

Between January 8 and 11, 2004, before the Napster service became available to anyone, we surveyed a random sample of PSU students about their attitudes and behaviors toward file sharing. We used the entire list of PSU students (at all campuses) as the sampling frame for the study. From this list, we selected 2,000 students and sent them individualized emails inviting them to participate in our Web-based survey. The Web survey accepted responses only from the selected email addresses and accepted only one set of responses per subject. We obtained responses from 311 students (15.6% response rate), which represents a decent response rate for surveys of this type. In return for their participation, we offered students electronic coupons that they could use to obtain two free tracks (i.e., untethered downloads) from Napster. The coupon could be redeemed either through the PSU Napster service or directly from Napster's Web site after a free registration. The RH students in our sample gained access to the PSU-Napster service starting January 12, 2004.

In late April and early May, 2004, we surveyed a stratified sample of students by randomly selecting 1,000 students from the list of RH students (including all those in the first sample) and 1,000 students from the list of OC students. For this survey, we obtained 148 participants from both lists (7.5% response rate). We again gave participating subjects coupons they could redeem for two free tracks from Napster. The lower response rate for our second survey likely reflects that we conducted it during the end of the semester (last week of class), just before final exams, whereas the first survey occurred during the first week of classes.

Ruckus service intervention. In the fall of 2007, PSU discontinued the Napster service and introduced the Ruckus service. This gave us an opportunity to replicate the findings from the Napster study using an entirely new context. Unlike Napster, which is a subscription service (paid by the university), Ruckus is supported by advertising⁶. In August 2007, we conducted a pre-test survey of a sample of students who had been admitted to PSU for fall 2007 (i.e., before the students actually came to campus). After the students activated their PSU accounts (i.e., after formally being admitted to PSU), they were able to access Ruckus. In December 2007, we re-contacted the students and asked them to participate in the post-intervention survey. We also collected usage data (until December 15, 2007) of those students who gave us permission. Because not all the pre-test survey participants subscribed to the free Ruckus service, we had the opportunity to evaluate the mental model changes for both the users (U) and the non-users (NU), which were respectively the treatment group and control groups. The Ruckus study allowed us to do within-subjects analyses, which could reduce the potential effects of unobserved differences between the treatment and control groups.

The sampling frame for the Ruckus study consisted of all 21,190 incoming students who were admitted into all the campuses of PSU for fall 2007. We selected this sampling frame to minimize contamination from prior exposure to the PSU-Napster service. We randomly selected 10% of this sampling frame for our Web-based pre-test survey, from which we were able to obtain 416 responses (19.6% response rate), of which 381 were usable. To encourage participation, we offered our subjects a chance to win one of 15 Amazon.com gift-certificates, each valued at \$100. Unlike the Napster study, we were not able to provide coupons for free permanent downloads from the Ruckus service. For the post-test survey, we sent e-mail invitations only to the 381 subjects who had participated in the pre-test survey. To encourage their participation, we offered them each \$7.50 for just participating in the 15-20 minute survey, and also a chance to win one of 5 Amazon gift certificates for \$100. We obtained 231 usable responses to the second survey (60.6% response rate).

Although there is potential for a selection bias in both studies, as we report later, there were no differences in either gender breakdown or genre preferences between the control and the treatment groups in the Ruckus study, which suggests that a selection bias may not be a serious issue. We also expect selection bias to be a bigger concern in the Ruckus study than in the Napster study. This is because in the Napster study, there is no reason to believe that disposition toward illegal file sharing would depend on whether someone chooses to stay in residence halls instead of in off-campus housing. On the other hand, in the Ruckus study, students more favorably disposed toward illegal file sharing may choose not to subscribe to the Ruckus service, i.e., there could potentially be an interaction between selection and treatment. Note that the Ruckus service was available to all students and not just to residence hall students. To the extent

there are differences in the results from the Napster and the Ruckus experiments, we treat the Napster results as being more valid because of the lower likelihood of selection bias.

Operationalization of Constructs

Self reported data. We measure all TPB constructs with reference to “use of file-sharing programs.” In other words, benefits in our model refer to the benefits that a subject obtains by using (illegal) file-sharing programs, and costs refer to the costs of using file-sharing programs. In most extant research based on TPB, researchers use self-reported indicators of behavior, and the behavior of interest here, namely, file sharing, is difficult, if not impossible, to track because of ethical and technical constraints. However, we obtain individual-level data regarding the actual songs downloaded (tethered downloads from Napster or Ruckus) or streamed from Napster. Table 1 summarizes the scales we developed to measure the constructs of the TPB theory as they pertain to file-sharing behavior, as well as the scale means across our eight groups (OC1, OC2, RH1, and RH2 for the Napster study, and NU1, NU2, U1, and U2 for the Ruckus study).

[Insert Table 1 here]

Data on actual usage. We were able to obtain actual usage data from both Napster and Ruckus for those students who participated in our study and agreed to provide us access to those data. With these data, we can get a rough assessment of whether Intent (as measured or modeled in our study) is correlated with actual behavior in the real world. Specifically, we can explore whether a *decrease* in Intent to use illegal file sharing is associated with an *increase* in use of legal file downloads.

From Napster, we obtained data on the date subscription started, the type of usage (tethered download, streamed, or purchased), time of access, name of artist, track name, album name, and genre name. We used these raw data to compile several weekly indices for each subscriber to capture the volume and variety of music that s/he listens to in a week. For the Ruckus service, we were able to obtain permission from fewer students (75 out of 149 users) to collect their downloading data. Although Ruckus was able to provide data on the number of songs that our subjects listened to (called playcount) and their genre, there were several data errors with respect to the genre of the songs. Therefore, we were able to use only data of the playcounts for each subject (number of songs) from the date of registration to the end of the 16-week period. For subjects who did not give us permission to obtain data, we have the overall average playcount (across all those subjects) during the same period. The usage data for both Napster and Ruckus are summarized in Table 1.

Estimation of TPB Model

We used partial least squares (PLS), a structural modeling approach that is well suited for contexts that involve predictions using complex models, especially with small sample sizes (Fornell and Bookstein 1982; Wold 1985; Chin, Marcolin, and Newsted, 2003; Wixom and Todd 2005). We applied PLS Graph version 3.0 (e.g. Chin, Marcolin, and Newsted 2003; Galletta et al. 2006) and used SmartPLS 2.0 to test for presence of latent classes within our samples (Ringle, Wende, and Will 2005b). The use of PLS helps us avoid estimation problems that can sometimes occur with covariance-based approaches, such as LISREL (Chin, Marcolin, and Newsted 2003). However, our conceptual framework and our approach for modeling the effects

of a service intervention are general enough to be used with other structural modeling techniques.

The difference-in-difference (DID) estimates are appropriate for assessing effects of the treatment (i.e., the service intervention) in the context of our two-group, before-after design. DID estimates control for the effects of factors (e.g., RIAA lawsuits) that could have influenced both the treatment and control groups. The DID framework can be used to assess the effects of the service intervention on the levels of the TPB model constructs and on the changes to the PLS path coefficients of the TPB model. For further details about DID estimation, see for example, Blundell, McCurdy and Meghir (2007). See our Web Appendix for further information about how we implemented DID estimation in our context.

Results

We present our substantive results in three parts. First, we examine the effect of the interventions on the mean levels of the TPB variables. Second, we examine whether the service intervention changes the mental models of the subjects in the treatment group as compared to the control group. Finally, we explore the correlation between intent to engage in illegal file sharing and the use of the legal music service.

Mean Levels of TPB Variables

Table 2 summarizes the means of the constructs of the TPB model from the Napster and the Ruckus studies. All the coefficients in Table 2 have the expected signs according to the TPB model, except for the link between Perceived Behavioral Control and Behavior Intent. However, these coefficients with incorrect signs were all insignificant. In terms of overall means, there are

some statistically significant shifts in the intervening years between the Napster and the Ruckus studies (2004 and 2007). In particular, we observe the following changes in overall (pooled) means when averaged across all subjects in each study: (1) AT has decreased from 4.69 to 4.40 ($p < 0.01$), (2) SN has decreased from 4.97 to 4.47 ($p < 0.01$), (3) PBC has increased from 4.33 to 4.62 ($p < 0.01$), (4) PB has decreased from 2.53 to 2.19 ($p < 0.01$), and (5) BI has had a large decline from 3.64 to 2.75 ($p < 0.01$). In particular, the decreases in the mean values of PB and BI between the two studies suggest that there is an overall decline in the predisposition toward illegal file sharing among college students between the years 2004 and 2007.

[Insert Table 2 here]

When we compare the DID effects across the two studies, there are some similarities in the effects, as well as, some differences. Such a pattern of results is not surprising because the two services are quite different in terms of their features (e.g., Ruckus is advertising supported), and the studies were separated by three years. Nevertheless, there are some interesting similarities on the effects of the interventions on the TPB constructs, which we highlight next.

An important result is that the DID effect of attitudes toward file sharing programs is negative in both studies, though it is only marginally significant in the Napster study ($p = 0.11$). Thus, this result is consistent with our hypothesis, and suggests that students' attitudes toward file sharing became more unfavorable after they experienced either service intervention.

Attitude changes can take a long time to be reinforced, and therefore, the effects we observed did not always reach full statistical significance. Nevertheless, the consistent pattern of results in the two studies is noteworthy, which suggests there is at least some value in battling piracy via legal music service interventions, which can change attitudes. The next important construct we

examine is Behavioral Intent, which has also decreased in both studies, but the differences are not significant.

There were also some statistically significant differences between the two studies on other constructs, but these were not consistent across the two studies. The perceived costs of file sharing increased as a result of the Napster intervention and PBC decreased as a result of the Ruckus intervention. The latter effect was mainly due to a significant increase in PBC in the non-user group. This suggests that students who opted not to subscribe to the Ruckus service got greater familiarity with illegal file sharing programs and learned to use them in effective ways, whereas those in the treatment group did not experience these effects (recall that the students in the Ruckus study were all freshmen). We also note here that differences in effects across the two studies are possibly due to differences in the nature of the Napster and Ruckus services as well as due to differences in the extent of selection bias in these two studies.⁷

Overall, the significance levels of our results suggest that our sample sizes may not have been large enough to generate sufficient statistical power to assess changes in the TPB constructs, although the results are generally in the expected direction. For example, in the Bamberg, Aizen, and Schmidt (2003) study, the sample sizes were over 570 in each group, which resulted in statistically significant results even though their effect sizes (see their Table 1) are comparable in magnitude to ours. In retrospect, it appears that it would take significantly more time and/or stronger intervention efforts to realize larger changes in attitudes, intent, or behavior.

TPB Models for Treatment and Control Groups

Before we examine changes to mental models (i.e., changes in path coefficients of TPB), we discuss the path coefficients of the TPB model separately for each of the eight groups in our study. Within each group, we also tested for the existence of latent classes using FIMIX-PLS (Ringle, Wende, and Will 2005a). In all cases, various information criteria indicate a one-segment model for both Napster and Ruckus data. Table 3 summarizes the path coefficients of the TPB model.

[Insert Table 3 here]

PLS path coefficients are akin to standardized beta coefficients of OLS. In all groups, we find strong and consistent results for the following path coefficients: (1) When perceived benefits of file sharing are high, users have a more favorable attitude toward using such programs, (2) when perceived costs of file sharing are high, users have a less favorable attitude toward using such programs, and (3) past file sharing behavior has a strong positive effect on future file sharing behavior. There is a moderately strong positive relationship between favorable attitudes toward file sharing and future intent to use file sharing programs. Subjective Norms and Perceived Behavioral Control have weak and inconsistent effects on the intent to use file sharing programs. Our results are broadly consistent with those of a meta analysis of TPB studies conducted by Armitage and Conner (2001). Specifically, we also find that past file sharing behavior alone is not sufficient to explain future file sharing behavior. Other constructs, namely, Attitudes, Subjective Norms, and Perceived Behavioral Control also have some influence on Intent, even after accounting for the effects of Past Behavior. The weak effects of SN on BI have also been observed in many past studies of the TPB model.

The strong effects of PB on BI may be explained as follows: File-sharing technologies require some learning on the part of their users, and those who have engaged in file sharing activities in the past are more likely to participate in such activities in the future. Also, those who have already taken the trouble to install file-sharing software such as Bit Torrent and become familiar with them may continue to use such software, regardless of the availability of other alternatives.

Table 4 summarizes the R^2 's for the endogenous constructs in the TPB model and the average variance explained for the exogenous constructs. Most of the values in the table are reasonable compared to the results of the meta-analysis conducted by Armitage and Conner (2001). In fact, the explanatory indices in our study seem to be higher than the reported averages of other studies. For example, the R^2 's for BI range from 0.35 to 0.75, which compares well with overall average of 0.39 across 154 TPB studies published prior to 1997. Not surprisingly, the *within-subjects* Ruckus study has higher R^2 's for BI (the "dependent variable" in the study) as compared to the *between-subjects* Napster study. Also, note that the R^2 's for the pooled model for BI are, on average, lower than that for the individual models (0.43 for the average of the individual models versus 0.37 for the pooled model in the case of Napster, and 0.59 for the average of the individual models and 0.51 for the pooled model in the case of Ruckus). Thus, developing separate models for the four groups (before-after, control-treatment), instead of single grouped model, improves model fits, and provides justification for evaluating the differences in coefficients between the models, which we consider next.

[Insert Table 4 here]

The Effects of Service Intervention on Mental Models

Figure 3 summarizes the results of our difference-in-difference estimates for the mean path coefficients of the TPB model before and after a service intervention. First, note that the relationships between Benefits and Attitudes and between Costs and Attitudes become stronger after both the Napster and Ruckus interventions. Although the interventions reduced the level of favorable Attitudes (see Table 2), they have also strengthened the effects of costs and benefits in forming their attitudes toward illegal file sharing, thus providing unequivocal support for both H1a and H1b.

[Insert Figure 3 here]

H2 is supported in the case of the Napster service which means that students who used this service were less likely to use file sharing programs even if they have a favorable attitude towards those programs. In contrast, for the Ruckus service, the effect of AT on BI is the opposite of what we predicted (though the absolute magnitude of this DID effect is much smaller than in Napster, and it also has about twice the variance as compared to the Napster data). This effect is primarily due to the users of Ruckus becoming more likely to follow-up favorable attitudes towards file sharing programs by exhibiting a stronger intent to use those programs in the future. Plausible explanations for the Ruckus result include self selection bias associated with our samples, as well as the differences in the perceived or actual quality of Ruckus service in comparison to the Napster service.⁸

H3 is not supported by both studies. In the case of the Napster service, we actually observe an intensifying (rather than a weakening) of the PB-BI link following the service intervention. In the Ruckus study, the PB-BI relationship is unaffected by the service

intervention, which also does not support H3. In the case of the Napster service, it appears that after experiencing the service, some subjects have increased intent to engage in file sharing, requiring a strengthening of the positive PB-BI relationship in order to achieve cognitive equilibrium. That is, those who engaged in more file sharing in the past have higher intentions of engaging in such activities in the future after they experience the Napster service. At the same time, those who did not engage in file sharing in the past, were even less likely to engage in such activities in the future after experiencing Napster. The somewhat different results with respect to the two services points to potential differences in the perceived or actual service quality differences between the two services, although potential changes in the music industry between 2004 and 2007 (see, Bhattacharjee et al. 2007) could also be responsible for these differences.

We also note that our results for the Napster study conflicts with the results reported by Bamberg, Aizen, and Schmidt (2003), who find that past behavior loses its predictive value after an intervention involving prepaid bus tickets. Our results suggest that one should be very careful in designing service interventions so that they do not inadvertently strengthen aspects of the mental models that are adverse to societal interests. H4 is supported by Ruckus results, but the effect is not significant in the Napster study, whereas H5 is supported by both studies, although the magnitudes of the DID effects are small. These significant effects are intuitive, and attest to the value of the interventions in bringing about a desirable change in the mental models of the subjects participating in our study.

Our results provide broad support for the hypothesized changes taking place in the mental models of subjects exposed to the legal music intervention, although not all the effects were in the desirable direction. The results common across the Napster and Ruckus studies reinforce the

reliability of those findings. In those cases where the results differ, they could be due to many reasons, including selection bias (especially in the Ruckus study)⁹, changes in the environmental context for digital music in the intervening years, as well as due to differences in the nature and quality of the two services (e.g., technology improvements between 2004 and 2007). As suggested earlier, there is a lower likelihood of selection bias in the Napster study, and therefore the Napster results have higher validity. In summary, two aspects of our results are noteworthy: (1) There are, in fact, changes in mental models as a result of the service interventions, and (2) the empirical results are broadly consistent with the hypotheses derived from our theoretical framework.

Some observations regarding actual music consumption behavior

Next, we consider the actual music consumption behaviors of our respondents. In 2007, PSU students accessed about 2 million songs every week (<http://live.psu.edu/story/23902>).

In the Napster study, for RH1, we are able to track usage for only 38 participants (out of a possible 79), because not all RH students had access to Napster service during the first semester of its availability. Of these 38, 3 students registered for the service but did not use it at all. In the RH2 group, 6 of the 68 participants had graduated by the time we gathered the usage tracking reports. Of the 62 remaining participants, 8 did not use the Napster service though they had registered for the service. Streaming was much more popular than either downloading or purchasing songs (Table 1). Paid purchases were very low and comparable to media reports that only about 2% of students actually purchase songs (Timiraos 2006). We also observed a novelty effect -- when the Napster service was new (weeks 2–18), students engaged in more experimentation and use, as reflected in the higher levels of both streaming and downloading,

compared with the RH2 group, for whom we measured usage in weeks 34–49. This type of decline in use has also been reported in the general media (Timiraos 2006).

Variety-seeking behavior mirrors usage behavior. Specifically, the number of genres streamed per individual per week declines from 2.96 (RH1) to 2.57 (RH2), and the number of genres downloaded per individual per week drops from .96 (RH1) to .57 (RH2). Variety seeking should be high at the beginning due to the novelty factor, but then decrease after a few months (though it may rise in the long run). Initially, our subjects seem to access the music they know but soon start looking for newer songs, but they typically stick to their favourite genres (e.g., pop, rock) and look within this genre for new releases. This behavior is consistent with expectations for hedonic goods (Kahn, Ratner, and Kahneman 1997).

The Ruckus usage data is sparse. Of the 117 subjects who gave us permission to obtain their usage records, only 80 had registered for the service, of which we were able to use only 75 for the TPB model estimation. 3 of the 75 for whom we have data, listened to only 1 or 2 songs in total during 16 weeks. The mean playcount for Ruckus is roughly the same as we observed in the Napster study, and playcounts also exhibited high variability across subjects (see Table 1).

To explore the relationship between Behavior Intent as represented by the TPB model with actual behavior, we computed the correlation between the predicted values of BI associated with illegal file sharing (as computed by the TPB model) with the average music consumption per day as recorded by the Napster and Ruckus services for our subjects. With RH1 data, this correlation is -0.21 ($p < 0.1$) and for RH2 data, the correlation is -0.22 ($p < 0.05$). For the Ruckus study, the correlation is -0.13 ($p < 0.14$). Although the correlations are weak, they are in the right direction, and provide additional face validity to our TPB model.¹⁰

Discussion and Implications

In the context of piracy for digital products, some scholars argue that a certain level of piracy may support the sales of the original product (Givon, Mahajan, and Muller 1995; Gopal and Sanders 1998). Prasad and Mahajan (2003), for example, show that for software companies, piracy is more than just a threat to their sales, because in many cases, network externalities and lock-in effects, even if initiated through piracy, drive sales of the original product. Media products, such as music or movies, may also experience positive network externalities, but contrary to the software industry, these externalities typically are not segmented into professional and private markets. Further, lock-in effects are much higher for software than for media products, which theoretically limit the positive effects of piracy on sales of the original. Thus, piracy of media files does not lead to higher sales due to network externalities, as is sometimes the case in the software industry, but hurts the copyright owners.

A potential benefit of file sharing for both consumers and copyright holders is consumers' discovery of new music through sampling, which may increase product sales. Liebowitz (2005) evaluates these possibilities as they apply to file sharing of music downloads and concludes that the net impact of file sharing is the reduction in sales of CDs. Our results are consistent with this finding. Based on the data we observed for the Napster service, the initial increase in music consumption and variety seeking decreased over time. Our subjects also engaged in very few purchases of songs.

Planned interventions in the form of offering consumers new services for legal music downloading have the potential to influence the attitudes and behavior of consumers who might

otherwise engage in file-sharing activities. Although we find some favorable effects of the service intervention in terms of modifying mental models (i.e., changes in both the levels of the constructs such as attitudes and intent, and the strengths of the relationships between these constructs), the overall changes were only modest. Specifically, we find that the free legal service interventions *reduced* favorable attitudes, intent, or behavior with respect to illegal file sharing. At the same time, the interventions also crystallized the potential benefits of file-sharing systems for respondents (i.e., led to stronger effects of perceived benefits of file sharing in generating favorable attitudes toward file sharing) and reinforced the intent of those who had used file-sharing systems in the past (i.e., a strengthening of the effects of past behavior on intent). These results suggest some interesting strategies for the distributors of legal file-sharing systems as well as for governmental authorities in the construction of a content flatrate embedded in a new service.

Trying to change consumer attitudes directly may not work. However, interventions in the form of low-cost or advertising-based legal alternatives can weaken the effects of favorable attitudes, subjective norms, and perceived behavioral control on the intent to download illegal files, and also weaken the link between intent to engage in file sharing and subsequent actual file-sharing behavior. At the same time, an intervention can reinforce the benefits of illegal file sharing, and also reinforce illegal file sharing behavior for those consumers who had previously engaged in illegal downloading, especially among those who find that the legal service is not superior to the illegal music files. Thus, our results suggest that it is important to introduce legal alternatives that are at least on par with the illegal alternatives in terms of their features and benefits. Further, if a free service is able to bring about only modest changes to mental models,

it points to the enormity of the challenge facing the music industry as it struggles to have consumers (especially younger ones) pay for legal alternatives. As an example of these challenges, the experience of the band Radiohead is instructive. Even though the band released its album “Rainbows” under a name-your-price model at its Web site (where the offered price could be zero), fans downloaded it from illegal outlets at ten times the rate of new albums by other top acts (Gunderson, 2010). In addition to the specific findings discussed above, our study offers a new methodology for studying how various types of service interventions could potentially alter mental models of users. For example, our framework of mental models, and changes to mental models, can also be used to explore how the use of Google’s search engine (an IT-intervention) modifies mental models and processes of consumers.

Our study has several limitations, which suggest some potential opportunities for further research. Although we use a controlled field experiment, a fully randomized experiment was infeasible. Thus, our study has all the attendant limitations induced by selection bias, though we expect such biases to be minimal because of the procedures we used in the study (e.g., studying two different interventions), and our data support this expectation. Another limitation is that we define and measure intent with respect to illegal file sharing, whereas for actual behavior, we measure the opposite, namely, the use of a legal alternative. We were able to measure actual behavior only with respect to the legal alternative, and we lack corresponding information from our respondents regarding any music files they may have downloaded illegally during the course of our study.

The service interventions we studied were free to the users (Napster was subsidized by the university, and Ruckus was ad-supported), and therefore, we could model only usage

behavior, not adoption behavior. Thus, in terms of external validity, our results and insights may not extend to other types of interventions, such as the iPod from Apple, for which customers must purchase the legal alternative. In future research, it would be useful to untangle how “legal” versus “legal and free” interventions influence changes in mental models. Also, being a US-based study, our results (i.e., effect sizes) may not be applicable to other countries. Finally, we note that we do not measure the opportunity costs associated with the legal music intervention. Other types of interventions (e.g., threat of law suits) may, in fact, be more effective deterrents of illegal file sharing.

In conclusion, our study represents an important first attempt to understand the determinants of an illegal behavior that is growing rapidly in the marketplace, facilitated by easy-to-use information systems tied to ever improving digital infrastructures. Consumers’ use of illegally obtained products represents a substantial problem that affects many industries, including book publishing, movies, and music. Our findings offer useful insights for these and other industries that face similar problems due to illegal availability and use of copyrighted materials. The owners of copyrighted digital materials should explore options to establish viable legal alternatives before illegal alternatives become prevalent and influence the formation of unfavorable attitudes, intent, or behavior toward legal alternatives. From a theoretical and methodological perspective, our study offers a useful framework that other researchers can apply in studying how service and policy interventions change the mental models and behaviors of those who will be affected by those interventions.

References

- Ajzen, I. (1991), "The Theory of Planned Behavior," *Organizational Behavior and Human Decision Processes* 50, 179-211.
- Ang, S. H., P. S. Cheng, A.C. Lim, S. K. Tambyah. (2001), "Spot the difference: consumer response towards counterfeits," *Journal of Consumer Marketing* 18(3), 219-235.
- Armitage C., M. Conner. (2001), "Efficacy of the Theory of Planned Behaviour: A Meta-Analytic Review," *British Journal of Social Psychology* 40(4 December), 471-499.
- Asvanund, A., K. Clay, R. Krishnan, M. D. Smith. (2004), "An Empirical Analysis of Network Externalities in Peer-to-Peer Music-Sharing Networks," *Information Systems Research* 15(2), 155-74.
- Bamberg, S., I. Ajzen, P. Schmidt. (2003), "Choice of Travel Mode in the Theory of Planned Behavior: The Roles of Past Behavior, Habit, and Reasoned Action," *Basic and Applied Social Psychology* 25(3), 175-187.
- Beck, L., I. Ajzen. (1991), "Predicting Dishonest Actions Using the Theory of Planned Behavior," *Journal of Research in Personality* 25(3), 283-301.
- Becker, J. U., M. Clement. (2006), "Dynamics of Illegal Participation in Peer-to-Peer-Networks - Why do People Illegally Share Media Files?," *Journal of Media Economics* 19(1), 7-32.
- Bernard, H. R. (2000), "*Social Research Methods: Qualitative and Quantitative Approaches*," Sage Publications, Thousand Oaks, CA.
- Bhattacharjee, S., R. D Gopal, K. Lertwachara, J. R. Mardsen, R. Telang. (2007), "The Effect of Digital Sharing Technologies on Music Markets: A Survival Analysis of Albums on Ranking Charts," *Management Science* 53(9), 1359-74.
- Bollen, K. A. and R. A. Stine (1992), "Bootstrapping Goodness-of-Fit Measures in Structural Equation Models," *Sociological Methods & Research*, 21(2), November, 205-229.
- Chellappa, R. K., S. Shivendu (2005), "Managing Piracy: Pricing and Sampling Strategies for Digital Experience Goods in Vertically Segmented Markets," *Information Systems Research*. 14(4), 400-417.
- Cheng, H. K., R. R. Sims, H. Teegen. (1997), "To Purchase or to Pirate Software: An Empirical Study," *Journal of Management Information Systems*. 13(4), 49-60.
- Chin, W. W., B. L. Marcolin, P. R. Newsted. (2003), "A Partial Least Squares Latent Variable Modeling Approach for Measuring Interaction Effects: Results from a Monte Carlo Simulation

Study and an Electronic-Mail Emotion/Adoption Study,” *Information Systems Research* **14**(2), 189-217.

d’Astous, A., F. Colbert, D. Montpetit. (2005), “Music Piracy on the Web – How Effective Are Anti-Piracy Arguments? Evidence From the Theory of Planned Behaviour,” *Journal of Consumer Policy* **28**, 289-310.

Dorner, Dietrich (1996), *The Logic Of Failure: Recognizing And Avoiding Error In Complex Situations*, New York, Metropolitan Books.

Fiske, Susan T., and Shelley E. Taylor (1984), *Social Cognition*, New York: Random House.

Festinger, L. 1957. *A theory of cognitive dissonance*, Evanston, IL: Row & Peterson.

Fornell, C., F. L. Bookstein. (1982), “Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-Voice Theory,” *Journal of Marketing Research* **19**(November), 440-52.

Forsythe, S. M., B. Shi. (2003), “Consumer patronage and risk perceptions in Internet shopping,” *Journal of Business Research* **56**(11), 867-75.

Friedman, Milton (1953), *The Methodology of Positive Economics*, in *Essays in Positive Economics*, Chicago, University of Chicago Press.

Galletta, D. F., R. M. Henry, S. McCoy, P. Polak. (2006), “When the Wait Isn't So Bad: The Interacting Effects of Website Delay, Familiarity, and Breadth,” *Information Systems Research* **17**(1) 20-37.

Givon, M., V. Mahajan, E. Muller. (1995), “Software Piracy: Estimation of Lost Sales and the Impact on Software Diffusion,” *Journal of Marketing* **59**(1), 29-37.

Gopal, R.D., G.L. Sanders. (1998), “International Software Piracy: Analysis of Key Issues and Impacts,” *Information Systems Research* **9**(4), 380-97.

Gopal, R. D., C. L. Sanders, S. Bhattacharjee, M. Agarwal, S. C. Wagner. (2004), “A Behavioral Model of Digital Music Piracy,” *Journal of Organizational Computing and Electronic Commerce* **14**(2), 89-105.

Gunderson, Edna (2010), “People are still listening; they just don’t pay,” *USA Today*, Jan 1-3, p. 6W.

Henseler, J., C. M. Ringle, R. R. Sinkovics (2009), “The Use of Partial Least Squares Path Modeling in International Marketing,” *Advances in International Marketing*, **20** 277–319.

Hessing, D. J., H. Elffers, R.H. Weigel. (1988), "Exploring the Limits of Self-Reports and Reasoned Action: An Investigation of the Psychology of Tax Evasion Behavior," *Journal of Personality and Social Psychology* 54(3), 405-413.

IFPI. (2009), *Digital Music Report 2009*. International Federation of the Phonographic Industry. <http://www.ifpi.org/content/library/DMR2009.pdf> (retrieved: 01/02/10).

Jacob, E. K. and D. J. Shaw (1998), "Sociocognitive perspectives on representation", in M. E. Williams (ed.), *Annual Review of Information Science and Technology*, 33, pp. 131-185. Medford, NJ: Information Today for American Society for Information Science.

Kahn, B. E., R. K. Ratner, D. Kahneman. (1997), "Patterns of Hedonic Consumption Over Time," *Marketing Letters* 8(1), 85-96.

Kwong, K. K., O. H. M. Yau, J. S. Y. Lee, L. Y. M. Sin, A. C. B. Tse. (2003), "The Effects of Attitudinal and Demographic Factors on Intention to Buy Pirated CDs: The Case of Chinese Consumers," *Journal of Business Ethics* 47(3), 223-235.

Liebowitz, S. J. (2005), "Pitfalls in Measuring the Impact of File-sharing on the Sound Recording Market," *CESifo Economic Studies* 51(2/3), 439-477.

Lwin, M. O., J. D. Williams. (2003), "A Model Integrating the Multidimensional Developmental Theory of Privacy and Theory of Planned Behavior to Examine Fabrication of Information Online," *Marketing Letters* 14(4), 257-272.

Mathieson, K. (1991), "Predicting User Intentions: Comparing the Technology Acceptance Model with the Theory of Planned Behavior," *Information Systems Research* 2(3), 173-191.

Mazar, N., D. Ariely (2006), "Dishonesty in Everyday Life and Its Policy Implications," *Journal of Public Policy & Marketing* 25(1), 1-21.

Prasad, A., V. Mahajan. (2003), "How Many Pirates Should a Software Firm Tolerate? An Analysis of Piracy Protection on the Diffusion of Software," *International Journal of Research in Marketing* 20(3), 337-53.

Peace, A. G., D. F. Galletta, J.Y. Thong. (2003), "Software Piracy in the Workplace: A Model and Empirical Test," *Journal of Management Information Systems* 20(1), 153-177.

RIAA. (2010), *2008 Year End Statistics*. <http://76.74.24.142/D5664E44-B9F7-69E0-5ABD-B605F2EB6EF2.pdf> (retrieved: 01/03/10).

Ringle, C., W. Wende., S. Will. (2005a), Customer Segmentation with FIMIX-PLS. T. Ahuja., V.E. Vinci, J. Casanovas, A. Morineau, M. Tenenhaus eds. *PLS and related methods: proceedings of the PLS'05 International Symposium*, Barcelona, 507-514.

Ringle, C., Wende, S. Will, S.: SmartPLS 2.0 (M3) Beta, Hamburg 2005b, <http://www.smartpls.de>.

Rossi, Peter H., Mark W. Lipsey, and Howard E. Freeman (2004), *Evaluation: A Systematic Approach*, Sage Publications, CA: Thousand Oaks.

Schoder, D., K. Fischbach. (2003), "Peer-to-Peer Prospects," *Communications of the ACM* 46(2), 27-29.

Senge, Peter M. (2006). *The Fifth Discipline: The Art & Practice of the Learning Organization*. NY: Random House Inc.

Sinha, R. K., N. Mandel. (2008), "Preventing Digital Music Piracy: The Carrot or the Stick?," *Journal of Marketing* 72(1), 1-15.

Sinha, R. K., F. Machado, and Collin Sellman (2009), "Digital Rights Management or Discard Restrictions on Music? DRM, Peer-to-peer Piracy and the Pricing of Digital Music," *Journal of Marketing*, forthcoming

Sundararajan, A. (2004), "Managing Digital Piracy: Pricing and Protection," *Information Systems Research* 15(3), 287-308.

Wang, C.-C. (2005), "Factors that Influence the Piracy of DVD/VCD Motion Pictures," *Journal of American Academy of Business* 6(1), 231-237.

Webb, T. L., P. Sheeran. (2006), "Does Changing Behavioral Intentions Engender Behavior Change? A Meta-Analysis of the Experimental Evidence," *Psychological Bulletin*, 132(2), 249-268.

Wixom, B. H., P. A. Todd. (2005), "A Theoretical Integration of User Satisfaction and Technology Acceptance," *Information Systems Research* 16(1), 85-102.

Wold, H. (1985), Partial Least Squares. S. Kotz, N.L. Johnson, eds, *Encyclopedia of statistical sciences*. Wiley, New York, NY.

Zeithmal V. A., A. Parasuraman, A. Malhotra. (2002), "Service Quality Delivery Through Web Sites: A Critical Review of Extant Knowledge," *Academy of Marketing Science*, 30(4), 362-375.

Footnotes

¹ Peer-to-peer technology enables the identification and sharing of data by a direct exchange between end-users' computers. Media files can be identified easily by their metatags, which makes sharing them very efficient. In addition, p2p networks are based on decentralized paradigms in which files are not stored on a central server. Instead, client software (e.g., the popular eMule) turns PCs into servers that can share files with other PCs connected to the network. The technology's popularity stems from its easy, convenient setup that has empowered informal networks of file sharers to make files available around the globe (Schoder and Fischbach 2003; Becker and Clement 2006).

² A survey of 1,010 colleges and universities conducted in May 2008 suggested that 15.4% of them offer services that provide access to online music and movies (Table 3-13, Fiscal year 2007 summary report, <http://net.educause.edu>).

³ In a statement to the House Judiciary Committee in October 2004, President Spanier of PSU indicated that the legal music service helped universities reclaim about half their network bandwidth, and at the same time provide a valuable service to its students.

⁴ We do not view the TPB mental model to literally be the internal representation in memory of how someone views illegal file sharing programs, or reacts to their availability. Rather, we follow Friedman's notion of "as if" models (Friedman 1953), i.e., it is best to view the TPB mental model as if it represents the collective mental model pattern of a target population, a view that is justified because TPB model has been shown to predict human behavior quite well.

⁵ Note that downloading music files from illegal file sharing networks is risky and people are likely to have a high degree of cognitive involvement before engaging in such behaviors (Mazar & Ariely 2006). Thus, illegal file sharing is likely to be a deliberative behavior for which the use of TPB would be appropriate.

⁶ There was one downside to the free Napster 2.0 service, namely, the potential "switching" costs when students leave the university. Their playlists will not work unless they pay to subscribe to the service, or convert their playlists to other services. With Ruckus, the downside is the accompanying advertisements when the student visits the Ruckus site to access music.

⁷ In the Napster study, the four groups (OC1, OC2, RH1, and RH2) may be non-equivalent because they were drawn from slightly different populations. In the Ruckus study, there is potential for a selection bias between the control and treatment groups because the assignment to these groups was based on the subject's own choice of whether to subscribe to the Ruckus service. To understand the threats to validity of our results because of these selection issues, we first assessed whether the groups in both studies were equivalent on some of their observable characteristics for which we had data. In particular, we were able to compare the groups with respect to age and their preferences for thirteen different music genres. Chi-Square tests indicated no significant differences between the groups. Nevertheless, we expect the results

from the Napster study to have higher validity. (In the interest of space we do not report these results here. Interested readers may contact the authors for further details about the characteristics of our subjects with respect to gender and music preferences.)

⁸ We measured service quality perceptions of both Napster and Ruckus by adapting the well-known multi-item SERVQUAL measure proposed by Zeithaml, Parasuraman, and Malhotra (2002). Although the overall perceptions of quality of both Napster and Ruckus were reasonable in the RH2 and U2 groups respectively (about 5 on average, on 1-7 scales), quality perceptions of Ruckus were significantly lower than Napster ($p < 0.01$) on the following dimensions: reliability, responsiveness, assurance, ease of use, and appeal. The two services did not differ on “perceived usefulness”.

⁹ There is some evidence in our data suggesting selection bias in the case of Ruckus. For example, in Table 3, the coefficient for PB-BI path is much higher in the Non-user groups than in the User groups. Likewise, the variance in the AT-BI coefficient is much larger in the non-user group compared to the user group.

¹⁰ The link between behavioral intent and actual behavior is weak at best, even when intent and actual behavior refer to the same behaviors. Self-reports of behavior are unreliable compared with more objective measures (Hessing, Elffers, and Weigel, 1988). A meta-analysis of the link between intent and behavior indicates that a medium to large change in intent leads to a small to medium change in behavior (Webb and Sheeran 2006).

Table 1: Scales and Means

Construct	Item	Napster Study (Between Subjects)				Ruckus Study (Within Subjects)			
		Mean OC1 (218)	Mean OC2 (93)	Mean RH1 (79)	Mean RH2 (68)	Mean NU1 (82)	Mean NU2 (82)	Mean U1 (149)	Mean U2 (149)
Benefits of File Sharing (Reflective measure adapted from Cheng, Sims, and Teegan 1997). Cronbach's Alpha: 0.70 (Napster); 0.75 (Ruckus)	There is a lot more variety of music available through file sharing programs than on CDs.	5.77	5.75	6.16	5.67	5.31	5.60	5.25	5.48
	I don't listen to the same songs too often.	3.45	3.63	3.28	2.52	3.68	3.37	3.41	3.10
	Without file-sharing programs, most students would not be able to listen to their favorite music.	4.36	4.36	4.69	4.43	4.34	4.61	4.61	4.33
	Music CDs are expensive.	6.09	6.22	6.27	6.03	5.99	6.15	5.96	6.21
	Purchasing individual tracks at 99 cents per track (e.g., at iTunes) is also expensive.	5.48	5.17	5.58	5.34	5.43	5.56	5.41	5.56
	I want to listen to the entire song first before making a purchase.	6.07	5.86	5.78	5.98	5.74	5.93	5.56	5.81
	I want to burn my own custom CDs.	6.04	6.11	5.94	6.03	5.68	5.83	5.74	5.76
	I like file-sharing programs because I don't have to pay anyone to be able to own and listen to music.	5.23	4.94	4.96	5.03	4.99	5.41	5.06	5.43
	There is a lot more variety of music available through file sharing programs than on CDs.	Not asked					4.72	5.57	4.48

Construct	Item	Napster Study (Between Subjects)				Ruckus Study (Within Subjects)			
		Mean OC1 (218)	Mean OC2 (93)	Mean RH1 (79)	Mean RH2 (68)	Mean NU1 (82)	Mean NU2 (82)	Mean U1 (149)	Mean U2 (149)
Costs of File Sharing (Reflective measure adapted from Peace, Galletta, and Thong 2003; Forsythe and Shi 2003). Cronbach's Alpha: 0.64 (Napster); 0.52 (Ruckus)	It is unlikely that copyright holders, or their associations, can really stop people from using file-sharing programs (RC).	4.97	4.82	4.74	4.76	5.13	5.49	4.90	4.94
	There is little chance of being caught using file-sharing programs (RC).	3.79	3.99	3.75	3.65	4.22	4.66	3.87	4.39
	If I am caught using file-sharing programs, I am likely to incur heavy legal expenses.	4.95	4.46	4.58	4.65	4.90	4.93	5.08	4.94
	Songs downloaded using file-sharing programs are of poor quality.	3.14	3.17	3.33	3.28	3.19	3.47	3.23	3.32
	Songs downloaded from file-sharing programs may have hidden consequences like viruses—there is no free lunch.	4.84	4.31	4.51	5.02	5.10	5.24	5.14	5.25
	If I use file-sharing programs, I become vulnerable to having my behavior tracked online.	4.93	4.66	4.54	4.77	4.95	4.74	5.01	4.96
Favorable Attitude Toward File Sharing (Reflective measure adapted from Ang et al. 2001).	Using a file-sharing program violates an unwritten contract between me and the artists (RC).	3.50	3.35	3.30	3.48	3.85	4.21	3.41	4.21
	It is risky to use file-sharing programs (RC).	4.35	4.23	4.20	4.57	4.48	4.35	4.56	4.73

Construct	Item	Napster Study (Between Subjects)				Ruckus Study (Within Subjects)			
		Mean OC1 (218)	Mean OC2 (93)	Mean RH1 (79)	Mean RH2 (68)	Mean NU1 (82)	Mean NU2 (82)	Mean U1 (149)	Mean U2 (149)
Cronbach's Alpha: 0.89 (Napster); 0.85 (Ruckus)	If I use file-sharing programs, I am being unfair to artists by robbing them of royalties (RC).	3.28	3.17	2.76	3.58	4.12	4.04	3.80	4.03
	Using file-sharing programs is unethical (RC).	2.94	3.10	2.77	3.40	3.23	3.82	3.42	3.79
	Using file-sharing programs is illegal (RC).	3.62	3.72	3.48	4.21	4.60	4.65	4.29	4.63
	File-sharing programs help to make even unknown musicians popular.	5.71	5.66	5.78	5.86	5.49	5.87	5.50	5.63
	In the final analysis, file-sharing programs are of real value to the music industry.	5.18	5.30	5.11	5.37	4.27	4.93	4.44	4.66
	Overall, file-sharing programs are beneficial to society.	5.12	5.11	5.04	5.21	4.49	4.79	4.44	4.50
	I do not trust file-sharing programs (RC).	3.72	3.70	3.61	3.83	4.16	4.34	4.18	4.44
	Using file-sharing programs is a waste of my time (RC).	2.43	2.74	2.33	2.74	3.07	3.21	3.00	3.13
	People who download copyrighted materials for free should be prosecuted (RC).	2.38	2.46	2.15	2.78	2.99	2.62	2.88	3.01
	It is against my principles to use file-sharing programs (RC).	2.36	2.66	2.38	3.14	3.13	3.21	2.87	3.25

Construct	Item	Napster Study (Between Subjects)				Ruckus Study (Within Subjects)			
		Mean OC1 (218)	Mean OC2 (93)	Mean RH1 (79)	Mean RH2 (68)	Mean NU1 (82)	Mean NU2 (82)	Mean U1 (149)	Mean U2 (149)
Perceived Behavioral Control (Reflective measure adapted from Peace, Galletta, and Thong 2003). Cronbach's Alpha: 0.80 (Napster); 0.79 (Ruckus)	I am in control when I use file-sharing programs—I only download the songs I need and no more.	5.19	5.06	4.84	4.67	5.03	5.18	4.81	4.52
	I carefully plan what songs I want to download using file-sharing programs.	4.71	4.77	4.57	4.47	4.36	4.83	4.36	4.32
Subjective Norms (Reflective measure adapted from Ajzen (2002), Peace, Galletta, and Thong 2003). Cronbach's Alpha: 0.71 (Napster); 0.66 (Ruckus)	My family thinks it is OK if I use file-sharing programs.	5.31	5.02	5.03	4.55	4.39	4.60	4.11	4.33
	Most people who are important to me would approve of my using file-sharing programs.	5.34	5.29	5.10	4.78	4.77	4.86	4.49	4.59
	I will lose face with my friends or family if I get into legal hassles for using file-sharing programs (RC).	3.38	3.09	3.72	3.36	3.60	3.73	3.56	3.42
Behavior Intention to use File Sharing (Formative measure)	As compared to the past year, next year I intend to download more music files from file-sharing networks	4.14	4.15	4.32	3.32	3.23	3.68	3.35	3.57

		Napster Study (Between Subjects)				Ruckus Study (Within Subjects)			
Construct	Item	Mean OC1 (218)	Mean OC2 (93)	Mean RH1 (79)	Mean RH2 (68)	Mean NU1 (82)	Mean NU2 (82)	Mean U1 (149)	Mean U2 (149)
	As compared to the past year, next year I intend to upload more music files to file-sharing networks	2.28	2.42	2.07	1.87	2.13	2.30	1.98	1.95
Past Behavior (Formative measure)	Frequency of downloading songs using file-sharing programs.	3.35	3.01	3.30	2.74	2.88	2.88	2.99	2.77
	Frequency of uploading songs using file-sharing programs (for others to download).	1.63	1.58	1.21	1.38	1.68	1.61	1.53	1.32
		Napster Study (Between Subjects)				Ruckus Study (Within Subjects)			
Construct	Item	Mean OC1 (218)	Mean OC2 (93)	Mean RH1 (79)	Mean RH2 (68)	Mean NU1 (82)	Mean NU2 (82)	Mean U1 (149)	Mean U2 (149)
Actual Behavior (Napster)	Number of songs streamed (average per respondent)			669.76 (1651.9)	477.81 (822.3)				
	RHI usage is Jan-Apr 2004. RH2 usage is Sept-Dec 2004 (Standard deviation in parenthesis).			238.76 (560.2)	116.29 (269.6)				
	Number of songs purchased (average per respondent)			0.42 (1.03)	1.13 (3.77)				
Variety Seeking (Napster)	Number of different genres streamed (average per respondent and week)			2.96 (3.88)	2.57 (2.99)				
	Number of different genres downloaded (average per respondent and week)			.96 (1.46)	.57 (.96)				

Construct	Item	Napster Study (Between Subjects)				Ruckus Study (Within Subjects)			
		Mean OC1 (218)	Mean OC2 (93)	Mean RH1 (79)	Mean RH2 (68)	Mean NU1 (82)	Mean NU2 (82)	Mean U1 (149)	Mean U2 (149)
Actual Behavior (Ruckus) (Standard deviation in parenthesis).	Average playcount (number of times songs played after download) per user [for the 75 subjects who gave us permission to obtain usage data from Ruckus]								690 (821.2)
	Average playcount for those users who did not give us permission to obtain individual downloading data								580 (n/a)

- (1) All constructs except stated behavior are measured on 1–7 scales, with 1 representing “Strongly Disagree” and 7 representing “Strongly Agree.” Stated behavior items are measured on 1–5 scales ranging from “Never” (1) to “Very Often—a few times a week” (5).
- (2) All means are reported as originally measured. Items marked RC were reverse-coded for further analysis.
- (3) Numbers in parentheses in the table heading refer to numbers of respondents whose data are included in the analysis.
- (4) We compute the Cronbach’s Alphas using the observations in all four conditions for each study (Napster: total sample size = 458; Ruckus: total sample size = 231).

Table 2: Means of the Constructs of the TPB Model

Construct	Napster Service Means				DID	Pooled Mean	Ruckus Service Means				DID	Pooled Mean
	OC1	OC2	RH1	RH2			NU1	NU2	U1	U2		
Benefits	5.31	5.26	5.34	5.13	-0.15	5.28	5.15	5.31	5.13	5.21	-0.08	5.19
Costs	4.19	3.97	4.08	4.22	0.36	4.13	3.98	3.86	4.12	4.04	0.03	4.02
Attitudes	4.68	4.69	4.81	4.58	-0.24	4.69	4.39	4.43	4.50	4.30	-0.25	4.40
Subjective Norms	5.09	5.07	4.81	4.66	-0.13	4.97	4.50	4.55	4.34	4.43	0.03	4.43
Perceived Behavioral Control	4.40	4.45	4.14	4.17	-0.02	4.33	4.69	5.00	4.58	4.42	-0.48	4.62
Past Behavior	2.61	2.58	2.44	2.33	-0.07	2.53	2.28	2.24	2.26	2.05	-0.18	2.19
Behavior Intent	3.63	3.79	3.54	3.55	-0.15	3.64	2.68	2.99	2.66	2.76	-0.22	2.75

- (1) The means of the constructs are computed by averaging the individual-level indicators.
- (2) The difference-in-difference (DID) values for Napster are computed as $DID = (RH2 - RH1) - (OC2 - OC1)$, and for Ruckus as $DID = (U2 - U1) - (NU2 - NU1)$.
- (3) Significant DID values (one-sided test) are shown in **bold** ($p < 0.05$). p-values are obtained using the DID approach described in the Appendix.
- (4) Attitude difference is almost significant in the Napster study ($p < 0.11$), and the change in past behavior is marginally significant in the Ruckus study ($p < 0.06$).

Table 3: Coefficient Estimates and Their Standard Errors

Path Coefficients (Standard Deviation)	Napster Service					Ruckus Service				
	OC1	OC2	RH1	RH2	Pooled	NU1	NU2	U1	U2	Pooled
Benefits	0.41	0.49	0.43	0.61	0.47	0.36	0.28	0.41	0.39	0.34
→ Attitude	(0.06)	(0.07)	(0.11)	(0.08)	(0.04)	(0.08)	(0.07)	(0.07)	(0.05)	(0.06)
Costs	-0.32	-0.27	-0.37	-0.23	-0.30	-0.37	-0.56	-0.34	-0.47	-0.42
→ Attitude	(0.06)	(0.07)	(0.11)	(0.09)	(0.04)	(0.08)	(0.08)	(0.08)	(0.06)	(0.06)
Attitudes	0.13	0.33	0.24	0.11	0.20	0.11	0.12	0.15	0.27	0.17
→ Behavior Intent	(0.08)	(0.11)	(0.13)	(0.09)	(0.06)	(0.26)	(0.26)	(0.08)	(0.08)	(0.08)
Subjective Norms	0.14	0.09	0.08	0.02	0.12	-0.12	0.12	0.13	0.07	0.11
→ Behavior Intent	(0.07)	(0.08)	(0.10)	(0.08)	(0.05)	(0.10)	(0.07)	(0.08)	(0.06)	(0.06)
Perceived Behavioral Control	0.10	-0.04	0.12	-0.04	0.05	0.04	-0.01	-0.02	-0.11	-0.07
→ Behavior Intent	(0.06)	(0.06)	(0.09)	(0.07)	(0.04)	(0.09)	(0.04)	(0.06)	(0.06)	(0.08)
Past Behavior	0.39	0.36	0.43	0.73	0.41	0.73	0.72	0.52	0.52	0.54
→ Behavior Intent	(0.09)	(0.11)	(0.14)	(0.10)	(0.05)	(0.14)	(0.08)	(0.08)	(0.07)	(0.07)

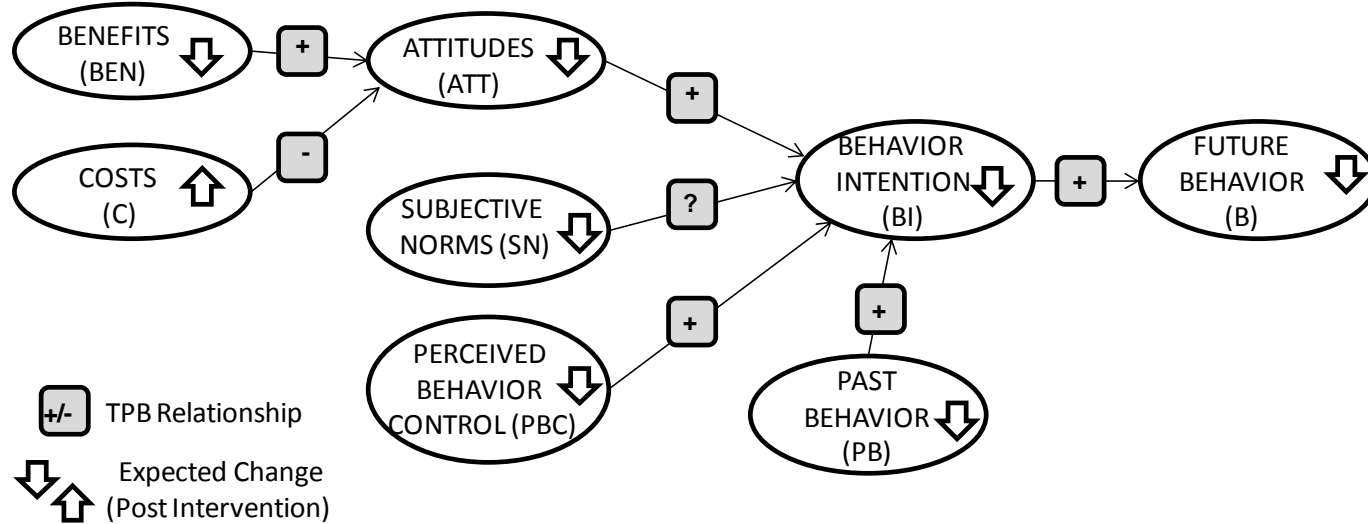
- (1) Significant coefficients are shown in **bold** ($p < 0.05$; one-tailed test). The standard errors of the coefficients were computed via bootstrapping. We used 1,000 bootstrap replications, which should be sufficient for getting stable estimates in each group in our study.
- (2) We estimated the pooled models for both Napster and Ruckus by stacking the data of all groups together and then estimating the TPB model. This means we ignore the within-subjects nature of Ruckus data when computing the pooled coefficients.

Table 4: R² of the Endogenous Constructs and AVE (Average Variance Explained) of Exogenous Reflective Constructs from PLS estimation

Construct	Napster Service					Ruckus Service				
	OC1	OC2	RH1	RH2	Pooled	NU1	NU2	U1	U2	Pooled
Benefit (AVE)	0.29	0.35	0.46	0.32	0.34	0.33	0.31	0.39	0.30	0.34
Costs (AVE)	0.41	0.32	0.31	0.25	0.35	0.27	0.30	0.30	0.39	0.32
Perceived Behavioral Control (AVE)	0.82	0.74	0.87	0.86	0.83	0.61	0.32	0.81	0.89	0.82
Subjective Norms (AVE)	0.64	0.68	0.56	0.64	0.64	0.57	0.56	0.57	0.60	0.58
Attitudes (R ²)	0.31	0.38	0.42	0.48	0.42	0.36	0.47	0.32	0.48	0.36
Behavior Intent (R ²)	0.35	0.41	0.36	0.61	0.37	0.55	0.75	0.48	0.57	0.51
Number of Subjects	218	93	79	68	458	82	82	149	149	462

(1) AVE of 0.5 or higher can be considered to be good. R² values of 0.33 or higher can be considered to be good (Henseler et al. 2009).

Figure 1: Mental Model Framework (The Theory of Planned Behavior)



Notes: The +/- designations indicate the expected signs of the relationships between the constructs as per the TPB model. The Up/Down arrows indicate the expected direction of changes in the construct (i.e., the components of the mental model) after experience with the service intervention.

Figure 2a: Experimental Design for Napster Study

	January 8– 12. 2004	January 12– May 12. 2004	April 27– May 12. 2004	January 11– December 15. 2004
	Pretest	PSU-Napster service	Posttest	PSU-Napster Service
Treatment group (RH)	O _{ST1}	X	O _{ST2}	O _B
Control group (OC)	O _{SC1}		O _{SC2}	

Notes: O_S: Measurement through Web survey; O_B: measurement of usage of Napster service; and X: Intervention (Napster service availability).

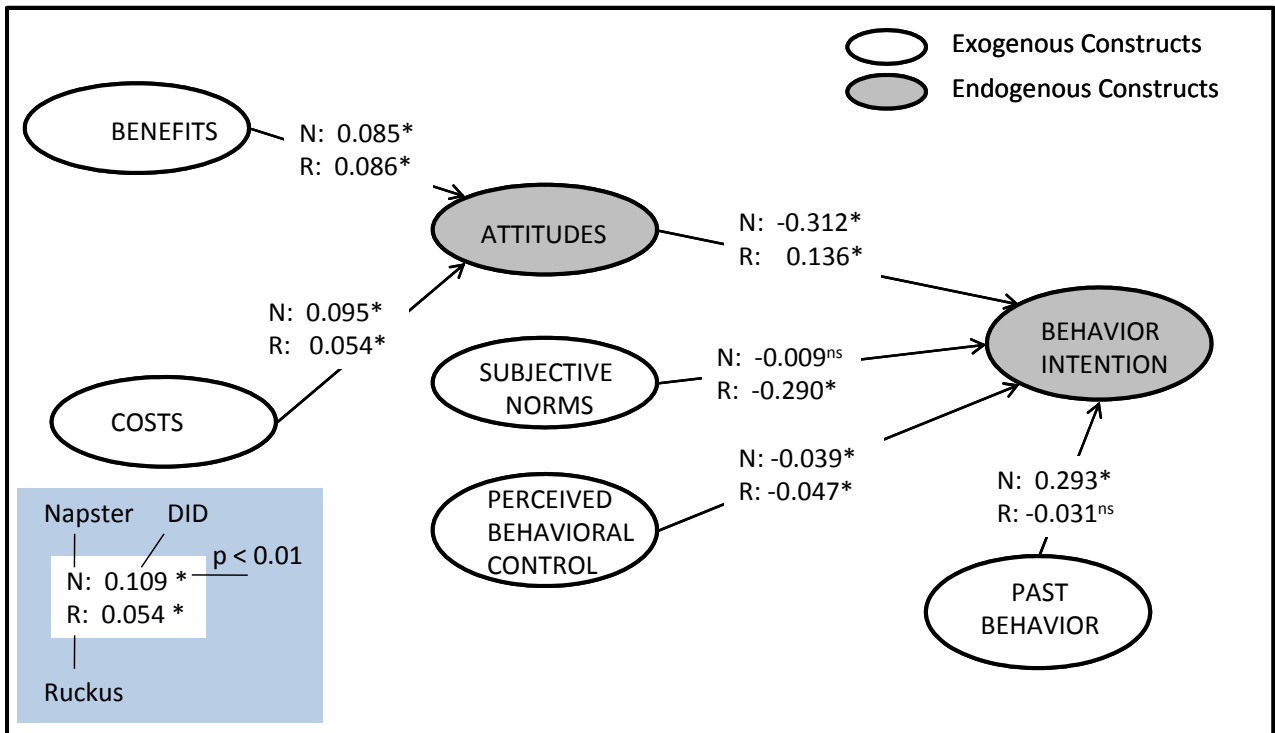
Figure 2b: Experimental Design for Ruckus Study

	Aug 10 – 27 2007	Aug 27- Dec 15, 2007	Dec 5 –15. 2007	Aug 10 -Dec 15. 2007*
	Pretest	PSU-Ruckus service	Posttest	PSU-Ruckus Service
Treatment Group (U i.e., Users)	O _{U1}	X	O _{U2}	O _B
Control Group (NU i.e., Non Users)	O _{NU1}		O _{NU2}	

Notes: O_S: Measurement through Web survey; O_B: measurement of usage; and X: Intervention (Ruckus service availability).

*: A handful of students who had registered on campus for summer school, started accessing the Ruckus in early August.

Figure 3: Difference-in-Difference of Coefficient Means and their Significance Levels Computed via Bootstrap



Notes:

1. For both the Napster and Ruckus studies, the coefficient means are computed from 1,000 bootstrap estimates of path coefficients. We computed the standard errors for the coefficient means, and not for the coefficients from the original sample, as summarized in Table 3. Thus, the reported changes here are with reference to the “average mental model” in each experimental group. Also, we applied the recommended sign-correction procedures in computing the bootstrap standard error estimates (see, Henseler, Ringle, and Sinkovics, 2009).
2. For the Napster study, we obtained 1,000 separate bootstrap samples for the four groups (OC1, OC2, RH1, and RH2). For the Ruckus study, we obtained 1,000 bootstrap samples each for the User (Treatment) and Non-user (Control) groups. Because of the “within subjects” design in the Ruckus study, in any bootstrap sample, we ensured that the set of respondents was identical in both the pre and post groups (see, Bollen and Stine 1992). As a result, DID estimates from the Ruckus study have lower variability than in the Napster study.

Web Appendix

Description of Difference-in-Difference (DID) Estimation

Let:

$C = 0$ if a measurement (e.g., AT , Attitude toward file sharing) belongs to the control group, and 1 if it belongs to the treatment group.

$T = 0$ if the measurement refers to pre-test and 1 if it refers to post-test.

Using the above dummy variables, for this example, we can model AT as follows:

$$(A1) \quad AT = a_0 + a_1C + a_2T + a_3C \times T + \varepsilon$$

Where ε is a normally distributed error term with mean 0 and a finite variance and $a_0, a_1, a_2,$ and a_3 are coefficients to be estimated from the data. We have the following interpretation of the coefficients.

a_0 = Estimate for pre-test control group, i.e., when $C = 0$ and $T = 0$.

$a_0 + a_1$ = Estimate for pre-test treatment group, i.e., when $C = 1$ and $T = 0$.

$a_0 + a_2$ = Estimate for post-test control group, i.e., when $C = 0$ and $T = 1$.

$a_0 + a_1 + a_2 + a_3$ = Estimate for post-test treatment group, i.e., when $C = 1$ and $T = 1$.

The DID estimate is given by

$$(A2) \quad [(a_0 + a_1 + a_2 + a_3) - (a_0 + a_1)] - [(a_0 + a_2) - (a_0)] = a_3$$

Thus, the DID estimate is the coefficient of the interaction term (a_3) in equation (A1) that we obtain by regressing the stacked vector of measurements from the four groups against an intercept and the set of dummy variables represented by T and C . We can also obtain the appropriate statistics from the regression model.

DID Analysis for TPB Path Coefficients

Step 1: Use bootstrap sampling to obtain the bootstrap estimates for each path coefficient of the TPB model in all four groups

Step 2: For the stacked vector (from all four groups) of the bootstrap path coefficients corresponding to each relationship in the TPB model, run the dummy variable regression outlined in A1.

As in (A2), the DID estimate for the path coefficient is given by a_3 , the coefficient of the interaction term in the regression model (A1), and the p-value of the DID estimate is given by the corresponding p-value.