

Selling Bits: A Matter of Creating Consumer Value

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Abstract. Digital goods such as music are vulnerable to illegal use over the internet. Technology-driven IT solutions to protection are useful but limited. Instead, we suggest that incentives to legal forms of consumption can be constructed by redesigning how the e-business model for digital content creates consumer value. We present a general framework that enables a quantified utility analysis and clarifies what parameters, technological as well as market ones, influence consumer value. On this basis, we discuss several business scenarios that show how to make the value gap between legal and illegal offerings as large as possible. This analysis framework is part of our e^3 -valueTM methodology for e-business modelling and decision making in which business and IT considerations are integrated.

1 Introduction

An advantage of selling products such as music, video, and information via the internet, is that they can be instantaneously delivered as a bitstream. Unfortunately, the drawback is that digital products can be easily copied against almost zero cost. This allows pirates to resell music or video against a fraction of the original price, or even to give it away for free. Today, illegal copying of digital content occurs at a large scale, decreasing revenues for all creative actors involved.

Clearly, there is a need for approaches that ensure that creative actors benefit from digital sales representing their creative efforts. The technology-driven IT approach is to protect digital content using encryption technology and watermarking [1, 7, 8]. However, all current IT-driven protection methods are vulnerable to attacks. At the other side of the spectrum, business-oriented approaches [9, 2] propose to sell multiple versions of digital content, to update content frequently, or to sell it in bundles with related products. The idea here is that one should focus on the concept of *consumer value*.

This raises the basic question how one might actually *calculate* the multi-faceted notion of consumer value, in such a way that it becomes possible to compare the results across different business-consumer scenarios and so make decisions about the suitability of various possible e-business models. The present paper aims to contribute to this rather ambitious goal.

It presents a practical framework to analyze the various dimensions of value contained within a single product [6], as a basis for understanding how consumers may

maximize their expected utility. Next, by evaluating a range of relevant *what-if* scenarios, it supports in uncovering in a *quantifiable* way what the major (IT as well as market) parameters are that influence consumer value. This framework is part of our *e³-valueTM* methodology [4, 5], a business modelling approach that offers an integrated view upon the business as well as IT factors that are relevant to executive decision making concerning e-business strategies.

As an application of our framework for value maximization, we consider a music track download service that enhances value by increasing convenience in terms of search and download time, and we compare this to a service offering illegal content. We use our framework to argue that products represented by bits such as music or video, have value aspects for consumers other than mere content. These aspects can be exploited to create additional consumer value such that consumers are encouraged to buy music or video legally rather than to obtain it from an illegal source. Moreover, this added value is difficult to create for illegal content providers.

This paper is structured as follows. In Sec. 2 we briefly review IT-dominated ways of protecting digital content. We do not argue that protection of content is unnecessary, but rather that creation of additional consumer value *and* protection of digital content should be seamlessly applied to selling bits. In Sec. 3 we discuss business-oriented ways to ensure that digital content is bought rather than illegally copied. One of these is the creation of additional consumer value. In Sec. 4 we analyze illegal copying of music from two perspectives: (i) legality and consumer value. Sec. 5 introduces a practical attempt to quantify the consumer value contained in digital products. It is the foundation for Sec. 6, which evaluates several scenarios for two prototypical consumer segments with respect to consumer value as a way to prevent illegal use of content. We show how these business scenarios help focus executive decision making. Finally, we present our conclusions.

2 Protection of Rights on Digital Assets

Protection is a way to discourage the unintended use of digital content (such as copying, unauthorized resale and more), but is, as we will show, not sufficient to prevent a piracy scene, especially if the price of legal content is high enough. Various approaches for *protecting* the intended usage of digital content exist. We distinguish (1) protection by encryption, (2) protection by watermarking, (3) protection by law.

Protection by Encryption. Encryption systems offer facilities to *prevent* violations of the intended usage of the music but have a number of weak spots. First, the consumer can *always* make copies by resampling the analog output. There is a small quality loss but all subsequent copies can be made without any further loss. Second, the consumer can intercept the decrypted bitstream and save this stream in a file. Third, the encrypted content itself can be attacked.

Protection by Watermarking. A next step is to *watermark* the content. A watermark can be used in court to *prove* violations of intended usage of the content. With watermarking technology it is possible to identify the digital content, to identify the original

producer of the content, and to identify the consumer who sold the rights to use the digital content [8]. This information is important to prosecute violations of intended usage of content.

However, in [3], a number of successful attacks on watermarks are identified, so protection by watermarking is not the only way to go.

Protection by Law. The last line of defense is to *prosecute* the person who violates the intended usage of digital content. Protection of digital content by law has a number of weaknesses. First, the law differs between countries. Laws of some countries offer more handles to prosecute illegal use of content than others do. Second, if the violator is in another country than the owner of the content (the prosecutor), it is difficult to prosecute the violator. Furthermore, suing itself does not scale up very well. If a large number of small violators exists (as is actually the case in music copying and downloading), it is not feasible to sue all these violators individually.

In conclusion, if digital content is to be sold, one should bear in mind that a consumer can violate the intended usage of the content, sometimes rather easily. This remains true also when various protection schemes have been applied. Especially if the motivation of the consumer is high enough, s/he is able to obtain digital content from sources other than the legal ones. Hence, protection of digital content alone is not sufficient to address the problem of misuse of digital content.

3 Business-oriented Approaches

Versioning and Bundling. Various authors, for instance [9] and [2], have proposed business-oriented solutions to ensure that content creators get paid for their creative efforts. However, these solutions are limited in that they are effective only for highly interactive or *time-dependent* digital content, i.e., content of which the value quickly decreases with time. One way to exploit the time dependence of digital content is to create multiple versions, for example a number of remixes of a music track, or different quality levels of images. However, the number of versions a consumer can choose from is usually very limited, and therefore illegal copies of versioned content will become easily accessible as well. A more extreme position is to sell complementary related products which cannot easily be copied such as merchandise of artists, while the content itself is nearly for free. In such a scenario, the digital content plays only the role of attracting consumers to a site: the revenues should come from related sales.

A variation on this theme is *bundling*: a consumer can only buy merchandise if s/he also buys the associated digital content. A general limitation of business-oriented approaches exploiting time-dependent value of digital content is that there are many cases of digital products (e.g., ‘classic’ songs and movies) that maintain their value over long periods of time. Hence, it is important to analyze the concept of consumer value contained in digital content *itself*, and not solely consider the generation of revenues from complementary products and related sales.

Dimensions of Consumer Value in Market Research. We thus want to explore how to exploit the value of digital content itself, in such a way that it creates a value gap between legal and illegal providers of digital content. We suggest that recent ‘interpretive’

marketing research on consumer value gives some useful initial handles on this topic. In particular, we use Holbrook’s value framework [6] that investigates different aspects or dimensions of value resulting from the consumption experience of a product.

In his framework, Holbrook makes a distinction between the *extrinsic* and *intrinsic* value of a product. A product has an extrinsic value component if a consumer uses the product to accomplish some goal that is outside the consumption of the product itself. For example, a consumer values a hammer mainly because it can be used to drive in a nail, rather than that s/he values the hammer in its own right. In contrast, something is valued intrinsically if the consumption experience is valued for its own sake. For example, music has an important intrinsic value component because listening to music, the experience, is of value by itself. In fact, the digital content considered in this paper relates to the *right* to have a, hopefully appreciated, experience. The bits are only the representation of the music that enables the experience.

Table 1. Value types in Holbrook’s framework.

<i>Value dimension</i>	<i>Extrinsic</i>	<i>Intrinsic</i>
<i>Active</i>	EFFICIENCY (I/O function, convenience)	PLAY (fun)
<i>Reactive</i>	EXCELLENCE (quality)	ESTHETICS (beauty)

Another dimension introduced by Holbrook is that value may have an *active* or *reactive* component. A product with an active value component requires that a consumer actively does something with the product (for example, using a music track for karaoke singing) as part of the consumption experience. Consumer value is called reactive if the product itself accomplishes something to or with a consumer as a result of a consumption experience, such as listening to music passively.

Putting together the 2×2 combinations from these two dimensions of consumer value yields four types of value, as shown in Table 1. Below, we show how such a value typology can be used as an aid in uncovering which different e-business parameters influence consumer value. In addition, we will quantify these value parameters, and analyze their effect on e-business model design through a collection of realistic business-consumer interaction scenarios.

4 The e-Business Design Space: Legality vs. Value Creation

We do not suggest that protection of digital content is irrelevant. On the contrary, such a first barrier prevents a number of consumers from committing an illegal act, and makes them aware that unintended use of the digital content is prohibited. However, we do claim that rethinking and redesigning the value to the consumer of a digital content service (e.g. the right to listen to a music track once) can contribute to reducing the illegal ways of consumption. We can exploit the fact that a digital product has valuable

aspects in addition to the actual content itself, cf. the Holbrook value typology. For example, convenience in selecting and ordering, receiving the content without delays, enhancing fun by different options to interact with the digital content may all be of great value to the consumer. In Sec. 5, we analyze the multiple aspects of value created by digital content in more depth.

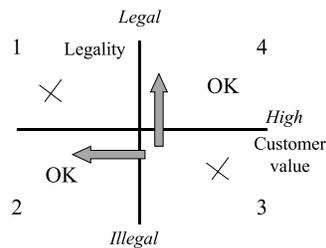


Fig. 1. Positioning e-business models: (il)legal content versus created consumer value.

Figure 1 shows how various e-business model options may be positioned in a design space spanned by the degree of legality and the degree to which consumer value is created. The first quadrant, digital content that is legal but offered with a low consumer value, is not interesting from a business point of view. Illegal content with a low consumer value, the second quadrant, is not likely to be very popular with consumers either. If for example the convenience is low, consumers will not be attracted to obtain the illegal content. Thus, offerings in this quadrant can be left alone (note also that from a business point of view, technical or legal protection measures are not really needed here).

The third quadrant, illegal content with a high consumer value, is highly unwanted, however. As indicated in Figure 1, there are ways to make the e-business ‘models’ positioned in this quadrant less attractive. Illegal content with high consumer value requires high visibility and accessibility in a market. If not, it takes too much effort for consumers to find and select the product. Furthermore, it must be easy and convenient to obtain and consume the content. However, visibility and a high-quality fulfillment infrastructure enable content owners to take corrective action, for example to prosecute suppliers of illegal content or to ask legally operating Internet Service Providers to remove or block illegal content. Such measures do not remove illegal offerings entirely, but result in illegal content with lower consumer value, thus moving illegal offerings from the undesirable quadrant 3 to the uninteresting quadrant 2 (in other words, these measures generate utility destruction). Alternatively, suppliers of such illegal content may decide to set up a legal operation and move up to quadrant 4. This quadrant represents the desired situation: providing legal content with a high consumer value. Finally, Figure 1 shows that legal content providers already in this quadrant may strive to increase the consumer value created by the digital products they offer.

Generally, the approach is to *increase the value gap* between legal and illegal offerings.

5 Consumer Value

5.1 Receipts and Sacrifices

We will now analyze which factors play a role in the various types of consumer value creation, how they can be quantified, and how they can be used as ‘control parameters’, so to speak, to design an optimally positioned e-business model.

In marketing literature (e.g., [6]), consumer value is often stated in terms of a *value*

$$\text{equation: Consumer Value} = \frac{\sum_{i=1}^n \text{Receipt}_i}{\sum_{j=1}^m \text{Sacrifice}_j}.$$

The sacrifices comprise all costs a consumer has to make to consume the product; receipts represent the sum total of the benefits s/he experiences from consuming the product. The consumer will only buy the product if the consumer value ratio is greater than one; otherwise, a consumer decides not to buy the product at all, because the sacrifices outweigh the receipts.

Receipts and sacrifices need to be further decomposed. First, we distinguish out-of-pocket costs. These are sacrifices that result in a direct transfer of money from consumer to supplier. Second, there are other value types (in terms of Holbrook’s framework) that are not directly payable to someone, but contribute to sacrifices or receipts. An example is the inconvenience for the consumer if the download-time of music is very long.

To focus our analysis, we will concentrate on a specific service in selling bits: the product comprising the right to *listen-once to a track of music*. This product allows a consumer to select a track of music, and after selection the music will be played as soon as possible. We assume a non-streaming service: the track has first to be downloaded completely before the consumer can listen to it.

We illustrate our claim that value creation is a key consideration to enhance legal ways of selling bits, by investigating and quantifying several possible business scenarios in terms of consumer value, for two prototypical consumer segments, viz., yuppies (enough money, but lack of time) and students (scarce money resources, enough time). Each scenario is studied from two perspectives: (1) obtaining the music legally, and (2) obtaining the same music illegally.

5.2 Out-of-pocket Costs

If a consumer wants to listen to a track s/he has to pay money directly to others, called out-of-pocket costs. These costs are part of the sacrifices mentioned in the value equation. Here, we distinguish (1) the *data communication costs* to be paid to a telecommunication company and/or Internet Service Provider, and (2) the *price* to be paid for the right to listen to the music track itself.

Data Communication Costs. We consider (1) communication costs for selecting content, (2) for downloading content, and (3) for uploading content. The latter costs may appear if a consumer obtains the content illegally. Many illegal sites use a *ratio* scheme. Such a scheme requires that a consumer first *uploads* a music-track, after which s/he can *download* tracks of choice.

Price. If the consumer buys the music legally, a fee is paid for the right to listen to the track. We assume this price is known and set by the supplier. In the illegal case, the price is \$ 0.00.

5.3 Instantiating Value Types

Table 2 shows the value creation parameters, structured according to the discussed Holbrook consumer value framework, for the product *listen-once to a selected track of music*. Such parameters can contribute to either sacrifices or receipts, depending on the valuation by the consumer.

Table 2. Value parameters for a *listen-once* service.

<i>Value dimension</i>	<i>Extrinsic</i>	<i>Intrinsic</i>
<i>Active</i>	selection time upload time download time	interactive track play
<i>Reactive</i>	presentation quality	track beauty

Selection Time. Selection time is the time it takes for a consumer to search for and select a particular track of music s/he wants to listen to. We assume that a consumer already *knows* the title of the music track as well as the performing artist before selection; the selection-time only indicates the time necessary to find a supplier offering the *downloadable* track under consideration. The track should be downloadable because in the piracy scene, it does happen in practice that a site indicates that a particular track is available, but the track itself has disappeared. In such a case, the consumer has to spend additional time to find a new site that offers the track, which increases the total selection time for the track.

The selection time is an important instrument to fight piracy. If the selection time is low for music tracks of illegal content providers, such providers have high visibility and reliability. This enables legal providers, content owners and right organizations to fight such pirates.

Upload Time. On an illegal ratio-based site, a music track must be uploaded first before one can obtain one or more tracks. The upload time is the time necessary to complete the upload and to gain the rights for one or more downloads. This includes the time necessary to obtain the track for upload from another medium such as a CD.

Download Time. The download time period starts when a consumer decides to listen to a previously selected track, and ends when the track is ready for play at the consumer site. At a ratio-based illegal site, the required upload has to be completed before the consumer can decide to listen to the desired track. The download and upload time depend on factors such as the available bandwidth. A legal provider can influence this factor positively, for instance by co-locating its content server with the Internet access points of its consumers.

Presentation Quality. The presentation quality of music is determined by the *bitrate* of the music track. For consumers, perceived quality may be expressed in terms such as CD quality, near-CD quality, radio quality, and telephony quality. A legal provider can influence this parameter by consumer-selectable presentation quality options.

Interactive Track Play. The aspect of play, as identified in Holbrook's framework, refers to possibilities for the consumer to actively interact with the product. This interactivity should be of value for its own sake. For the *listen-once to a selected track of music* product we define the play aspect as the presence of functionality to turn on and off music instruments and vocals, allowing consumers to produce the vocals themselves (as in karaoke), or select alternative instruments and vocals so as to create their own version of a song. Such functionality is for example offered by the website of David Bowie (www.davidbowie.com). Legal providers can exploit this creative play and fun element, initially because they can obtain access to alternative instrument and vocal recordings, and subsequently by providing different versions of these. This boils down to a versioning approach as discussed in Sec. 3.

Track Beauty. Finally, there is the aspect of beauty, implying that the music itself is valued as a consumption experience for its own sake by the consumer.

We note that we have introduced several independent parameters relevant to value creation. For example, a consumer may like the interactive play element of a David Bowie song, because it gives you the possibility of acting as a creative designer making a new instrumentation of a song, but s/he may not actually like David Bowie's music.

5.4 Calculating Consumer Value

To compare scenarios with each other on a consumer value basis, it is necessary to calculate direct out-of-pocket costs (which can be done in a rather objective fashion) as well as the different Holbrook value type aspects (of which the valuation is more subjective with respect to the consumer). As an example, consider the valuation of a short download time by the consumer. One part of this stems from the objective expected download time, which depends on the size of the track in bits and the available bandwidth. Another part may be formulated as an *inconvenience fee* in \$/second incurred by the consumer, expressing that the utility of absorbing consumer time also has to be taken into account (as a more subjective, and consumer segment-dependent opportunity cost or nuisance value component). This utility quantification of the various objective and subjective factors is presented in Table 3. To calculate consumer value, we use the following measurable quantities:

- The *bitrate* (bits/second) used to represent the content in a digital way.
- The *duration* of a track in seconds.
- The *bandwidth* (bits/second) available to stream content to the consumer. A provider of music can influence this factor positively, for example by co-locating its servers close to Internet access points of consumers, by having a high-bandwidth connection to the Internet, or even by exploiting an own access infrastructure for consumers. Note that all these measures make the content provider visible for organizations controlling the correct use of digital content. Therefore, enhancing consumer value in this way is not an option for illegal content providers.

- The *data communication costs* or *ticks* (\$/second) and a *connection setup fee* (\$/connection setup), to be paid by the consumer for a connection to the Internet.
- In the case of an illegal provider, the *ratio* between uploaded and downloaded tracks. The ratio is the number of tracks which need to be uploaded before a consumer can download one track of his choice (typically 0.1).

Table 3. Calculation of out-of-pocket costs and Holbrook value type parameters.

Out-of-pocket costs	Calculation
<i>Data communication costs:</i>	
selection time	$selection-time * ticks + setup-fee$
download time	$\frac{bitrate * duration}{bandwidth} * ticks$
upload time	$\frac{bitrate * duration}{bandwidth} * ticks * ratio$
price	<i>determined price by supplier</i>
Holbrook value type	Calculation
<i>Inconvenience costs:</i>	
selection time	$selection-time * inconvenience-fee_{consumer}$
download time	$\frac{bitrate * duration}{bandwidth} * inconvenience-fee_{consumer}$
upload time	$\frac{bitrate * duration}{bandwidth} * inconvenience-fee_{consumer} * ratio$
presentation quality	$f_{consumer}(bitrate)$
interactive track play	$f_{consumer}(availability)$
track beauty	$f_{consumer}(content)$

6 Scenarios

Scenarios constitute an established tool for strategic analysis [10]. We will discuss a number of scenarios representing different kinds of consumers. The first set of scenarios is about a yuppie, a consumer characterized by enough monetary resources but with a lack of time. The second set of scenarios focuses on a student consumer, who has scarce monetary resources but enough time. For both scenario sets, we analyze two situations: (1) the consumer obtains the music from a illegal site, and (2) the consumer buys the music from a legal site.

For the evaluation of the yuppie and student scenarios, we assume values for the consumer utility parameters as summarized in Table 4. Values for some parameters differ between the legal and the illegal case. The rationale for this is that by carefully influencing or controlling such parameters, a legal provider has an opportunity to create additional consumer value. This especially holds for the available bandwidth, selection time, and price. By fighting piracy effectively, the search time for illegal providers can

be increased, resulting in a lower consumer value of illegal content. However, some parameters cannot be easily influenced by content providers such as the costs for telecommunication.

Table 4. Parameter values for the yuppie and student scenarios.

<i>Consumer utility parameter</i>	<i>Illegal case</i>	<i>Legal case</i>
selection time	60 s	30 s
bit-rate	128 kb/s	equal
mean duration of track	240 s	equal
bandwidth	30 kb/s	60 kb/s
ticks	\$ 0.01/minute	equal
connection setup fee	\$ 0.05/setup	equal
ratio	0.1	0

The values of the consumer utility parameters are, where possible, based on realistic empirical estimates. We assume that an illegal site offers only 50% of the bandwidth a legal site offers to its consumers. This bandwidth is measured end-to-end: from music supplier to consumer. The bandwidth is therefore constrained by the bandwidth offered by Internet Service Providers to their end users. We take, for the legal case, a value of 60 kbit/s, which is possible using ISDN. A content provider can fully exploit this bandwidth if its content servers are co-located with the access servers of the ISP. The values for *ticks* and *connection setup fee* are taken from the current standard tariffs of a large Dutch telecoms company. We assume that Internet access itself is for free, as is the case in the Netherlands and the United Kingdom. For the *ratio* we assume a value of 1:10, which is often seen on illegal sites. For *bitrate* we assume a value which is currently typical for MP3 tracks on the Internet.

6.1 Scenario A: Yuppie

Table 5 illustrates a valuation of the product *listen-once to a selected track of music* by the yuppie, both for the legal and illegal cases. We call this scenario the null scenario. We have chosen hypothetical but reasonable values, using the following approach. First, a consumer equally values the presentation quality and the beauty aspect for the legal and illegal case, because for both cases a consumer values the same track of music. Second, we assume that the consumer ranks the value of Holbrooks aspects in the following order (from high to low): (1) the beauty aspect (the first priority is to listen to a particular track of a selected artist), (2) the presentation quality aspect, and (3) the interactive play capability. Further, we have assumed that the yuppie inconvenience fee is \$ 1.-/hour. Of course, this is an example for which it is difficult to get accurate numbers. However, an important point to note is that these numbers are not intended for exact value calculations *per se*. Instead, we are interested in the much more modest goal of *relative* statements, drawn from a comparative analysis and a sensitivity analysis of relevant business scenarios. As we will see, it is indeed possible to come to strategically

relevant conclusions from a quantified analysis based on rough, order-of-magnitude, numbers. This is all we aim for in this paper.

Table 5. Yuppie consumer value equation: null scenario.

Consumer value equation	Illegal Case		Legal case	
<i>Variables</i>	<i>Receipts</i>	<i>Sacrifices</i>	<i>Receipts</i>	<i>Sacrifices</i>
Out-of-pocket costs				
(Data communication costs)				
selection	-	0.060	-	0.055
download	-	0.17	-	0.085
upload	-	0.017	-	-
price	-	-	-	0.10
Holbrook value type parameters				
(Inconvenience costs)				
selection time	-	0.017	-	0.008
download time	-	0.28	-	0.14
upload time	-	0.028	-	-
presentation quality	0.15 (near CD)	-	0.15 (near CD)	-
interactive track play	- (no)	-	0.05 (yes)	-
track beauty	0.20	-	0.20	-
Consumer value equation results	Illegal case		Legal case	
<i>Total Receipts and Sacrifices:</i>	0.35	0.572	0.40	0.388
<i>Ratio Receipts/Sacrifices:</i>	0.61		1.03	

Variations on the Null Scenario. Several variations on the null scenario are interesting to analyze; they are motivated by expected changes in the null scenario that are likely to occur: (1) nearly equal end-to-end bandwidth for the illegal and illegal case, (2) an increase of the overall bandwidth without changing costs, (3) changes in the play factor of the product, (4) changes in the consumer's inconvenience fee, and (5) a service extension to repeated listenings to the same track.

Scenario A1: The Bandwidths of the Legal and Illegal Sites Become Nearly the Same. It is possible that the music industry is not sufficiently capable of fighting the illegal scene, as previously discussed in Sec. 4. Then, a consequence may be that illegal sites are offering music with nearly the same bandwidth as legal sites. If we assume for the illegal site a bandwidth of 50 kbit/s, the consumer value equation ratio for the illegal case becomes 0.93 instead of 0.61, i.e., close to the value for the legal case. If bandwidths are equal (60 kbit/s) the illegal offering is even favored over the legal one in terms of consumer value. Thus, the bandwidth difference is an important parameter to create a value gap between the legal and illegal cases.

Scenario A2: The Bandwidth Increases. In the near future, it is reasonable to expect an increase of available bandwidth nearly without any change in costs. Developments

such as xDSL, which offer a high bandwidth connection (order 1 Mbps) over the local loop of a telecoms operator, are now being commercially introduced. A bandwidth increase will heavily cut down both the out-of-pocket and inconvenience sacrifices, especially those related to download times. Compared to the null scenario, a bandwidth increase above about a factor of 5 (both for illegal and legal bandwidth) will start to favor the illegal site over the legal site. Therefore, a differentiation in bandwidth only (scenario A1) is not sufficient in the long run as a means to sell music legally. Because this scenario is very likely to happen in the near future, we analyze the following scenarios in conjunction with this scenario.

Scenario A3: The Selection Time for the Illegal Case Increases Substantially. If the music industry is successful in fighting piracy, the selection time for illegal tracks increases. For instance, if it takes 600 seconds to find a downloadable illegal track, the consumer value of the illegal scenario is 0.43 instead of 0.61, whereas the legal case remains the same at a value of 1.03. Moreover, if we additionally suppose that scenario A2 occurs, the consumer value of the illegal case becomes 0.82, while the legal scenario results in a consumer value of 2.46. Consequently, differentiation in selection time is a powerful instrument to have consumers favor the legal offering.

Scenario A4: The Inconvenience Fee is Nonlinear. In our model, we assume that the yuppie uses a flat rate for his inconvenience fee. However, it might be more appropriate to assume that the costs associated with waiting for a music track grow more than linearly with time. In this way, we model the likely situation that a consumer wants to have the music fast, and if it takes too long, s/he is not interested anymore. If the inconvenience fee during the first 5 minutes is \$1.- per hour, during the second 5 minutes is \$ 5.- per hour, and is \$ 25.- per hour beyond that, the consumer value for the legal case is 0.64, but for the illegal case 0.086. If we analyze scenarios A2 and A4 in combination, the consumer values of the illegal and legal cases are about equal (1.89 vs. 1.88). If also scenario A3 occurs (selection time differentiation), the consumer will however prefer the legal case (0,46 vs. 1,88).

Scenario A5: Repeated Listenings of the Same Track. Our null scenario is based on a *pay-per-listen* product. However, for content such as music and video, *repeated* consumption occurs frequently. A consumer then listens to the same track of music a number of times. If in such a case the consumer stored the music-track locally after the first initial download, communication costs are zero for the subsequent listenings.

In our null scenario, a supplier of legal content differentiates himself from an illegal supplier by offering a fast download service (more bandwidth), so that the legal consumer saves data communication expenses. However, for subsequent listenings, no downloads are necessary if the content is stored locally, and the advantage of a fast download service becomes less significant. Table 6 presents the effect of subsequent listenings on consumer value.

From this table it can be concluded that if a yuppie expects to listen to a track more than twice, it becomes attractive to obtain the track illegally. A way to deal with this issue is to use a nonlinear pricing scheme. In Table 7, the price of n subsequent listenings is calculated as follows:

$$price_{n\text{-subs.-list.}} = discount\text{-factor}_{n\text{-subs.-list.}} * price * number\text{-of-}n\text{-subs.-list.}$$

Table 6. Yuppie valuation of subsequent listenings.

<i>Consumer Value</i>	<i>Illegal case</i>	<i>Legal case</i>	<i>Total revenue</i>
1 listening	0.61	1.02	0.10
2 listenings	1.21	1.62	0.20
4 listenings	2.42	2.32	0.40
10 listenings	6.06	3.10	1.00

Using such a nonlinear pricing scheme, the yuppie will be encouraged to buy the music legally. The drawback of such a scheme is that, after two subsequent listenings, hardly any marginal revenues are generated. If we assume that scenario A2 also applies, the illegal offering becomes attractive. However, if scenario A3 occurs in addition, the legal offering has a higher consumer value. Application of scenario A4 strengthens this conclusion.

Table 7. Yuppie valuation of subsequent listenings using a nonlinear pricing scheme.

<i>Consumer Value</i>	<i>Discount Factor</i>	<i>Illegal case</i>	<i>Legal case</i>	<i>Total revenue</i>
1 listening	1.00	0.61	1.02	0.10
2 listenings	0.90	1.21	1.69	0.16
4 listenings	0.50	2.42	3.26	0.16
10 listenings	0.21	6.06	8.07	0.17

In sum, nonlinear pricing is a useful mechanism to create value for the consumer. Bandwidth differences only help in the short run. Selection time differences turn out to be a key to create a significant value gap between legal and illegal offerings.

6.2 Scenario B: Student

The student null scenario assumes that the student's inconvenience fee is \$ 0.10/hour (one order of magnitude lower than the yuppie inconvenience fee). We keep all other values the same. The consumer value of the illegal case now becomes 1.25, while the value of the legal case is 1.57. Consequently, for consumer segments that incur a low inconvenience fee (that is, they are willing to spend their own time) illegal offerings become relatively more attractive.

We briefly summarize the results from variations on the null scenario.

- *Scenario B1: The bandwidth of the legal and illegal site is nearly the same.* A lower inconvenience cost results in a lower fee for waiting on a download. Therefore, the difference of bandwidths between the illegal and legal case is of less importance compared to the yuppie scenario. If the bandwidth of the illegal provider is 41 kbit/s and the bandwidth of the legal provider remains 60 kbit/s, the consumer will already opt for the illegal provider, while in the yuppie scenario bandwidths should be nearly equal.

- *Scenario B2: The bandwidth increases.* Because of a lower inconvenience fee, an increase of available bandwidth by a factor of about 2 is already sufficient to favor the illegal case over the legal one. Therefore, bandwidth cannot be exploited very successfully in the student scenario to create additional consumer value.
- *Scenario B3: The selection time for the illegal case increases substantially.* A selection time of 600 seconds for the illegal case makes that the sacrifices outweigh the receipts, favoring the legal offering. This is also the case if we assume both scenario B2 and B3.
- *Scenario B4: The inconvenience fee is nonlinear.* If the inconvenience fee during the first 5 minutes is \$0.1/hour, the second 5 minutes is \$ 0.5/hour, and beyond that is \$ 2.50/hour, the consumer value for the legal case (1.43) is higher than the consumer value for the illegal case (0.56). If bandwidth is no issue (scenario B2, with a 5 times increase of bandwidth), the illegal case will be chosen by the consumer.
- *Scenario B5: Repeated listenings of the same track.* In case of repeated listenings, we find that for two listenings and more, the student chooses to obtain the music illegally. A nonlinear pricing scheme as discussed previously ensures that a student obtains music legally if the discount factor as presented in Table 7 is 1 (1 listening), 0.82 (2 listenings), 0.41 (4 listenings), and 0.17 (10 listenings). A nonlinear pricing scheme plus scenario B2 results in a preference for the illegal case, but scenarios B2, B3 and B4 together favor the legal case.

In sum, our scenario analysis shows that for both consumer segments, selection time differences are a key parameter that must be controlled in order to create a significant value gap between legal and illegal offerings. Nonlinear pricing also is a useful ‘control parameter’ to make legal offerings attractive to the consumer. The difference between the student and yuppie consumer segments is that for the former, illegal offerings become attractive more quickly due to the lower inconvenience fee. Bandwidth differences only have short-term relevance, because the bandwidth itself is likely to increase strongly in the near future.

7 Conclusions

The key point of this paper is that creation of additional consumer value contributes to legal obtainment of digital goods such as music and video, apart from IT-based ways to protect content. To show this in a quantifiable way, we have presented a multi-aspect utility framework, grounded in Holbrook’s consumer value approach, that can be used to calculate consumer value for different business-consumer scenarios. Using this framework, we have analyzed two prototypical music consumer groups, yuppies and students, and shown what the major parameters are that affect consumer value.

In this paper we have applied this framework to a comparison of legal and illegal music download services. A major application conclusion is that exploiting end-to-end bandwidth as a way to minimize download time, and thereby inconvenience, only has a short-term effect. This is caused by expectations that end-to-end bandwidth will grow substantially, both for legal and illegal services. If the bandwidth passes a certain threshold, it is not a good way anymore to create additional value for legal providers. Our key long-term conclusion is that legal content providers have to enlarge the gap between the

search time for legal and illegal content. If our estimates of the inconvenience fee or ‘nuisance value’ of long waiting times are order-of-magnitude correct, this promises to be an effective barrier to inhibit consumers from obtaining illegal content. Other interesting results of our analysis are that all successful business scenarios have to be based on a low price for the right to listen to a track of music, and that subsequent listenings to a track should be priced in a nonlinear way to discourage illegal acquisition of music.

More generally, we feel that our framework makes an advance in getting a better, more quantifiable, grip on the many dimensions and parameters in consumer value. There is no claim that it is a tool for calculating consumer value exactly. This is also not needed: as shown, it is adequate if it aids executive decision making, by differentiating and understanding the trade-offs between various conceivable strategic scenarios in e-business. The presented framework is part of ongoing research into our *e³-valueTM* methodology that approaches e-business modelling as designing new value exchange networks enabled by IT methods [4, 5]. Such a value-based approach is in our opinion the most fruitful one to achieve the required integration between business and IT factors in electronic commerce applications.

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