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ABSTRACT

Digital technologies are profoundly transforming the production and consumption of culture and entertainment products. The emerging digital re-mix culture is an open source approach where content products in the arts and entertainment industries are increasingly rearranged, manipulated, and extended in the process of creating new works. This article offers a unified description of the tools and techniques that led to the development of the open source culture and that enable the processes which promote re-use of previously recorded materials. It then lays out the incentives and forces that either promote or inhibit the development, distribution, and consumption of modified cultural content by individual consumers and by derivative artists. Using multiple perspectives from economics, design sciences, and arts and culture, new theory is built to suggest how "rip, mix and burn" strategies based on re-use and recombination of content components can create significant economic value, stimulate artistic innovation, and spur creativity and growth in the culture and entertainment industry. The potential for wealth transfer and who loses and who gains in the open source digital re-mix culture are explored. The creative and economic forces enabled by digital re-use technologies are shown to play a significant role in the observed move towards more open source and social production modes in the culture industries. Five-mini case studies provide supporting perspectives for the proposed interdisciplinary theory of open source digital re-mix culture.

Keywords: Digital culture, digital entertainment, digital music, information goods, innovation and creativity, theory development, interdisciplinary theory, open source culture, re-mix, social production.

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I. INTRODUCTION

Culture and entertainment represent a significant industry. According to Vaidhyanathan (2001, p. 110), it produced about 7% of the United States gross domestic product and exported roughly US$80 billion worth of products in 1999. Digital technologies profoundly transform the production and consumption of culture and entertainment goods and are challenging traditional business models. Our aim is to bring into focus *digital re-mix* as one specific issue at the intersection of technology, economics and business strategy that will play an important role in the digital entertainment space. We describe the emerging digital re-mix culture as an open source approach where content products in the arts and culture industries are increasingly rearranged, manipulated and extended in the process of creating new works. *Transmutability*, the technical capability to easily change cultural content products that are encoded as digital data, is an inherent property of digital goods. It makes the sources of digital culture goods open for re-use and re-mix. The economic and strategic implications of open source culture creations, newly enabled through digital re-mix methods, have not been fully recognized in prior research in the Information Systems discipline or elsewhere.

This article seeks to develop new theory and takes the conditions of the industry of digital culture products seriously in theorizing the impacts and implications of IT (Chiasson and Davidson, 2005). Specifically, we develop what we believe to be the first *unified theoretical model* for open source culture and entertainment that explains the processes and forces that promote or impede the re-use of previously-recorded materials. What technologies are available, what do they enable, and what do they make easy or difficult? What are the incentives, who benefits and who loses, and how does this go beyond wealth transfer into the creation of additional social welfare? What should legal norms and regulations permit and what should be discouraged? Using multiple perspectives from economics, design sciences, and arts and culture, we derive conditions and boundaries within which “rip, mix and burn” and other open source approaches

based on re-use and recombination of content components can create significant economic value, stimulate artistic innovation, and spur creativity and growth in the culture and entertainment industry.

Unregulated application of re-use technologies can also damage the value of the original works, either through free-riding or the easy creation of inexpensive or free substitutes, or by the creation of alternative images that change the meaning from the original creator's intent and destroy demand for the original. Reusing and recombining previously-recorded content, however, enables artists and producers not only to create product differentiation at an unprecedented level, but also to do so very efficiently. This efficiency also explains the potential for re-use technologies to create wealth transfers away from the original content developer. For digital culture businesses, re-use means that digital re-mix approaches can be exploited for creating large portfolios of offerings at very low production cost. Our findings indicate that digital technology alone cannot explain the increasing use of re-mix methods. Rather, we argue that creative and economic forces play a key role in the move towards more open source production modes in the culture and entertainment industries, and we therefore integrate these forces into a unified theoretical model with high relevance to its industrial context.

The remainder of this article is organized as follows. Section II introduces digital culture goods and the concept of transmutation, which is the basis for all digital re-mix methods. [1] Section III briefly reviews literature related to the business of digital culture and entertainment products, as a means to lay a foundation for the application of the theoretical perspective that we will build. Section IV identifies and classifies different kinds of transmutation activities. It contributes a novel way of modeling the economic impact transmutation, by conceptualizing it as a function of the intensity and purpose of the applied manipulations. Section V further develops our theory of digital re-mix culture through the multiple lenses of eco-

[1] We include two "glossary tables" in an appendix at the end of the article to orient unfamiliar readers to the new language of this emerging area.

nomic theory, design theory, and the history and theory of art. Section VI discusses regulatory issues that seem to be influencing the adoption and development of digital re-mix approaches in the creation of culture and entertainment goods. Section VII presents implications for firm strategies. Section VIII discusses some open questions and future research possibilities. The article ends with our assessment of the contributions of the work, and the key conclusions the reader should draw, as well as the limitations of our theory and the future research that they suggest.

II. DIGITAL CULTURE AND ENTERTAINMENT GOODS

Although digital culture and entertainment products are examples of the general class of goods known as information goods, they are also different from others in several important ways. *Culture goods* constitute a category that requires separate consideration as a special subclass of digital information goods for at least three reasons. First, culture goods may be marketed by firms, but their meaning and their ultimate value is created only by their audience. Second, the value of culture goods is realized as a social process, not through individual consumption. A consumer may find a set of facts from an online information service (e.g., a weather report) useful without considering what others may think about it, but the same is not true of literature, songs and movies. Their meaning and value are largely created through shared experiences. They are irreducibly contextual. We acknowledge this fact implicitly in the term itself, *culture goods*. Songs and stories are situated and realize their value in specific cultures and subcultures. Third, ownership and control of American culture belongs ultimately to the American people,[2] and reside, to some extent, in the public domain. Culture has elements of a public good, and is meant to be accessible for further development to some extent, as regulated by copyright.

[2] A similar argument can be made about culture outside the United States, however, we have written this from a U.S.-centric perspective.

Frozen Products, Liquid Content

As long as culture goods were delivered in analog form, firms marketing culture goods were able to treat their products for the duration of the copyright term as *immutable assets*, intellectual properties whose content was physically fixed in the analog vehicles used for distribution. Manipulation of the content contained in analog form such as vinyl LPs was impossible unless one possessed expensive analog audio editing equipment and the considerable skills required to use it effectively; even then, the range of possible manipulations would be limited. Today, however, the shift from analog to digital platforms for the distribution of culture goods has made them less like frozen properties and more like fluid ideas: appropriable for extension, recombination and innovation (Katz, 2004; Negativland, 2001).

Locked into a single, protected form by both legal copyright and the technological barriers to reproduction and modification inherent in printing presses, vinyl LP and CD stampings, and videotape recordings and DVD stampings, these culture and entertainment products were delivered in the past to a public whose main function in this business model was to passively consume. But those technological barriers no longer exist. Culture has become increasingly digital and many culture artifacts have become liquid in the digital age. They are easily reproduced, easily distributed, and amenable to endless modification, extension and recombination. Once a text, song or film is converted into bits, those bits can be copied, changed, recombined, and morphed to produce new, derivative *re-mix* works or new works that are entirely made of complex layers of modulated *samples* whose origins may no longer be recognizable to a casual audience. [3]

[3] From a technical point of view, many works are based on *extreme sampling.* This involves the use of large numbers of samples that are subjected to digital manipulations that significantly change their sound or appearance. Re-mix and extreme sampling are also derivative, even if one may be unable to tell from which originals they derive. We will not strictly distinguish between such extreme mixes and derivative pieces that are apparent variations and extensions of recognizable originals, or largely new works that merely use a few samples. For example, Negativland pioneered the digital re-mix genre in the 1980s, releasing complex sound collages made up solely of dozens or hundreds of manipulated audioclips. These clips (i.e., samples) were taken from non-copyrighted radio transmissions on some tracks and

Digital files are inherently liquid because they are transmutable. Creators have digital technology at hand to sample and re-mix. Artists with the urge to do so now have the technical means to create derivative works with ease. User-friendly interfaces have lowered the expertise required to appropriate digital culture products for further processing. Because they are digital, culture products have migrated from playback-only platforms (audio and video players) to computing platforms, where passive consumption has never been the norm. Instead, artistic creators equipped with powerful IT tools can, almost by nature of the digital medium, employ various "rip, mix, and burn" strategies in the creative process. Sampling from existing works (ripping), modifying and recombining pieces (re-mixing), and releasing the new, derivative product (via burning) is becoming a defining mode of cultural creativity in the digital age (Katz, 2004; Lessig, 2004; Negativland, 2001).

Defining Transmutability

Transmutability of digital content arises from its representation as binary data. In brief, *digital culture product transmutation* involves three essential activities (Hughes and Lang, 2006):

- **Decontextualization (rip):** the sampling of content from a finished digital work;
- **Manipulation (mix):** the rearrangement, modification, or extension of digital content, using authoring and editing tools;
- **Recontextualization (burn):** the finalizing and release of the new, derivative work, to produce a digital re-mix.

A *digital re-mix product* uses finished culture works such as music and movies as a source for raw materials, which then are recombined according to the creative choices of the re-mix author. A typical project employs the following procedure:

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without permission from copyright-protected popular songs by the Beatles and the Rolling Stones on others. In either case, the end result became something entirely different. It took the listener's full attention to identify Beatles' or Stones' samples. Sampling and re-mix, as the transmutation of content, to such extremes was also used later with great commercial success on Public Enemy's seminal Hip Hop album, *Fear of a Black Planet* (1994), for example. Clearing copyrights for extreme sampling, however, soon created such costly and cumbersome legal troubles that music producers had to largely abandon this innovative artistic practice (Broussard, 2005).

Raw Material 1 (sounds/images, etc.) + Raw Material 2 (sounds/images, etc.)

+ … + Raw Material *n* (sounds/images, etc) = New Derivative Work

A *re-mix creator* may be the author of the original works that are used as raw materials, or a third-party producer. The raw materials themselves may consist of newly created content or samples taken from existing works. Samples can be re-used in their original or some manipulated form. They may be copyrighted, the case that raises significant copyright issues, or in the public domain. For example, one might combine 3-D vector graphics images made by the graphics engine from a game with edited audio tracks drawn from a variety of sources to create a new work of *machinima,* an increasingly popular genre of multimedia entertainment made possible by the transmutability of digital music and games. A music artist might decide to create an audio *mashup* by manipulating tracks from existing albums. Another re-mix innovation combines screen-motion captures of a virtual online environment with audio tracks to create a new form of multimedia talk show, distributed as a podcast (e.g., the show *This Spartan Life* at www.thisspartanlife.com).

These new forms of creative production are made possible by the transmutability of digital culture products. Transmutation activities rest upon two convergent developments. First, the culture industry has largely completed its shift in the delivery of its products from analog to digital formats (e.g., Alderman, 2001). Second, the IT industry has increased the power of microcomputer platforms to such a point that most forms of multimedia content can be manipulated with relative ease, using software and hardware available at low cost to virtually anyone who wants to acquire and learn to use it.

III. RELATED LITERATURE

We are concerned with the emerging literature on the business of digital culture. Since there is no specific unified body of literature addressing this interdisciplinary topic, we need to draw on

three separate, largely disjoint streams of literature that relate to the production and consumption of digital culture products.

Information Goods Research

Because digital culture products are also digital information goods, they take on the qualities that have been recognized as characteristic of such goods generally. These include high fixed costs of developing the first copy, low costs of reproduction and distribution, indestructibility, non-rivalry and non-excludability, and transmutability (Choi et al., 1997; Liebowitz, 2002). Analyses of digital information goods under these conditions have concluded that non-cost-based pricing methods, such as value-based pricing, are necessary, since pricing based on marginal cost would lead to near-zero competitive prices for digital products (Kauffman and Walden, 2001). Versioning as a source for price discrimination has been recognized as a powerful strategy to increase producer profits (Varian, 2005; Wu et al., 2003). Versioning, however, makes only very limited use of transmutability, and does not address the possibilities of extreme sampling methods and digital re-mixes produced by third-party creators.

IS research to date has not much addressed the economic potential of transmutability. Choi et al. (1997) discuss transmutability mostly as a risk, in that firms may lose control of their content after it is released commercially. In order to forestall such problems, they suggest, for example, that software firms can take advantage of transmutability to quickly upgrade application programs, to reduce the value of older versions and prevent loss of control over content. Our analysis will show that the effect of transmutability of digital information goods is not just limited to risk mitigation, but entails potential for creation of new value as well.

Digital Entertainment Research

IT sometimes confers power upon entities outside the firm, such as artists and consumers, and impacts the value chain of digital culture products. Bockstedt et al. (2006) noted that IT has provoked changes in traditional power relationships among the various stakeholders in the mu-

sic business. Clemons et al. (2002) concluded that changes in production resources have shifted power in favor of artists who increasingly use easily-available digital recording technologies and no longer need to depend exclusively on record labels for access to recording and production capacity. Reduced transactions costs made possible by IT may lead to a move toward unbiased electronic markets, with the result that record labels are being forced to reconsider their selling and distribution strategies (Granados et al., 2006). Hughes and Lang (2003) pointed out that emergent digital community networks organized around music are driving dramatic changes in the way that music is experienced and used. They noted, for example, that Internet communities of music lovers now distinguish among a proliferation of tightly-defined music genres, instead of just a few broad categories, thus revealing that music consumers today have highly varied tastes which need to be supplied with a greater variety of music.

In peer-to-peer (P2P) file-sharing networks and on other consumer-to-consumer content sharing sites, consumers not only reproduce legally frozen works, but actually alter or transmute them in ways that improve their usability and performance. Songs from CD's are unbundled from albums, offered as single tracks, re-bundled in users' custom-made playlists, and re-encoded as MP3s. Movies are re-encoded as DivX or Xvid files, and TV shows are compressed and edited. The industry's defenses against these modifications have included legal restrictions on use, and digital rights management (DRM) as an attempt to employ technological means to freeze and protect content. Some prior economics and IS research indicates that this approach may not lead to optimal outcomes (e.g., Bhattacharjee et al., 2003; Chen and Png, 2003; Romer, 2002). [4] However, new forms of collaboration between industry and consumers in which

[4] In the description and analyses which follow, we will note that activities undertaken by creators and consumers in the transmutation of digital culture products include both legal and illegal manipulation of digital culture products, such as the distribution of self-made derivative goods in P2P file-sharing systems or the circumvention of copy protection measures. The legal problems of such markets for digital culture goods are unresolved and the object of considerable dispute (e.g., Lessig, 2004), but resolution of such arguments on legal or political grounds is not our concern here. Thus the discussion of unfreezing digital content is not about advocating that digital content be made freely available without payment. Instead, we

consumers participate in the creation and distribution of digital content can create economic benefits for both producers and consumers (Arakji and Lang, 2007; Kwok et al., 2002; Lang and Vragov, 2005).

Creative Culture and Innovation Research

Current experimentation with digital culture products in the marketplace suggests that not only the risks but also the considerable potential benefits of transmutability need to be considered (Vaidhyanathan, 2004). The appeal of digital video recording for electronically storing television programs, for example, includes the ability to edit and personalize program TV broadcasts. In the movie business, we see that Lucasfilm, headed by director George Lucas, has made a large number of video clips from the classic Star Wars series available to fans (on www.starwars.com) and invited them to produce their own mashups using video mix technology from *Eyespot* (www.eyespot.com), and share them on online social network sites like MySpace and YouTube (McBride, 2007). The influential Grammy Award-winning industrial rock band, *Nine Inch Nails*, has released a number of their popular original tracks on their website (www.nin.com) that can be remixed with Apple's GarageBand software suite. Fans have contributed thousands of home-made remixes (by July 2007) that are made available freely for download. In Japan, copyright holders of highly popular graphic novels, a genre known as *manga*, a multibillion-dollar market, allow other commercial producers to appropriate their creations for the purpose of turning out new derivative stories. These *doujinshi* (同人誌), as they are called, both borrow and extend the original characters and storylines in both stylistic form and plot development. Manga, thus, are creating profits for the borrower while also increasing the value of and demand for the source product (Lessig, 2004).

In computer gaming, fans alter or add to the content and code of their favorite games (via *game mods* or *modding*) and exchange their innovations with others. In weblogs, bloggers se-

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note the potential for value creation that is triggered by recognizing and adapting to the inherently liquid, transmutable nature of digital culture products.

lect, manipulate and recombine images and snippets of news stories and other text from all over the Internet, accompanied by their own thoughts and commentary. Podcasters do the same thing with audio and video content. In popular music, fans are acquiring digital music files and putting them on computers, PDAs, iPods, cell phones, car stereos, and customized playlists and mix CD's. Clearly, consumers are willing and prepared to do more with digital culture products than just passively purchase and consume them. Creators and consumers alike are already engaging in transmutation and re-mix activities and will continue to do so with increasing scale and intensity. The following section analyzes these transmutations in greater detail.

IV. TRANSMUTATION IN DIGITAL CULTURE

Given that culture products have largely become transmutable, what does that mean in actual practice? What do we observe has been happening? The transmutation of media products takes many different forms. We offer a systematic categorization of transmutation activities, described below and summarized in Table 1.

Here, *product* is the basic unit of analysis and refers to the original content in whatever form or digital format it was released. The following analysis divides transmutation activities into two basic categories, according to the intent and intensity of the transmutations applied to a digital culture product. The first, *consumer-driven transmutation*, is primarily about enhancing the value of an acquired product for home use and consumption. The second category, *producer-driven transmutation*, relates to the process of creating new derivative products from existing sources. The output of the latter is intended to find an audience through release and distribution.

Consumer-Driven Transmutations

If consumers are taking advantage of the liquid form of digital culture goods to engage in their transmutation, the question arises as to why they are doing so. Looking at current practices, a number of distinct purposes can be identified. The first group of purposes listed below lists transmutation activities available to most users, without the necessity of engaging in extensive

additional creative and artistic activity.

Table 1. Levels of Transmutation			
Type	**Purpose**	**Methods**	**Examples**
Consumer - Driven Transmutations			
Level 1: Invisible Content Changes Bits are altered, but presentation of file content changes little or not at all. Casual users	Time-shifting Space-shifting Platform mobility Compression Stripping DRM code	Re-encoding Digital-analog transfer Video or audio stream Capture	DV to MPEG-2, 4 DVD to Xvid, DivX DVD to VCD Redbook Audio to MP3 TiVo
Level 2: Visible Content Changes Content within a product is visibly altered. Dedicated fans Expert users	Editing for customizing content Editing for personalizing appearance	Dedicated software tools for images, audio, animation and video	Pinnacle Movie Suite Photoshop Video game mods
Producer - Driven Transmutations			
Level 3: Content Extension Content is appropriated for extension, manipulation, re-interpretation, and recontextualization. Skilled creators; professional artists	Creation of new derivative works for artistic expression and community recognition	Dedicated software tools for images, audio (Garageband for Mac), animation, video and text	Fan films Podcasting Video game level editors Machinima
Level 4: New Product Creation Derivative works for commercial distribution Commercial producers, firms	Creation of new derivative works for commercial distribution	Dedicated software tools for images, audio (Pro Tools), animation, video and text	Hip-hop Dance re-mixes Manga and doujinshi

- **Unbundling.** Transmuters use IT to disaggregate bundled digital culture goods. Music fans may purchase songs bundled into complete albums on CDs, but may then use *ripping tools* to copy the songs into separate files onto hard drives, free of the original physical media.
- **Re-bundling.** Transmuters also use IT to recombine individual digital culture products into bundles which suit their own preferences. With simple software tools and media players, music fans can aggregate their own customized bundles of songs as *playlists*, or burn *mix CDs* organized around some dedicated purpose, such as *Party Music*, *Prayer Music*, etc.

- **Portability and Distribution.** Users take existing digital files and re-encode them using readily-available software tools to make them portable across different computing platforms, or compress them for more efficient storage. The MP3 specification for audio and MPEG-4 for video are the most popular and widely supported multimedia data formats, although dozens more exist.
- **Personalization.** Using digital editing resources, consumers increasingly modify cultural products to their personal tastes, often in an ongoing, continuous process. One example is altering the appearance of software interfaces by downloading and applying new *skins*. Another is the use or creation of new digital *textures* in online multiplayer games to redesign the appearance of game characters and avatars.
- **Editing / Re-editing.** In this case we are referring only to manipulation of existing content, mainly in the form of deletions and re-ordering of particular segments. This type of transmutation does not imply any additions to the original content. Fans of movies with digital video editing skills produce their own edits of commercially released films. Re-edits of *Star Wars* films are significant early examples of this emerging practice. Another example is the editing by instructors of long documentaries for in-class screening, so that the most relevant portions of content can be viewed and discussed within the constraints of the available class time. Digital video-recording of television broadcasts can be edited to remove commercial breaks, or to create short clips with comic or satiric intent, which are then passed around the Internet as *viral videos*. [5]

Producer-Driven Transmutations

A second group of transmutation processes is associated with *producers*, which we define as both serious hobbyists and professional artistic creators (writers, musicians, video makers and editors, and content programmers). The activities listed below require a relatively high level

[5] Some edited segments from John Stewart's popular comedy program *The Daily Show*, for example, reach a larger audience over the Internet than during TV airtime. The creators of the show themselves routinely use digital collage techniques when producing their contributions.

of skill, motivation and commitment from the transmuter to effectively exploit the potential of these modes. Users with better resources in terms of equipment, skills, ambition and talent tend to make much more substantial alterations. Distribution of the new, re-mix products is an explicit goal at this stage.

- **Re-contextualization.** Transmuters use IT to situate excerpts of existing digital culture products in new contexts, for new purposes. In podcasts, talented enthusiasts and professionals can create complete audio programs which may combine custom music selections with their own commentary. For example, a podcaster may combine background music with live voiceovers for museum tours or walking tours of famous sites. The resulting audio files may then be made available for download on the Internet. Video content excerpts from sources such as movie trailers, television commercials, or news broadcasts are selected and manipulated, often for their comic effect. Many examples of such clips can be found on user-generated content sites like YouTube (www.youtube.com).
- **Extension**. Transmuters use IT to add something substantially new to an existing digital culture product. For example, many weblogs extend digital texts by posting portions of existing content along with their own notes and commentary. Enthusiasts of the *Star Wars* movies have created a sizable catalog of what are known as *fan films*. These home-grown movies appropriate the characters and virtual world of the Star Wars universe to imagine and realize new stories, which are then produced and distributed over the Internet. Some of the biggest video game franchises have begun to offer *level editing software* along with the original game, to support the activity of users who wish to supplement the gaming experience with their own characters, objects, sounds, virtual environments, and game scenarios (Arakji and Lang, 2007). Entire modding communities of users creating and exchanging new game content have grown up on the web around games such as *Half-Life*, *Tomb Raider*, *Deus Ex*, and others (Postigo, 2003; Castronova, 2005).

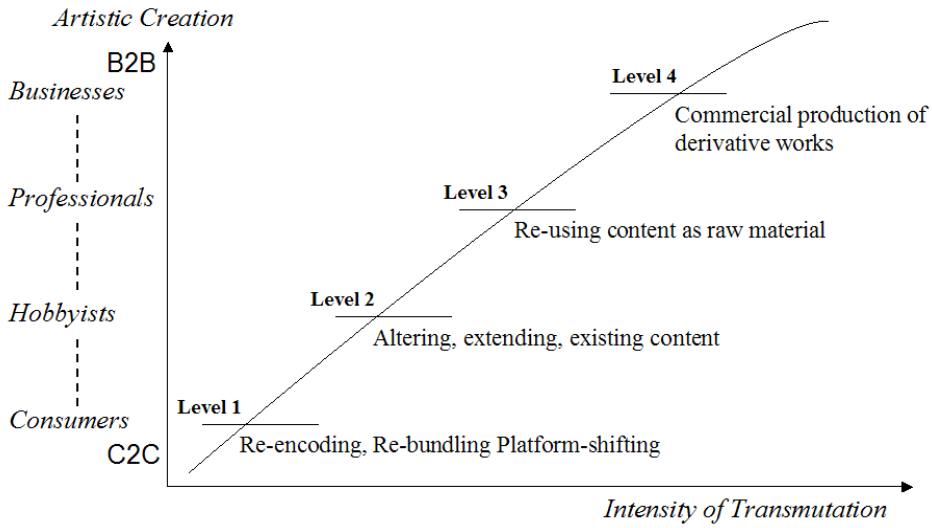
- **Recombination / Re-mixing / Sampling**. It is at this level that the intensity of transmutation is greatest, as transmuters collect bits and pieces from a variety of sources, modify them, and put them together in innovative ways to create re-mixes as entirely new products. The renowned artist collective *Negativland* (www.negativland.com) creates new music and video artworks by assembling collages from clips of existing music and video content, creating radically new meanings through striking juxtapositions of dissimilar materials. The entire genre of hip-hop and much of contemporary electronic music is premised upon the notions of sampling by using small clips from existing works of music from different sources and then re-mixing by combining loops of modulated samples to achieve the desired results.

Transmuters and Transmutations

Table 1 above summarizes the different transmutation possibilities and organizes them according to type, purpose and specific methods. Each of the four levels of transmutation implements some form of rip, mix, and burn strategy. *Ripping* means accessing and sampling content for further processing by making digital copies of a selected part. *Mixing* encompasses the various forms of digital manipulation of sampled content. And *burning* refers to arrangements resulting in a final copy of the digital re-mix that can be distributed for consumption or to serve again as input material for new re-mixes by someone else.

In Figure 1, we model the activities as transmutation and impact on creative output. The first, *intensity of transmutation*, uses the levels identified above to reflect the degree to which the original digital culture product differs from the derivative work as a consequence of transmutation. The second dimension, *artistic creation,* places transmuters along a spectrum of interests, skills and goals. Thus at Level 1 *(Invisible Content Changes)* we see very common activities, such as transferring the contents of a music CD to custom-made playlists on an MP3 player. At this level, we also see millions of consumers engaging in (now) very easy activities, with the

goal of maximizing the value and pleasure they can obtain from consuming a digital culture product.



Note: Level 1 = Invisible Content Changes Level 2 = Visible Content Changes
Level 3 = Content Expansion Level 4 = New Product Creation

Figure 1. Transmutation and Impact on Creative Output

Level 2 *(Visible Content Changes)*, which concerns alterations and extensions of existing products, involves more creative inputs from the transmuter, with some knowledge of multimedia object creation and editing required. Here we find enthusiastic, dedicated hobbyists and fan communities, with a deep enough level of interest to commit the resources of time and energy required to alter a digital culture product. The goals at this level include not only perceptive enjoyment and cultural appreciation of the original, but also to a limited extent the exercise and display of the transmuter's own creative sensibilities and skills, and sharing their creations with others. At Level 3 *(Content Extension)* we find professional creators developing re-mix works using the raw materials from existing works, with the expression of artistic creativity and commercial aspirations now playing the dominant role. At Level 4 *(New Product Creation)*, the production of derivative new works is organized as a business activity within firms.

As a consequence of the differing levels of skills, talent, and investment of resources re-

quired, we see higher numbers and lower skills of transmuters at the low end of the vertical axis and lower numbers and higher skills at the top. The dominant force at the low end of the scale is maximizing consumptive efficiency, while productive efficiency and innovative artistic expression are at the high end.

V. THEORETICAL PERSPECTIVES

We identify transmutation and re-mix as a question of particular interest in what might be called the *economics of digital culture*. Although research in this newly-emerging interdisciplinary area is just beginning, we now will attempt to take some first steps towards building a theory for open source culture and digital re-mix. For that purpose, we draw on supporting literature in economics, design sciences, and art. The proposed model integrating the theoretical elements involved appears in Figure 2 below.

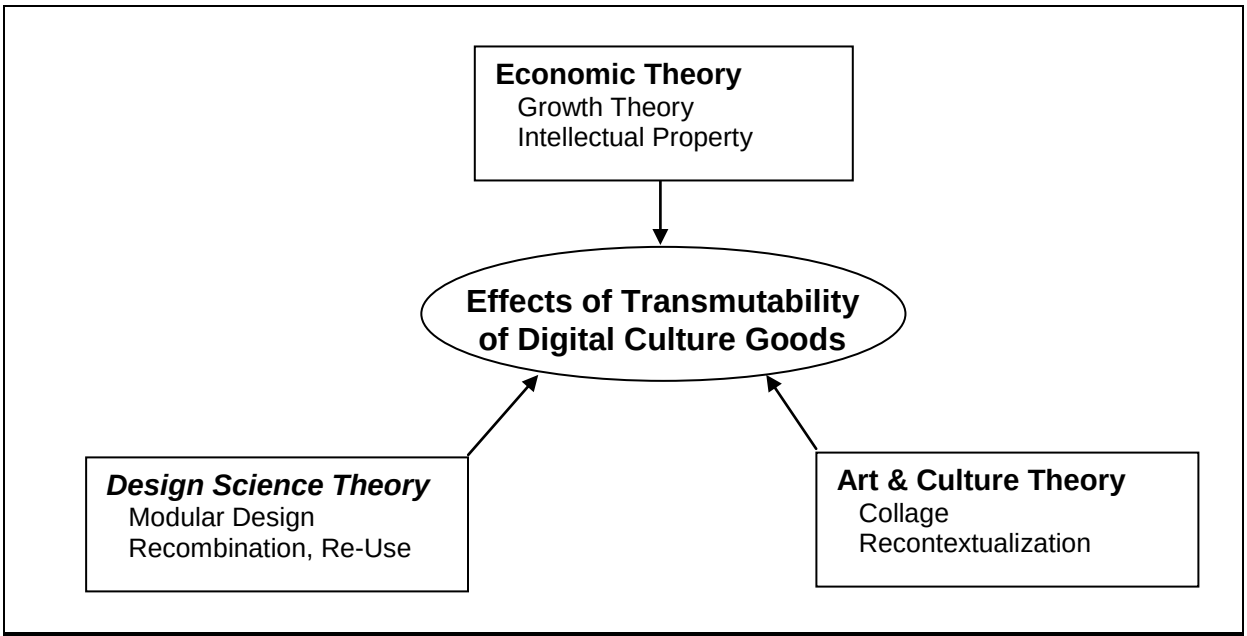


Figure 2. Theoretical Model

The following subsections examine the phenomenon of transmuting and re-mixing digital culture goods through each of these three theoretical lenses. We synthesize the findings from these disparate areas to provide support for the economic viability and significance of digital re-

mix culture.

Economic Theory

There are two areas in economics that are particularly relevant to the issue of digital re-mix production. First, modern economic growth theory considers the recombination of knowledge components as an important factor for growth and development. Second, the economics of intellectual property rights analyzes the impacts of regulation, affecting the transmutation activities and re-mix methods relative to the appropriability of value and innovation. Notice that economics research generally theorizes about knowledge in very abstract terms. Here, we conceptualize cultural content as one concrete form of knowledge and relate the relevant findings from growth theory.

Economic Growth Theory

Classical growth theory derived economic output models from the input factors of capital and labor, and treated technology change and knowledge merely as a residual variable (e.g., Solow, 1988). However, in the modern economy, the factors of production must also include technological change and the creation of, access to, and use and re-use of information and knowledge as endogenous variables (Barua et al., 2000; Ho et al., 2007). *Knowledge* has been variously described as ideas, innovations, know-how, best practices, and creative designs. We extend this conceptualization by asserting that culture content products are essentially knowledge-based goods. Hence, we suggest that research about knowledge creation and innovation can be extended to include cultural creativity and development.

Arrow's 'learning by doing' model first introduced explicitly the concept of organizational knowledge creation in economic analysis (Arrow, 1962). Romer's endogenous growth theory argues that knowledge-based economies can achieve increasing returns with respect to firm-specific investments in research (Romer, 1986). Modern growth theories now emphasize aggregate knowledge accumulation specifically based on the exploration of new combinations of ideas (Aghion and Howitt, 1999). Romer stipulates that access to knowledge created by individ-

ual firms ultimately benefits the entire economy, because some of it, whether voluntarily or not, spills over and accumulates as generally available aggregate knowledge in the public domain. [6] Knowledge cannot be fully controlled. Though the firm's individual production technology can be assumed to be linear (or having diminishing returns), it also necessarily creates spillover that benefits everyone else. That is, doubling inputs in research investments will double the firm's output, but will also create, at the same time, additional output at other firms through spillover effects. In other words, the re-use and recombination of existing knowledge has become the driver for innovation and economic growth. In the realm of digital culture, we find that knowledge spillovers can occur with incredible speed and effectiveness in terms of sharing and re-mixing artistic ideas, innovative styles, and creative methods. Spillover effects may be dampened because of re-use limitations due to copyright regulation and enforcement, but can hardly be eliminated.

While hard empirical economic data measuring the phenomena described in endogenous growth theory (actual growth in knowledge stock) are difficult to come by, Schiff's (1971) analysis of macroeconomic data from the period when Europe industrialized suggests that strong patent protection regimes may not be necessary to stimulate innovation. During 1850 to 1907, both The Netherlands and Switzerland repealed legal patent protection. Yet innovation at Dutch and Swiss firms, measured as the numbers of new products developed and brought to market, flourished and helped grow the two national economies despite competition from neighboring countries such as Britain and Germany, which already had relatively strong patent protections written into law. Thus companies in these two nations innovated for decades even in the absence of the economic incentives that derive from patent protection law. Knowledge spillovers in the two countries accelerated under those conditions and may indeed have stimulated innovation and economic growth.

[6] This is formally expressed as the central relationship in the analysis in [Romer, 1986] as $F(\psi k_i, \psi K, \psi x_i) > F(\psi k_i, K, \psi x_i) = \psi F(k_i, K, x_i)$, where the k_i refers to the firm's individual research investments in knowledge creation and x_i refers to other inputs. The aggregate stock of knowledge is denoted by K.

A more recent study looking at the Japanese patent reforms of 1988 obtained a similar result, finding that the stronger patent protections embodied in the reforms could not be claimed to have had any effect in spurring greater innovation and knowledge creation (Sakakibara and Branstetter, 2001). Since most artists are motivated by a far more complex set of incentives than most other economic actors, it should be added that reasoning from patent research may overstate the potential negative impacts from the reduction of the artist's purely economic incentives.

Intellectual Property Rights Economics

Copyrights, patents, trade marks, and trade secrets have always been important to competitive strategy, but intellectual property rights has become an issue that is more central in the information economy than it ever was in the industrial economy (Farrell and Shapiro, 2004). This is particularly true for the digital culture industry, where copyright questions significantly influence competitive conditions. The goal of copyright regulation is to strike a balance between productive and consumptive efficiency. On the one hand, copyright protection should enable content creators to appropriate enough value from their works to provide strong incentives for them to create new works in the future. On the other hand, there is also the intent to foster social progress by making culture products easily available to society at large, and to promote artistic development by limiting patent and copyright protection so that artists can build on previous works when creating new output. [7] The controversial implications of copying content for the purpose of sharing among consumers in terms of socio-economic benefits and harms have received a lot of attention in the information economics literature (e.g., Bakos et al., 1999; Bhattacharjee et al., 2003; Chen and Png, 2003; Choi et al., 1997; Krishnan et al., 2003; Liebowitz, 2002; Varian, 2000).

Here, however, we are concerned with a different issue, namely accessing content for the

[7] The U.S. Constitution, in Article 1, Section 8, explicitly asks Congress to "…promote the Progress of … useful Arts, by securing for limited [emphasis added] Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries …"

purpose of remaking it into something new and different, rather than copying it just for sharing. Copyright law protects content in both situations. Specifically, it also regulates how creators can sample existing pieces of cultural content – whether a few notes of recorded music, an image, or longer segments of copyrighted works – and re-use them as input, or raw materials, when creating derivative works (cf., Litman, 2001). These new products may be intended for for-profit sale to consumers or for personalizing content, which consumers have legally bought, for private use.

In a different but related context, reverse engineering has become an important knowledge discovery method in the IT industry to re-use valuable ideas first invented and patented by someone else. The economic benefits of this kind of knowledge re-use have, in this case, been recognized by the courts who have granted fairly extensive rights for reverse engineering technology products, establishing precedents for fair use in case law which serve as a complement to legislated patent law (Samuelson and Scotchmer, 2002). Nevertheless, a number of scholars are calling for reforms in patent law, which they see as currently too restrictive in terms of allowing effective knowledge sharing. Similar arguments have been recently made in the context of sharing artistic ideas in producing culture products (Lessig, 2004; Negativland, 2001; Vaidhyanathan, 2004).

Reverse engineering has always been possible and widely used by creators of music, movies, literature, and so on. Copying storylines, characters, sounds and melodies has been the standard mode of artistic creation, as long as the copying was not verbatim, and as long as some alterations were made that would distinguish the new product from the original. This kind of artistic inspiration, or knowledge spillover and re-use, has been viewed as largely positive, as it creates immense variation and nuance in almost all cultural genres, and thereby affords better choices for consumers. This is also the reason why copyright only protects specific expressions of ideas but not the idea itself. But in the digital age, the boundary between artistic ideas (e.g., styles and patterns) and their specific expression (e.g., as sound recordings or movie images) is

no longer so clear, as creative artists use digital samples not as identical copies but instead as raw materials from which they craft and mold something that is often entirely different from the original. In that sense, we believe that digital re-mix approaches are similar to the re-use of artistic ideas, and thus they should arguably not be entirely prohibited by copyright restrictions. This does not mean that copyright holders could not or should not charge re-mixers for using samples as raw materials. Rather, there should be an efficient process in place that provides profit-oriented creators better access to cultural materials in a predictable and affordable manner.

Such a process already exists for the re-use of music compositions as well as for live performances of recorded music. Anyone can perform or record music pieces that were written by someone else. The copyright owner cannot prevent anybody, whether a famous star or some unknown dilettante, from reusing his original composition in a new derivative cover version of a song, but compensation is obligatory and provided through the royalty fees collected from those who play or perform their works for commercial purposes. This system, known as *mechanical licensing*, is administered by agencies such as the American Society of Composers and Publishers (ASCAP) and Broadcast Music Incorporated (BMI). It also oversees uses such as recordings played for entertainment of patrons in restaurants and clubs. Mechanical licensing provides a revenue stream for copyright holders, but more importantly, it provides a transparent and efficient way for creators to obtain the rights to use others' work, with completely predictable costs. No equivalent set of rules exists for sampling and re-mixing previously released content. Allowing more openness to cultural content through innovative licensing schemes will spur creativity and increase the supply of derivative works (Landes and Posner, 1989; Lessig, 2001). This may not be just socially desirable, but may also be economically beneficial to the original copyright owners.

Design Theory

The principles of recombination and re-use are well established in the disciplines of design in areas like architecture, engineering, software development, and manufacturing. They aim at improving productive efficiency by reusing existing components and are often referred to as *modular design* of products and production processes (Huang, 2000). The modern Ford 4.6-liter V-8 engine, for example, is a modular design with internal components that are re-used across multiple product lines. It is interesting to note that though Ford owns the rights to the modules used in its engines, it also allows deliberate transmutation of this product, often by hot rodders, through the substitution of aftermarket modules which can be used to replace stock parts in order, for example, to increase horsepower (though such changes may void the manufacturer's warranty). Likewise, modern Ford product modules, particularly electronic ignitions and computerized engine controls, can be used to replace less efficient parts in older models, using new Ford modules to transmute an old Ford.

Architectural design also takes advantage of modular components for reasons of both efficiency and flexibility. Similarly, object-oriented software is premised upon the idea that program code need not be created *de novo* for each project (Gamma et al., 1995). Instead, vast libraries of re-usable software components are explicitly designed and distributed for the purposes of recombination and re-use, to improve the efficiency of the development process. IS research has begun to take increasing interest in the area of open source software development, which has some important conceptual parallels with the transmutation of digital goods. We argue that the digital re-mix culture can essentially be construed as *open source culture production* that shares basic principles with open source software, while also differing in some important aspects.

Traditional analog means of culture goods production are similar to those of proprietary software production, in that the original, finished product in both cases is not amenable as dis-

tributed to modification. In addition, only the owners of the original product control the development of content. Open source software overturns both of these principles. (See Table 2.)

Table 2. Open Source Production Modes: Software vs. Culture Goods

Similarities	Differences	
	Open Source Software Production	***Open Source Culture Production***
Open access to source material	Executable program code	Digital data content
3rd party development, participation incentives	Large-scale collaborative processes	Small-scale collaboration
Both raise issues of intellectual property rights	Complexity management – high	Complexity management - low
Both involve issues of content control	Forking and versioning problems	Versioning benefits

The source code is made publicly available, for the express purpose of encouraging further development and re-combination of the existing software components (Lerner and Tirole, 2002; Stallman, 2002). The openness of this process thus leverages the power of a community of external participants who contribute to the further production of code. We find a similar situation with digital culture products, in that digital content can be made available for re-mix, and that such availability cultivates the contributions of peer artists and communities of dedicated fans.

However, we also need to point out some important differences between open source culture production and open source software production. At the technical level, software is executable program code, while digital culture content is non-executable data code in audio and video bitstreams. The collaborative processes of the two also differ. An open source project may involve cooperative work among a large number of participants who need to be effectively organized and managed, while a digital re-mix project is typically carried out by just one or a few contributors. This means that complexity management is far less demanding in open source culture production. In open source software, production code forking and version management requires extensive coordination, whereas in open source culture production there are no compatibility problems raised by multiple versions. On the contrary, multiple versions can represent an increase in consumer benefits: the more variety, the better the selection of choices for increa-

singly fragmented consumer tastes.

Art and Culture Theory

To theorize about value creation of digital culture goods, it is also necessary to understand the main contributions from art history and art and culture theory in terms of creation and uses of cultural artifacts. For most of human history, art and music have been essentially public goods, appropriable to anyone who came across cultural artifacts. Music, for example, was for centuries a good created, distributed and valued in common, not privately, and the categories of *consumer* and *creator* were not exclusive (Hauser, 1982). Musicians actively borrowed and modified each other's work, and it was understood that they would do so (Vaidhyanathan, 2004).

A new stage of the evolution of culture consumption was ushered in by a technological innovation in recording technology that made it possible not only to preserve a specific performance, but to market consumer products out of frozen moments in time. Before the advent of the phonograph, experiencing (i.e., consuming) music was necessarily a social act, since there was no alternative to live performance. With first the wax cylinder, then the wax record, vinyl LP, and CD formats, the recording industry developed production models that created economies of scale and made cultural products cheaply available to mass consumer markets (Theberge, 1997).

As long as the technological means of creating and distributing recordings were relatively expensive to acquire and difficult to use, the recording industry was able to exercise a high degree of channel power over music products. During this period, culture industry firms built comprehensive repositories of exclusive copyrights covering the works produced and distributed by them. Copyright ownership became a strategic resource in the culture industry, a resource that was strongly defended against potential encroachment by digital technologies (Clemons and

Lang, 2003). Now, the sampling of as few as three notes from a copyrighted work can constitute infringement of copyright. [8]

We are today again entering a new stage of cultural development. The massive sharing and transmuting capabilities among consumers and independent creators are mounting forces that increasingly affect the role of content ownership in the digital age. Social networks of online consumers are employing information technology not just to enjoy culture goods individually, but also to share their experiences and opinions with each other. The philosopher John Dewey theorized the experience of art as a *social process of communication* (Dewey, 1934). The more consumers who like or dislike a piece of music, the more urgently they want to share the experience with friends.

Art and culture theorists have long championed the idea of creative re-use and recombination of existing expressions (Greenberg, 1986). Such methods of artistic expression are called *collage*. This innovative art form is generally seen as fundamental to the very idea of modern art. Taylor (2004), for example, describes the significance of collage to the development of art by stating that the " … primary contribution of artists of the 20th century is the notion of collage …". The creation of new artworks based on existing cultural goods has been a universally accepted practice that artists in different disciplines have been developing since at least the turn of the 20th century (Taylor, 2004).

In Table 3 we show a handful of prominent examples to illustrate methods of collage. They all employ processes of sampling, modification and recombination in precisely the sense of transmutation and re-mix that we have introduced above in the context of digital culture goods. In this sense, the re-mix is basically just a *digital collage*, and can be considered as a digital extension of the traditional physical collage.

[8] This is a judicial ruling from *Bridgeport Music v. Dimension Films*. In this 2004 case, the judge found that three notes from the guitar solo of a song which were sampled for use in a movie soundtrack constituted infringement, and established the "two-note" rule as legal *de minimis* standard. For details of the case and how the judge's decision was reasoned, see fsnews.findlaw.com/cases/6th/04a0297p.html.

Table 3. Transmutation and Re-mix in the Traditional Arts		
Recontextualization		
Marcel Duchamps	*Fountain* (1917) *L.H. O.O. Q. (Mona Lisa)* (1919)	sculpture, print/drawing
Andy Warhol	*Brillo Box Installation* (1968)	Installation
Jeff Koons	*String of Puppies* (1988)	Sculpture
Recombination and Manipulation		
Pablo Picasso	*Still Life with Chair Caning* (1912)	Painting
Andy Warhol	*Campbell's Soup* (1960) *Marilyn Monroe* series	Painting Silkscreen
Max Ernst	*Switzerland, Birthplace of Dada*	Object
William Burroughs	*The Naked Lunch* (1959)	Literature
Beatles	*Revolution #9* (*White Album,* 1968)	Music
Terry Gilliam	*Monty Python's Flying Circus* (1969)	Television
Public Enemy	*Fight the Power* (1989)	Music

We see the aesthetic principles of re-mix at work in all of the examples of collage listed in Table 3. Artists appropriate existing objects, modify them and place them in new contexts in order to create new meanings. Thus, re-use is not viewed as copying but as a value-creating act. Legal questions about the use of sourced materials with copyrighted or trademarked content and materials found in the public domain did not arise as a deterrent for making these works. Andy Warhol, for example, painstakingly reproduced the precise appearance of the Brillo boxes, including its trademark-protected logo. (See Figure 2.) The copying and re-contextualization of an image of a common consumer object was a critical element in its artistic purpose.

The item appears identical to the actual consumer product, though Warhol's Brillo box is made of acrylic and silkscreen, not cardboard, so it has been re-encoded in different media. It has also been decontextualized, removed from the original context for which it was intended, and finally recontextualized, by placing it in a gallery installation, essentially “platform-shifting” the object. Warhol provokes the viewer to reconsider the meaning of images that were originally created purely for marketing purposes as they are arranged and shown in a different context.

Marcel Duchamp's *Mona Lisa with a Mustache*, depicted in Figure 3, re-mixes an image that has become iconic and ubiquitous in modern culture, appropriated in thousands of ways.

Source: Available at kunstonline.dk/indhold/pop_classics.php4. Last accessed on July 10, 2007.

Fig. 3. Warhol's *Brillo Boxes Installation*, 1964, *Aarhus Kunstmuseum,* Aarhus, Denmark

Source: Schwarz (1975)

Figure 4. Duchamp's L.H.O.O.Q. (1919, Collection Mary Sisler, New York)

This work, like Warhol's, took an item from mass culture, in this case a simple postcard of Da Vinci's *Mona Lisa*. Duchamp thus closes a conceptual cycle: from artwork to throwaway consumer item and back again, via Duchamp's intervention, to the condition of an artwork. The artist uses raw material from a commercial product as a starting point for building a derivative

work which, by virtue of its selection, and of the changes Duchamp made to it, has a meaning and impact which is dramatically different from that of the original artifact.

Salvador Dali's *The Accommodations of Desire* from 1929 closely integrates the borrowed elements, illustrations of a lion's head cut from mass-produced print media, with Dali's own painted elements. (See Figure 4.) Notice that Dali not only appropriates the lion image, he also manipulates it and combines it with his own original content, making it a motif which appears several times in different guises across the painting, with radically different meanings. The result is a new work of collage art which, though it makes prominent use of an image created by someone else, is unmistakably Dali's own.

Source: Gerard (1968)

Figure 5. Dali's *The Accommodations of Desire* (1929, Metropolitan Museum of Art, NY)

From an art theory point of view, the example of artists of the stature of Warhol, Duchamp, Dali, and many others demonstrates that for many creators, theorists, and consumers of high culture, the principle of re-use and recombination is essential to cultural creation and valuation. Today with the power of digital technology, the possibilities for making collages are greater still.

Of course, it must be understood that, for various reasons, artists and original copyright holders may not wish to release content for re-use by others. For example, Apple Records, which owns the Beatles catalog, has taken a very restrictive stance against sampling of their

music. The band Pink Floyd is known to be very protective about the representation of their artistic creations and does not permit re-use of their materials by others either. The artists Madonna and Britney Spears, on the other hand, both have recently embraced digital sampling and re-use and extensively used the new technical and artistic digital re-mix possibilities on recent album releases (Britney Spears, *B In the Mix – The Remixes,* 2005; Madonna, *Confessions on a Dancefloor*, 2005).

VI. REGULATING CULTURE CONTENT AND RE-MIX

The concept of re-combination and re-use of knowledge or knowledge-based content is not new. A belief in the concrete value of re-using and extending knowledge is written into the original body of U.S. copyright law. Ideas were deliberately made non-copyrightable, while specific expressions of ideas as knowledge goods like recordings are protected. However, protection is mandated for a limited time only so creative works pass into the public domain where they can be freely accessed for either consumptive purposes or for re-use in derivative works. In the digital age, copyright holders generally pull in one direction to restrict uses, while consumers and creators pull in the opposite direction by practicing wider and more flexible uses. Creators who wish to create derivative products often claim that current copyright law over-regulates innovative production practices, locking down a substantial amount of American culture by placing undue limitations on their ability to make effective use of digital re-use technologies (Lessig, 2004). For example, the acclaimed music artist DJ Z-Trip points to precisely this problem as a major barrier to the production of innovative works in his genre of music. (See Mini-Case 1.)

Having analyzed a number of important re-mix practices and significant problems, we now present a more systematic look at the various conditions that render digital culture objects useful for transmutation. In practice, anything that is or can be digitized has the potential for digital re-mixing. Table 4 organizes different possible sources and types of digital components and corresponding re-mix approaches and regulatory constraints.

Mini-Case 1. DJ Z-Trip

In 2001 the re-mix artist Z-Trip completed and prepared to release his latest work, *Uneasy Listening*, a musical collage work which sampled dozens of existing works. Originally conceived as a very small-scale self-distributed work, it quickly proved so phenomenally popular that Z-Trip was signed to a major label on the strength of it. As the record company prepared for commercial release, it began to undertake the process of clearing rights for the samples used. After over a year's worth of effort to find copyright holders and negotiate terms, and making little progress, they gave up and withdrew the album. Today *Uneasy Listening* is an underground hit, but it is illegal to sell or distribute it.

The impact of this experience is not limited to just this work. In an interview published online, Z-Trip (1994) talks about the consequences for himself and other artists:

> *"...this fear looms over every artist's head that does this stuff. And some of the best music might not be heard if people are afraid. I don't think music and fear have good compatibility. Every day I live with the fear of "Do I silence myself?" or do I do my art. I have so much work I want people to hear that they never can legally hear. So, what do I do, what do we do?"*

Z-Trip, his fans, and his record labels lost out with *Uneasy Listening*, because the transaction costs of clearing material was too high, and because the legal risks of going ahead were too great. Until these problems of regulating digital content are solved, similar losses in terms of both artistic innovation and firm revenues will continue.

Notice below that the last row in Table 4 differs from all of the prior entries. It represents the segment of copyrighted cultural goods that are subject to especially restrictive, expensive, and burdensome regulation. Re-mixing copyrighted works represents only one of several modes of production, but it is commercially the most significant. The question of intellectual property rights policy has strong advocates on two opposing sides (Farrell and Shapiro, 2004). The *incentives school of thought* favors a strong copyright protection scheme and emphasizes the question of whether creators are in a position that allows them to capture a large enough portion of the value of their creations so that they will continue to produce more works in the future. The *openness school*, on the other hand, prefers weaker copyright regimes that emphasize the stimulation of creativity and innovation. They argue that artists are intrinsically motivated to create, even in the absence of strong copyright protection. Overall, our analysis of the literature suggests that the findings on the effects of strong or weak protections remain inconclusive.

Table 4. Digital Culture Materials for Re-mix			
Sources	**Types**	**Examples**	**Regulatory Conditions**
Public domain works	Digital books, images, music, movies and video, available for any re-use in a new work	FreeStockFootage.com Gutenberg Project (free Internet archive of public domain works)	No restrictions
Creator's own materials	Album re-mixes: re-working existing recordings	Beatles' *Anthology* Lee Scratch Perry's *Blackboard Jungle Dub* Kraftwerk's *The Mix*	No restrictions
Found sounds	*Musique concrète* – sounds recorded live	Stockhausen, Cage, Varèse, Einstürzende Neubauten	No restrictions
Materials created for re-use	Beats and samples recorded and sold specifically for other music creators to use (new niche industry)	BEATS365.com premiumbeat.com	No restrictions: License acquired with purchase of the library of samples
Materials for parody or political satire	Video and audio of public figures, with satirical audio or images added	Jon Stewart's *Daily Show*	No restrictions: Fair use exemption guaranteed by federal copyright law
Commissioned re-mix works	Existing audio recordings which are re-interpreted and re-mixed by artists hired for that purpose	Mariah Carey's *The Remixes* Re-mix compilations	No restrictions: creators solicited explicitly for their input to a derivative work
Collaborative knowledge projects	Actively soliciting the contributions of the public to a collective product	Wikipedia	Minimal restrictions: Monitored for off- topic or disruptive content
Open Source licensed works	Works released for various types of re-use to the public	BBC Creative Archive Flickr (www.flickr.com) Creative Commons Project (www.creativecommons.org) Nine Inch Nails Fan Re-mix Site (www.ninremixes.com)	Variable restrictions: Tiered system of permissions
Copyrighted works	Works which may be used only with direct legal permission granted by owner	Public Enemy's *Fight the Power* Fatboy Slim's 1998 re-mix of Camille Yarbrough's 1975 song	Severe restrictions on fair use Copyright term repeatedly extended. All rights reserved

Romer, for example, warns that allowing the recording industry to control what devices and software are used to play digital music could slow down technological innovation (Romer, 2002). Similarly, Boldrin and Levine (2002) argue that locking up ideas in order to create a condition of intellectual monopoly has hidden social costs, and that better alternatives are available. On the other hand, Hui and Png's (2002) empirical study of the movie industry concluded that the 1998

extension to the period of copyright in the U.S. has had little impact on new creative activity. In addition, Klein et al. (2002) argued that the unregulated use of copying technologies has a negative effect, in that the copyright value of existing works is reduced and may diminish the incentive for creators to create new work.

We do see some evidence that the current regulatory environment is in some cases having the practical effect of stifling innovation, however. Recent court decisions concerning how audio samples can or cannot be used have had the effect of deterring some creators from pursuing new directions in creating sample-based music. (See Mini-Cases 1 and 3.) Innovative products have been shelved indefinitely, not just in the case of music and culture, but also in the IT industry, which is supplying the technology products and tools needed for consumers and creators to engage in digital transmutation. Legal risks stemming from regulation also affect filmmakers. Producers specializing in documentaries, for example, find that all copyrighted images and sounds in their productions, even those captured incidentally, must be licensed from the copyright owners (Ramsey 2005). This means that directors with limited budgets usually have to severely compromise what they can put on film. (See Mini-Case 2.)

Under the current regulatory framework, producers of derivative works have the problem of determining in the legal sense what materials may need copyright clearance. (See Mini-Cases 3 and 4.) Discovering who actually owns the copyrights to a particular piece is another problem, as each work may have dozens of people and legal entities who have some copyright claims. These copyright owners are often difficult to find, as they may have withdrawn from public activity, or died and bequeathed their rights to persons unknown. Nor is there any means, short of direct negotiations with each copyright holder, of determining under what conditions a sample may be released for use in a derivative work.

Finally, even a good-faith effort to solve each of these problems cannot entirely dispose of the risk that, after a derivative work is offered commercially, more hitherto unanticipated claims against the use of materials in a digital re-mix product could surface in the form of lawsuits.

Mini-Case 2. Clint Eastwood Documentary

In 1993, Starwave, a company founded by Microsoft to create innovative digital entertainment, produced a documentary about the life and career of Clint Eastwood. The product, to be distributed on CD-ROM, was to survey Eastwood's work in film, including clips from his movies. The lawyer for the project, Alex Alben, set out to clear the rights for the digital samples:

> *"So we very mechanically went about looking up the film clips. We made some artistic decisions about what film clips to include —of course we were going to use the "Make my day" clip from [the] Dirty Harry [series].* † *But you then need to get the guy on the ground who's wiggling under the gun and you need to get his permission. And then you have to decide what you are going to pay him. We decided that it would be fair if we offered them the dayplayer rate for the right to re-use that performance. We're talking about a clip of less than a minute, but to re-use that performance in the CD-ROM the rate at the time was about $600. So we had to identify the people—some of them were hard to identify because in Eastwood movies you can't tell who's the guy crashing through the glass—is it the actor or is it the stuntman? And then we put together a team, my assistant and some others, and we just started calling people."* (Lessig, 2004, pp. 101-102).

In this case, the project did get completed, rights were cleared, and the product did well in the marketplace. But without the financial backing and strong support by Microsoft this outcome would have been unlikely. Alben acknowledges: "very few...have the time and resources, and the will to do this" and that thus very few works would ever be made (cf. p. 103).

Note: † Words in brackets have been added for the sake of clarity. The actual quote appears in *Sudden Impact* (1983), one of the later movies in the *Dirty Harry* series.

Mini-Case 3. The *Grey Album* and Opposing Views of the Copyright Holders

In 2004, Brian Burton, a 26-year-old Los Angeles-based music artist who uses the stage name "Danger Mouse," made some promotional copies of an underground hip-hop work and gave them to fans and friends. The audio *mashup* he created is called the *Grey Album* because it mashes up vocal tracks from famed acclaimed hip-hop artist Jay-Z's 2003 *Black Album* together with music from the Beatles' seminal 1968 *White Album*. The transmuted derivative work, a complex layering of edited and sonically manipulated components from both source works, was an instant sensation. The *Grey Album*, given out by Danger Mouse on CD-R's, immediately appeared on the Web in MP3 format, and the number of downloads is estimated in the millions. Critical reviews were glowing.

This was a natural and expected outcome for Jay-Z, who posted the so-called "Jay-Z Construction Set" on the Web, expressly for the purpose of making re-mixable components of his original works available for DJs to use in new derivative works. This "construction set" contained the content and software tools for creating a re-mix version of Jay-Z's work.

Record label Capital Records, which owns the U.S. rights to the Beatles' *White Album*, however, did not approve. When it became aware that copies of *Grey Album* existed, it sent out cease-and-desist letters threatening legal action unless all reproduction and distribution of this derivative work ceased, along with other demands. Danger Mouse did not seek permission to use recorded tracks from Capital Records, nor is it likely that he would have gotten permission to use *White Album* if he had tried.

Thus, despite its huge critical success and popularity with fans, the *Grey Album* never became a commercial product. Nevertheless, it forcefully demonstrates the considerable market potential of digital re-mix products. Ironically, the underground success of the *Grey Album* did spark new interest in the Beatles' *White Album* among a new generation of music consumers who may otherwise not have discovered this music. For a more complete account of the *Grey Album* phenomenon, see www.illegal-art.org/ udio/grey.html.

Many products never get made due to high transaction costs, resulting from the expenses, efforts, and uncertainties incurred in the process of clearing rights to re-use copyrighted material. The process currently in place imposes such a great burden in terms of investment and risk of hold-up, as well as content poaching and misappropriation that substantial *Williamsonian underinvestment* in digital culture products may be the result (Clemons and Hitt, 2004; Williamson, 1971).[9] Deregulation of access to culture content for use in derivative works may be needed to increase the efficiency of cultural production in the digital world (Lessig, 2004).

Mini-Case 4. Fatboy Slim and Camille Yarborough

In the realm of digital music, we find the example of a derivative new work by famed dance music creator Norman Cook, known to his fans as Fatboy Slim, who in 1998 sampled and re-mixed music recorded by Rhythm & Blues singer Camille Yarbrough in 1975. He created a derivative work called "Praise You", which was a number one hit on multiple record charts, and helped garner the album on which it appeared three MTV awards and two Grammy nominations. In a bilateral agreement, Cook and Yarbrough split the royalties from the resulting music sales, with Yarbrough receiving 60%.

At the time this deal was made, Yarbrough's moderately successful career in music had long since peaked and gone into steady decline. Fatboy Slim's re-mix of one of her songs has resurrected the forgotten original artist's career. The sampled artist earned and continues to earn substantial income from the derivative work, including not only direct sales of Fatboy Slim's album, but also licensing fees from film and television productions which used the song. In addition, the attention from fans formerly unaware of her music brought about the re-release of her 1975 album *The Iron Pot Cooker*, and two further re-mixes have followed, along with a re-evaluation by critics of her place in the world of popular music. In this case, re-use of content proved to be profitable for both the original copyright holder and re-mix creator (Katz, 2004).

VII. IMPLICATIONS FOR FIRM STRATEGIES

Transmutation and re-mix activities, whether sanctioned or not, are already occurring on a large scale, as a fundamental consequence of broad access to digital data and the power of information technologies. There is no reason to suppose that the trends we have observed will somehow halt or reverse. On the contrary, Moore's Law and the growing availability and ease of use of multimedia software make it likely that transmutation activities will only increase. Firms

[9] Williamsonian underinvestment benefits no one; that is, neither the original content creator nor the re-mix producer will be better off because a possible derivative product does not get made. There are, of course, some original creators or copyright holders who are actually delighted if their work is not re-used by others, no matter what arrangements are offered. Hence, although Williamsonian underinvestment is substantial, it does not occur universally.

need to respond to the fundamental technological changes that are inducing a shift from the traditional closed content control paradigm to a production and consumption paradigm in the emerging re-mix culture that necessarily needs to be more open to access and re-use. Next, we outline three particular business strategies that describe economically viable and sustainable models that control risk while embracing transmutability and re-mix.

Complementary Products and Services

One set of opportunities centers on selling products which are complementary to the actual digital culture products themselves and necessary to maximize consumer utility. Both Apple and Microsoft have already taken steps to exploit this opening, as in Apple's "Rip, Mix and Burn" and Microsoft's "Create Something Sonic" ad campaigns, which explicitly encourage their customers to "Mix and Mashup" content. To take advantage of these new rip, mix, and burn possibilities, consumers repeatedly upgrade hardware and bandwidth, acquire additional software, and buy new gadgets that enhance their experience with digital culture. The combined market for these complementary products is far larger, and more profitable than the entire culture and entertainment industry. For IT and telecommunications, this means that the more consumers adopt content transmutation activities, the more they demand the necessary complementary products. So locking up content cannot be in the interest of the IT industry. Pressure to deregulate the cultural content industry is as likely to come from the IT industry as it is from consumer groups.

Private-Collective Innovation Model

Classic economic analysis strongly suggests that production based on private investment leads to the most efficient outcomes (e.g., Demsetz, 1967). More recently, however, some researchers have argued that community-based, collective action models using technology-enabled forms of networked collaboration can outperform traditional private enterprises in certain contexts such as software development (Lee and Cole, 2003) and information production (Benkler, 2006). In light of our discussion on digital re-mix culture, we have a proposal for the

case of the culture and entertainment industry in accordance with von Hippel and Krogh (2003): some hybrid approaches may be the most efficient.

For software development, von Hippel and Krogh argue for approaches that strike a balance between proprietary and open development models, to achieve socio-economic solutions. Likewise, firm strategies based on more open cooperative collaboration with external developers and consumers in the digital culture space may be successfully deployed. Effective strategies may include profit-sharing arrangements or indirect appropriations of original content value. Leading computer game developers have already succeed in employing private-collective innovation models, by distributing tools for transmuting the original game with the game itself, to encourage the further development of extended game content. (See Mini-Case 5.)

Hyper-Differentiation and Resonance Marketing

The *theory of hyperdifferentiation and resonance marketing* (Clemons et al., 2005a, 2005b, 2006) asserts that firms in competitive consumer markets that play to "sweet spots" will outperform firms that play to "fat spots." The bulk of sales will continue to come from mainstream products aimed at the traditional middle of the market, but the bulk of profits is increasingly coming from highly-differentiated products that delight passionate, well-informed consumers who like exploring the fringes of their favorite product categories. While these new, hyperdifferentiated products may not necessarily appeal to very large consumer segments, those who do appreciate the uniqueness they express tend to be willing to pay premium prices for such must-have products.

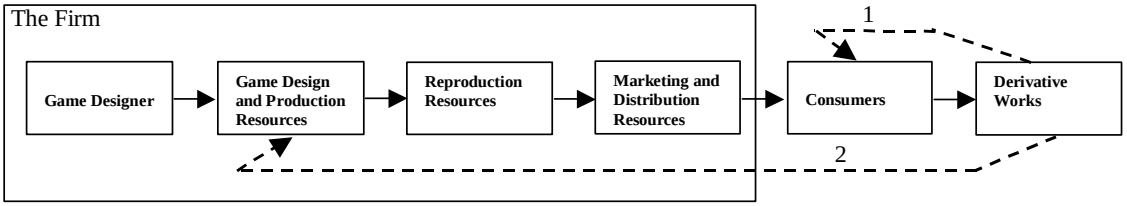
In the Information Age, consumers are better informed about choices available in the market and, as a result, are less likely to compromise on products they really care about. Adopting increasingly flexible technology-based production platforms, producers are now able to cost-effectively manufacture product portfolios at unprecedented levels of differentiation. Using advanced methods of consumer data analysis and innovative marketing tools, firms are also better able to learn what products really resonate with consumers and to identify underserved market

segments, and to respond with developing new products that hit these sweet spots. Hence, firms that employ hyperdifferentiation strategies should command better margins and profits.

Mini-Case 5. Valve Corporation: Transmutability and Producer-Consumer Collaboration in the Computer Game Industry

Gabe Newell, CEO of Valve Corporation, a swift-growing and powerful player in the game industry, has adopted private-collective action as an explicit strategy for his company, leveraging the transmutability of his source product for the creation of additional value and innovation. Valve is the owner of the hugely successful game *Half-Life*, which has sold over fifteen million copies. This original game has been subjected to thousands of transmutations (mods) created by fans, including mods of such excellence that they have been developed as commercial successes in their own right. For example, one particularly creative mod created by two students, *Counterstrike*, was purchased back by Newell, further transmuted by the company in preparation as a commercial product, and then released by Valve as a new game. The development path of *Counterstrike*, which has since sold five million units, implies the following value chain.

Mini-Case 5 Figure. Harnessing Transmutability as Private-Collective Action



The dotted line marked '2' represents the mod *Counterstrike*, which is a derivative work, a transmutation of *Half-Life* which was then repurchased by the firm and prepared for release as a new retail game. The dotted line marked '1' represents typical fan mods, which are shared among enthusiast communities through Internet websites. Both of these paths represent potential additional revenues for Valve, since playing or making any *Half-Life* mod requires ownership of the original game itself.

Valve gives away software tools for modding *Half-Life*, as a deliberate strategy to encourage modders. His company now sells 15 different mod versions of Valve games. As reported in *Forbes* magazine, "[t]he rise of mods — letting your fans and even rivals freely tap into your game to redesign it — is a key reason behind the success of the privately held company." In 2004 Valve experienced a 100% increase in sales over 2003, and made $55 million profit on revenues of $70 million. 20% of Valve's total revenue.

Clemons and his associates have successfully used their theory to analyze a wide range of categories of consumer goods. Arts and cultural goods, however, have not been studied yet in this context. Hyperdifferentiation theory seems to be a fitting lens to analyze digital arts and culture goods. Exactly to what extent the theory applies to this industry remains an open question and will require additional research. We offer some initial thoughts in this direction.

As we pointed out earlier, the culture industry serves a consumer market with increasingly fragmented preferences. Culture products are increasingly available in digital formats online and information about them is increasingly available also, so consumers are developing more so-

phisticated and more varied tastes, and new products are proliferating more than ever. Although hits that appeal to a mainstream audience are still important revenue and profit generators, online retailers are now also earning substantial profits from specialized products that are only appreciated by dedicated niche audiences (Anderson, 2006; Leeds, 2005). Unclear, however, is whether sellers of digital culture goods are in a position to charge premium prices for highly differentiated fringe products. Nevertheless, advanced digital re-mix technology allows creators to produce creative derivative works at low production cost. This flexible production technology enables firms to put out highly differentiated offerings at much lower cost than that of producing comparable conventionally produced material. This cost advantage could translate into better margins, even if consumers do not pay premium prices. Re-mixes are often variations on original pieces that have found a dedicated audience. Rather than substituting one product for another, fans are likely to seek out, via online reviews and fan community sites, for example, and obtain re-mixes of their personal favorites in addition to the original piece. This may provide creators as well as intermediary firms with profitable cross-selling opportunities.

Consistent with hyper-differentiation theory, it is evident that fragmentation and product proliferation are occurring in the culture goods industries and that consumers appreciate and demand increased choices (Hughes and Lang, 2003). Both increased flexibility and accessibility to production technology on the creators' side and increased information availability on the consumers' side have been important drivers of increasing product proliferation and market fragmentation. While digital re-mix technologies are just one factor explaining this phenomenon, its contribution appears increasingly significant. Exploiting the possibilities of digital re-mix technologies and shifting towards open source production modes to create highly differentiated cultural products that cater to increasingly fragmented consumer tastes could be a basis for developing effective hyperdifferentiation strategies in the arts and entertainment industry. This may be in contrast to the *winner-take-all hypothesis* (Frank and Cook, 1995), which argued that small dif-

ferences in performance can create huge differences in rewards and that a few big stars will reap most of the profits in the entertainment industries.

VIII. OPEN ISSUES

We now discuss a number of open issues that we have identified during our research and analysis. They include the impacts of changing nature of transmutation and re-mix methods on the robustness of the conclusions that we have drawn, what kinds of regulation (if any) are appropriate, and the extent to which technology-driven transmutability of information goods has the capability to take us into new and uncharted territory relative to the boundaries of the firm.

Transmutation and Digital Re-mix Technologies

Although the specific nature of transmutation activities and re-mix methods will change over time, we expect our theoretical model and analysis to be fairly durable. Each of the transmutation levels that we have presented and discussed implies a different set of questions of potential interest for IS research. Is there a measurable economic value associated with the ease or difficulty with which a digital culture product can be transmuted? Do considerations of the transmutability of a product affect adoption decisions for consumers? Consumer-driven transmutations are performing mass customization and personalization, enhancing product value outside the firm. These newly-emerging forms of collaboration between firms and consumers are not well understood.

Our mini-cases show that producer-driven transmutation does indeed occur in real-world settings. However, just how important this new phenomena has become is unclear. How much does our cultural output depend on re-mix approaches? How much value do they really create? What losses can be attributed to new digital re-use practices? How significant are those? Are digital re-mixes just a fad or are they an increasingly important means of cultural expression? How will continuous technological change affect the adoption and impact of digital re-mix tech-

nologies? Empirical studies quantifying the effects of open source culture and digital re-mix will be needed to answer these sorts of questions.

Regulation and Value Appropriation

As derivative digital culture products become more common in the market, the question of how best to regulate them arises. What are the optimal licensing arrangements for commercially offered digital re-mix products? The movie company Lucasfilm has very recently adopted a hybrid model that lets Star Wars fans freely download and re-mix video clips of the popular series but, at the same time, retains exclusive rights for all commercial uses, including distribution and re-use in other film products or advertising (Lessig, 2007). Parker and van Alstyne (2005) analyzed when and how software firms should release proprietary information to third party developers. They concluded that a timed and partial release of free information can benefit both developers and consumers, including a real increase in firm profits. The Creative Commons license (www.creativecommons. org), which provides creators with a method for retaining or releasing tiered re-use permissions, is one approach that has been adopted by a growing number of content creators. It authorizes others separately or in combination to reproduce, distribute, modify or sample an original work.

More effective and efficient means of fairly compensating creators for the re-use of their original works need to be developed and business processes put in place that do not impose the uncertainty and high transaction costs of the current system (Broussard, 2005). It has been suggested that a system of compulsory licenses, similar to that which has already long been the standard for mechanical licensing in the music industry, could solve value appropriation problems associated with content distribution via file-sharing networks (Vaidhyanathan 2004). Similarly, Liebowitz (2002) recommends that entertainment companies sell blanket licenses to individuals, using a pricing structure that would allow them to price discriminate depending on the buyer's economic profile and usage pattern. Although both compulsory and blanket licensing schemes have been developed with buyers in mind who do not alter content, we propose that

these ideas can be extended to include transmutation activities as well. Finally, Lang et al. (2007) propose market-based mechanisms as perhaps the most efficient solution to trading copyrights for cultural content components. Electronic markets designed for the express purpose of bringing together the interested parties in derivative culture works could establish online exchanges for clearing rights for digital re-mix, as the basis to create more efficient sourcing markets for the production of derivative cultural goods.

Considerations Relating to the Theory of the Firm

The *boundary of the firm* lies at the point where the costs of production within the firm are equal to those of acquiring production from outside the firm. It determines which economic activities are performed inside the firm and which are contracted out to the market (Coase, 1937). Advances in IT lead to a reduction of transaction costs and improvement in performance monitoring and mitigation of some other risks associated with external contracting. The result has been that firms outsource more activities, but to a relatively small number of suppliers if task execution is relationship-dependent (Clemons et al., 1993).

The analyses and examples that we have provided indicate that the transmutability of digital culture goods can have dramatic impacts on the boundary of the firm, as the clear distinction between producer and consumer is broken down by transmutation activities. When consumers re-encode, re-bundle, re-interpret and re-distribute the music of their favorite bands, TV shows, and so on, they are engaging in value-adding activities that until a few years ago were exclusively executed inside the firm. When modding communities create and post fan-made missions and new player maps for their favorite computer game, they are carrying out the tasks of the game designers themselves (Arakji and Lang, 2007). Transmutability takes us into new territory, in which culture creators and digital re-mixers without formal market contracts puncture the boundary of the firm by creating value outside the firm and traditional markets. But open source culture cannot flourish unless value created that way is distributed so that it offers an incentive for firms to cooperate with independent re-mixers and networked distributors.

IX. CONCLUSION

In this article we have undertaken to develop a unified interdisciplinary theory of the effects of the transmutability of digital culture goods upon the arts and entertainment industries which depend on them. Following the recommendations of Chiasson and Davidson (2005), we have examined the conditions of the industrial setting itself in order to identify influences most relevant to this particular set of IT artifacts. Consequently, we have drawn upon three distinct disciplines: economics, design science, and art/culture theory. The result, we hope, is a holistic model of forces which provides an in-depth understanding of the phenomena in question which could not be obtained by more narrowly construed theoretical means.

The power of digital development platforms that are widely available at relatively low cost has created enormous potential for the production of new derivative works from original sources in digital culture products. Our analysis indicates that adopting open source culture production modes may be beneficial for:

- creators who embrace digital re-mix as a form of artistic expression;
- owners of the rights to sampled works, through royalties collected on the sale of derivative works and increased exposure of the original works;
- firms that produce and distribute re-mix works, through lowered production costs and increasing product differentiation;
- consumers, through increased product selection and the ability to enhance product value through home-transmutation activities; and,
- cultural development, more generally, from accelerated spillover and cross-fertilization of artistic ideas through open source and digital re-mix approaches.

These potential benefits need to be weighed against potential losses and harm. It is possible that deregulation of content protection might entail economic losses for some owners of original works that are sampled and re-used. Those losses would mostly occur in cases where:

- derivative works sales have the potential to significantly reduce sales of original works;
- royalties and fees obtained from sample licenses, plus additional sales of the original works due to increased exposure in derivative works together fail to offset the losses in direct sales; and,
- some unsanctioned re-mixes cause damage to an artist's reputation, whether perceived or real, through distortion, misrepresentation, or distaste or inept use of borrowed works.

Independent of regulatory changes, transmutation activities associated with digital culture products are unlikely to diminish because the same forces of technological change that brought them about continue unabatedly to increase:

- Internet bandwidth and cheaper, more powerful IT and better re-mixing tools;
- availability of digital content that is amenable to re-use and re-mix;
- re-mix activities and new collaboration by technology-empowered artists;
- collective action by technology-empowered consumers;
- demand for greater product variety from well-informed consumers; and,
- preferences for interactive entertainments over passive consumption.

Although changes in regulation may slow down or speed up this process, they will not stop the transformation of the entertainment industry that the emerging digital re-mix culture has triggered. This does not mean, however, that all culture goods will be re-mix products, nor does it mean that all artists will or should adopt re-mix or other open source-based creative methods. There will always be a market for "original" originals, that is, for works that do not re-use other work, irrespective of whether digital technologies are employed in the creative process. Artists pursuing traditional creative means will retain an audience.

At an aggregate level, our theory for open source culture and digital re-mix indicates that the inherently liquid quality of transmutable digital goods may not be a problem, but instead there is an opportunity for artistic creativity and innovation, growth, and production efficiency. Our theory suggests a move toward more open source approaches in the creation of cultural goods. History

shows us that regulatory policy will eventually follow radical market shifts, as it did when mechanical licensing was adopted. Although initially opposed by songwriters and performers of the time, compulsory mechanical licensing quickly proved to be of enormous economic benefit to them, and to music consumers. The same happened with videotape recording technology for the home. First opposed by the movie industry, it later became a tremendously profitable revenue stream. Similarly, transmutable digital culture products governed by an efficient licensing system could become the source for significant new revenue streams in the entertainment industry.

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APPENDIX: GLOSSARY TABLES

Glossary Table 1. Technical Terms	
Term	**Definition**
Analog	In this context, storage media and playback systems which are non-digital, instead using continuously variable magnetic fields (taped music and video) or physical analogues of a signal (vinyl records) to represent sounds and images.
DivX	A high-quality, high-compression video data format based on the MPEG-4 standard; very popular format for Internet video distributions.
LP	Long playing record, an analog format for sound recordings made of vinyl. The audio signal is stored in microscopic grooves on the vinyl surface, and played back on a revolving turntable with a crystal stylus which tracks the grooves, converting the vinyl waveshapes into an electric signal.
MP3	High-compression audio data storage format based on MPEG-1 Layer 3 standard; relatively low quality compared to music CD's; near-universal interoperability with software and hardware media playback devices.
MPEG-4	Motion Picture Experts Group specification #4, an open standard for encoding, compressing and storing high-quality video data streams. MPEG-4 is the basis for the popular Xvid and DivX video encoders, among others.
Redbook Audio	Standard audio data storage format for all music CD's; high-quality, uncompressed.
Sample	In multimedia, a sample is any usable excerpt of a digital multimedia file. In music, this can be as little as one complete wave-cycle of a sound source, or a sound clip several minutes in length. In hip-hop and many popular re-mix works, most sample units are a few seconds long, forming a complete music thought such as a melodic phrase or rhythm pattern.
Stream Capture	Using dedicated software and hardware to write incoming multimedia content, such as Internet radio or cable television broadcast, to a hard drive.
Texture	A bitmap (digital graphics file) used to control the appearance of an element of a computer game or software application interface. Computer game modders may create new textures to alter the appearance of virtual environments or game characters.
TiVo	Proprietary system for capturing television broadcast video data to hard drive; includes some minimal editing capability.
VCD	Video compact disk. A high-compression data format based on the MPEG-1 standard which can write a full-length movie to an ordinary CD. Lower in quality than DivX or Xvid, but considerably cheaper than burning DVD-RW disks.
Xvid	Another high-quality, high-compression video data format based on the MPEG-4 standard.

Glossary Table 2. Concepts and Neologisms Related to Transmutation and Re-mix		
Term	**Definition**	**Example**
Blog	From *weblog*; a personal online document, updated regularly. In the form of a pure personal diary, no transmutation would necessarily be involved, but a great many blogs integrate existing content with the author's original contributions and commentary.	blog.wfmu.org
Culture goods	Arts and entertainment culture products such as music, games, television programs and movies.	Music, games, television programs and movies
Fan film	A film made by dedicated fans of a particular movie or movie series, using existing characters to make a new story. Combines edited existing footage from the original film with new content.	*Revelations*, a *Star Wars* fan film. See www.fanfilms.net
Machinima	New genre of multimedia entertainment: non-interactive computer-generated animations created from PC game 3D-vector graphics and new or borrowed audio, distributed as a digital video download.	*Mine*, by Snoken. See www.machinima.com
Mashup	A general term referring to any sort of recombination of digital media content from varying sources. Text, image, audio and video mashups are all possible.	*Grey Album* – audio. *They're Taking the Hobbits to Isengard – video*
Mix CD	CD with customized selection of songs collected from different sources burned together onto a CD-R disc.	See many examples available at www.mixunit.com
Mods	Fan-created extensions, modifications of existing computer games. May make changes to appearance of game characters or objects, design new game environment maps, substitute background music, etc.	*Counterstrike*, a mod of *Half-Life*. See many examples available at www.moddb.com
Playlist	Originally used in radio broadcasting to refer to the order of specific songs to be played on the air. This term has been adopted for digital music players such as Windows Media Player, iPod or WinAmp to refer to that portion of the digital player interface which allows users to select individual songs from their digital collections, creating customized programs which can be titled and played back any time.	"Exercise Music," for example. See many examples at www.playlistmag.com/playlists/
Podcast	From "iPod broadcast"; a digital file of audio or video content distributed as an Internet download. In the form of totally original content no transmutation is necessarily involved, but podcasts incorporate audio and/or video data from existing sources.	*Beyondjazz* podcast. See many examples at www.podcastbunker.com
Re-mix	A term from recording engineers, who used it to describe the processes of selection, manipulation, and recombination used to create audio mashups; refers now to processes generally involved in transmutation activities which have as their goal the creation of new derivative works in any combination of media.	Shirley Bassey: *Diamonds are Forever – The Remix Album*
Rip	Refers to the process to selecting a portion of multimedia data for re-encoding and/or further manipulation, as in "rip a CD to MP3."	Software tools: Easy CD Ripper DVD-Ripper
Skin	A digital graphics file used to change the appearance of an interface element, but not its function.	WinAmp skins, Windows Media Player skins
Viral videos	Clips of video content of various kinds, hosted on websites dedicated to that purpose such as iFilm or YouTube, and viewed for entertainment.	*Reservoir Dogs … in 60 Seconds*. See many examples at www.ifilm.com