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The Supply Chain of Digital Music: Empowering Independent Artists Through Availability and Accessibility

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The Supply Chain of Digital Music:
Empowering Independent Artists Through Availability and Accessibility

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By Justin Reed
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Abstract

The process of creating and sharing digital music can be viewed from the “supply chain” perspective: identifying the resources and value-adding tools that ultimately result in a final audio product. By researching and documenting the steps involved in this process, I identify this supply chain as a series of steps, an itinerary, or process model of digital music creation. Moreover, I found that each step in the process can be assessed for its accessibility and usability by independent artists. I conclude by exploring how this democratizes the music industry by affording independent artists the necessary tools and empowerment to create and share high-quality digital music productions and discuss how this is altering the commerce and culture surrounding the global industry of music.

Introduction

It is common for one to tie the word “artist” to a specific medium or tool with which that artist creates his or her product. Qualifying utensils could be a paintbrush, a chisel, a camera, or a piano. These instruments are used to conjure a new creation and to make tangible the imagination of the artist. One vastly overlooked, yet often utilized medium for artistic expression is the computer. It is widely understood that the computer has revolutionized the production and popularization of all forms of physical and nonphysical art, there is a growing consensus that those who use a computer as his or her exclusive medium for creation are to be considered an artist in this traditional sense of the term. To the contrary, there is an exponentially growing wave of musicians using the computer (and little to no other equipment) to create high-quality audio products and share them with the world.

Envision a young boy or girl of 13 with a taste for a certain genre of music. They have no formal musical training or education, and their technological skills are typical of a young teenager who peruses social media and completes their schoolwork on Microsoft applications. Suppose they don’t have the resources, opportunity, and/or interest necessary to master a physical instrument, but they want to learn how to create music that reflects their unique preferences and perhaps forge a career path centered around this passion. Thirty years ago, a kid in this situation would likely have been disqualified from chasing these dreams. Perhaps they would have been described as unartistic – they don’t know how to play an instrument, so how could they ever be a musician? Or maybe they would be called unrealistic – even *if* they were able to find a way to be an artist, who would listen to their work? Today, however, the

13-year-old aspiring musician has every tool necessary to achieve their goals waiting for them if they have a laptop sitting in their bedroom.

The rapidly evolving production and popularization of audio-creating and -sharing technologies provides unprecedented empowerment to independent artists, and the ensuing consequences have revolutionized the industry and culture of music. This empowerment is not unique to the child you envisioned in this scenario, but to any human with a computer, internet access, and desire to create something new.

In this paper, I will aim to demonstrate that a) there exists a robust supply chain for the production of music, b) this supply chain can be accessed by virtually anyone in possession of a few basic tools, and c) this accessibility empowers independent artists to freely produce and share their music with the world.

Accessibility

Before diving into the technicalities of producing and sharing digital music, it is important to frame the forces that pioneered the development of its foundational technology.

In a world of extraordinary connectivity and accessibility, individuals wield unprecedented access to an endless web of commerce and production. In “The World Is Flat (Friedman),” Thomas Friedman details this concept via his theory on the progressive stages of globalization. While Friedman contends Globalization “1.0” was driven by nations and Globalization 2.0 by companies, he touts individuals as the primary agents of change. In this stage of “flattening” the world, he claims that individuals have a “newfound power to collaborate and compete globally.”

The ideas that Friedman details in his book are most commonly applied to manufacturing, retail, finance, and other forms of business and commerce. Though these applications are certainly valid and accurate, they far from exhaust the arenas that have become unrecognizably accessible and democratized in this third stage of globalization. The empowerment of the individual transcends the realms of traditional goods and services and pervades the world of information and culture as well.

In fact, it could be argued that, as products become less tangible and more digital, such as in the case of producing digital music, Friedman's ideas apply even more profoundly. An entirely digital product or service bypasses countless obstacles and liabilities to which physical products are exclusively subjected, particularly in terms of transportation and transmission. This, of course, includes digital music and the audio products that comprise a musical piece.

Whereas a physical product must incur the additional time and costs required to transport it to the next link in its supply chain, the transmission of digital information is virtually free and immediate. This is true in large part due to the ten flatteners to which Friedman refers in his book. These flatteners were "major political events, innovations, and companies" responsible for empowering individuals in this stage of globalization. Four of these ten flatteners (Netscape, the development of workflow software, uploading, and informing) are especially applicable to the production of digital music.

Netscape

The first of these four flatteners which are particularly relevant to the creation and distribution of digital information was the initial public offering of Netscape on August 9th, 1995. In the words of venture capitalist John Doerr, whose firm financed Netscape, "The

Netscape IPO was a clarion call to the world to wake up to the internet. Until then, it had been the province of the early adopters and geeks." Though Netscape has been unmaintained and overtaken by other browsers since 2008, its influence remains to this day as the first browser to publicize and popularize for the general public the use of the world wide web. Now, nearly 25 years after Netscape's IPO, there is no need to belabor the impact and ubiquity of the Internet. It is, however, of value to note that the internet is the foundation upon which the networks of producing and disseminating digital information, including music, have been constructed. The internet provides an endless wealth of tools, services, and other resources that enhance the creative and technical capabilities of digital music producers.

Workflow Software

The second of these particularly relevant flatteners is the development of workflow software that expedites creative and business processes on a computer. This development was hastened by the newfound availability of the internet provided by Netscape. Friedman states that, once the internet was popularized, people were not content to send emails and share rudimentary files with each other – "[People] wanted to shape things, design things, create things, sell things, buy things... and they wanted to be able to do any of these things from anywhere to anywhere and from any computer to any computer—seamlessly" (Friedman, 79). From this desire stemmed the rapid development and/or popularization of technology capable of achieving these goals with unprecedented speed. Examples include early transportation management systems, enterprise resource planning systems, creative software like Photoshop, and music production technologies like DAWs, plugins, and recording software that will be discussed in this paper. With these new

technologies, it became simpler, cheaper, and faster than ever to run a business, collaborate with colleagues, and bring one's creativity to life.

Uploading

The next flattener, uploading, refers to the “newfound power of individuals and communities to send up, out, and around their own products and ideas, often for free.” Consequently, uploading is “fundamentally reshaping the flow of creativity and innovation” (Friedman, 95). Anyone with an internet connection can share their thoughts, ideas, art, goods, and services with the world. This, of course, is incredibly vital to the empowerment of independent artists in the music industry. The freedom to easily and immediately share audio – including anything from a small musical component to a completed album – allows independent artists to bypass historically restrictive channels and distribute their work.

Informing

Friedman's ninth flattener, informing, is deeply ingrained within the empowerment of independent musical artists. Referring to the ability of an individual to search for, and likely find, an overwhelming wealth of information on virtually any topic they choose, informing eliminates the need for formal training and education to succeed in a chosen field. Of course, there are caveats to this development (a self-taught engineer is unlikely to be commissioned to build an interstate bridge, and a self-taught lawyer is unlikely to be placed on a high-profile case), but it is entirely achievable for a prospective artist to master the skill of music production using nothing but the readily available and endless expanse of information and tutorials that exist only a few clicks away. At the time of this writing, a Google search of “FL Studio Tutorial” (FL Studio is one of many popular music-production programs) yielded just under 38 *million* results.

Though it has been 15 years since the release of “The World is Flat,” the forces Friedman introduced in 2005 still frame the current environment that empowers individuals to use technological and commercial forces to access, contribute to, and take advantage of the supply chain of music. This virtually unobstructed path to obtaining the tools and knowledge necessary to independently create audio products greatly democratizes the music industry. As a result, the music industry is evolving to reflect the ability of anyone with an interest in making sharing music to do exactly that.

Delineating the Upstream Supply Chain

Overview

Here, I will break down each step in the process of creating an audio product in order to detail the upstream supply chain of creating digital music. This upstream supply chain is the network of suppliers, tools, and resources used in the process of creating an audio product. With each serving as an input material for the next, the subsections of the upstream supply chain are sources, components, and audio processing.

Sourcing

Within the context of this paper, a source is defined as a person, file, sound bank, or tool from which a raw audio file is created or obtained. These sources are used to create the various components of an audio product. These components, like the raw materials of a physical product, are the individual parts of an audio product that are then assembled to create the finished product. The process by which these components are formed into the final product will be referred to as audio processing. This process involves composition, arrangement, and post-production audio refinement.

Sourcing, in terms of traditional manufacturing of physical products, “describes all those activities within the procurement process concerned with identifying and evaluating potential suppliers, engaging with selected suppliers and selecting the best value supplier(s)” (Rogers). Suppose you are interested in manufacturing a simple wooden pencil composed of wood, graphite, aluminum, and rubber. There are many firms throughout the world that can provide these raw materials you need for your product, but your decision as to which of these firms from whom you will procure these components depends on a variety of factors. Price, availability, quality, legal agreements, personal connections and much more can influence your decision. Regardless of your choice, you’ll end up with the raw materials you need, but the resource from which you obtain them will impact your final product. Decision-making factors for sourcing the various components of an audio product mirror the considerations involved in selecting sources for physical products. However, instead of procuring physical raw materials, the artist must decide how to acquire or create the audio files that will ultimately comprise their piece.

There are four primary methods of sourcing the components of an audio product: recording, downloading, sampling, and producing. These four methods are to be detailed in the coming sections.

Recording

Recording, referring to using a microphone or other audio-capturing technology to record a sound from the physical world, is ostensibly the simplest. The foundation of digital audio recording an audio sample is the conversion of analog frequencies to digital frequencies. This process, called data sampling, disintegrates an analog signal at a constant interval and assigns a

single digital value to each portion of the signal (Tu & Lu). This value is then translated to a digital frequency and becomes playable via audio files like .mp3, .wav, .aiff, and more.

An artist can use this process to record vocals, instruments, ambient sounds, or anything else they see fit to be included in their project. Using self-recorded audio also bypasses many of the setbacks of other audio sources. It is unlikely that a recording could infringe upon copyrights assuming the artist is recording original work. Additionally, the technical difficulty of recording is very low as it requires nothing more than a recording device and compatible software onto which the newly recorded audio file can be stored and altered.

One barrier to accessibility for this method of sourcing is, of course, a suitable microphone. Most devices and computers are now equipped with microphones. These are useful tools, but their level of quality is lower than more expensive recording microphones. Like any other device, higher levels of quality typically at higher costs. Despite this, an artist can obtain the necessary tools for high-quality recordings at a reasonable price.

Take, for example, the FIFINE K669. This microphone, priced at \$37.99, is currently the best-selling recording microphone on Amazon. With a cardioid polar pattern, a 20-20kHz frequency response, $-34 \pm 30\%$ sensitivity at 1kHz, and a 78dB S/N ratio, this is a relatively high-quality microphone at an affordable price point. In conjunction with creativity and simple recording techniques to minimize interference and maximize quality, this and many other cheap microphones can enable an independent artist to use self-recorded audio as a source for their audio product.

Downloading

Unlike recording, an option which requires the artist to creatively conceive new ideas for sounds, downloading offers readily available audio files immediately suited for incorporation into a computer music piece. Alongside the rise of independent music production, an entire supportive ecosystem of ready-made sounds has developed to provide producers with the necessary building blocks to convert their concepts into reality.

The predominant method of sharing or obtaining these ready-made sounds is through the production and acquisition of sample packs. Defined as “a collection of sounds consisting of loops and one-shots that are specially designed for producers to use as building blocks in their productions” (Raman), sample packs contain anywhere from a few to thousands of individual sounds that can be immediately used in a new production. These sounds can range from a single beat of a drum, to a quick guitar riff, to an ornate piano melody, to a full choir.

There are countless individuals and companies that specialize in providing high-quality sample packs for producers of all skill levels. One such example is Cymatics.fm. Founded in 2015 by producers Drew Domalik and Steven Skunberg, Cymatics has developed into a multi-million-dollar company by catering to a large market of producers who lack the technical skill to design their own sounds or are looking for a creative impetus for their productions. Cymatics offers dozens of sample packs for a wide range of genres and styles, MIDI packs (collections of preset melodic notation that can be applied to any sound), sound design presets, and various other products. Once purchased, these products are royalty-free and therefore free to be used in any manner with no fear of copyright infringement, licensing fees, or any other sort of legal or financial ramifications.

Though Cymatics excels in the field, they are far from the only provider of sample packs and other ready-to-use musical components. A simple Google search of “free [genre] sample pack” yields far more options than any one producer could ever use in a lifetime. This incredibly robust and accessible support system of ready-to-use sounds virtually eliminates the technical and financial barrier to sound design for those with access to a computer and internet, thereby democratizing the world of music production by providing the necessary sound components to complete a project of any genre or style.

There does exist some pushback on the use of downloaded audio sources. One common indictment is a fairly popular belief among music producers that the use of loops, a previously created sound or melody that can be repeated in a piece of digital music, displays a lack of skill and creativity. Though there is truth to this accusation, the reality is that the raw, unedited version of a loop seldom remains unadulterated in a finished product and is, in fact, part of a wider movement in the arts more generally.

In his book “The Inevitable,” Kevin Kelly forecasts twelve technological forces that will drive the coming decades. Kelly defines the eighth force, “remixing,” as “unbundling existing products into their most primitive parts and then recombining in all possible ways” (Kelly, 244). Kelly applies this concept of remixing to a multitude of media forms including video, literature, visual art, and, of course, music.

In their current state, remixing capabilities are effectively limitless. A producer can take any loop they find and use a variety of programs and methods to alter it to their liking until the original sample is virtually unrecognizable (Kelly). Of course, the foundation of a new version of a sound comes from someone else’s work and creativity, but a single loop can be altered into an

infinite number of ensuing renditions. Therefore, while it can be argued that using premade loops indicates a lack of technical skill, it in no way hinders the creative avenues available to a producer. Ultimately, the availability of this resource of pre-designed sounds allows a producer of any levels to easily obtain a variety of input materials to use in their work.

Sampling

Likely the most contentious of the various methods of sourcing audio components, sampling has a long history of legal and ethical controversy. Here, we can define a “sample” as a recycled portion or component of another artist’s work. In more creative terms, as expressed in his book “Rhythm Science,” writer, musician, and sampling-advocate Paul D. Miller defines sampling as a “a new way of doing something that has been with us for a long time: creating with found objects” (Miller). He goes on to assert that there is creativity in “how you recontextualize the expression of others.” It is important to note that Miller was a DJ, so his musical career, like any DJ who plays the work of other artists, was driven by this “recontextualization” of the work of other artists, and there are many academics and artists alike with a significantly less reverent opinion of the practice of sampling. For example, a 2017 lawsuit made headlines for its exploration of possible copyright infringement by artist Drake regarding his use of a 1982 spoken-word sample in the song “Pound Cake/Paris Morton Music 2” from his 2013 album, *Nothing Was the Same*.

Despite its risks and critics, sampling remains as a viable option for sourcing components of a musical piece and is entirely legal with express permission from the copyright holder. In fact, after popularizing as a practice in the 1980s, sampling has become a cornerstone of modern music production. A 2018 study by Bose and Curry’s PC World analyzed data from

WhoSampled.com, a website that allows a user to search for a song and then returns any tracks which were used as samples. Table 1, shown below, depicts their findings.

<i>Table 1: Uses and Origins of Samples Since 1970</i>					
	1970s	1980s	1990s	2000s	2010s
Songs Using Samples	2,926	23,925	97,190	74,051	78,577
Songs Used as Samples	94,551	73,232	47,865	25,422	12,234

As demonstrated in Table 1, the popularity of sampling skyrocketed in the 1990s (likely driven by the advent and popularization of new, user-friendly music-making technologies) and, despite a slight dip in usage in the decades since, has remained a commonplace method in music production. There also exists an evident affinity for older music to be used as a sample.

One massively popular artist and producer known for his frequent use of samples is Kanye West. Samples are found throughout Kanye's most popular work. Table 2 illustrates this for some of his most popular hits.

<i>Table 2: Kanye West's Use of Samples</i>		
Gold Digger, 2005 (Billboard #1)		
Sample Title	Sample Artist	Sample Release Year
I've Got a Woman	James Charles	1954
Another Story to Tell	Mase	1999
Bumpin' Bus Stop	Thunder and Lightning	1974

Stronger, 2007 (Billboard #1)		
Sample Title	Sample Artist	Sample Release Year
Harder, Better, Faster, Stronger	Daft Punk	2001

N****s in Paris, 2012 (Billboard #5)		
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Sample Title	Sample Artist	Sample Release Year
Baptizing Scene	Reverend W.A. Donaldson	1960
Victory	Puff Daddy	1997
072.5 Fm	Big Fish Audio	2011
Blades of Glory	<i>Blades of Glory</i>	2007

All Falls Down, 2004 (Billboard #7)		
Sample Title	Sample Artist	Sample Release Year
Mystery of Iniquity	Lauryn Hill	2002
Real N****z	The Notorious B.I.G.	1995
Wow	Kanye West	2004

I Love It, 2018 (Billboard #6)		
Sample Title	Sample Artist	Sample Release Year
Adele Givens Stand-Up	Adele Givens	1993
What Is This Thing Called Love	Alexander O'Neal	1991

As you can see in Table 2, Kanye fits music from a variety of genres – and even a comedy movie, a stand-up comedy routine, and himself – into his stylistic profile. Kanye’s discography, along with countless other examples, demonstrate that sampling is both an incredibly versatile tool and a viable method of creating wildly popular music (as evidenced by the peak Billboard Hot 100 positions displayed for each song in Table 2). Even if they aren’t Kanye, an artist who adequately navigates the ethical and legal uncertainty of using samples in their music thereby opens an entire world of potential sounds to incorporate in their productions.

Production: Virtual Instruments

A fourth option for sourcing the components for computer music is to use virtual instruments to obtain or generate a desired sound. The first order here is to understand the

foundational host programs, digital audio workspaces (DAWs), used in creating digital music. A DAW is any device or software that is used to record, edit, and/or produce audio files. DAWs can come in many configurations, but modern options feature a singular interface that allows the user to mix multiple recordings and tracks into a final piece (Kefauver). Think of a DAW as the artist's canvas whereas the tools and sounds used within it are the artist's paintbrushes and paint.

One of these metaphorical "paintbrushes" used within a DAW is a virtual instrument, which typically comes in the form of a plugin. Plugins are external programs that run within a host DAW and are used to generate sounds (often by mimicking the sound and style of physical synthesizers or instruments) or apply effects to existing sounds like limiting, compression, equalization, reverberation, and more to alter existing sounds (White, 411-421). This section will primarily focus on the functionality of generating new sounds.

Virtual instruments can largely be traced back to the Moog synthesizer, the world's first commercial synthesizer, developed by Robert Moog and debuted in 1964 in response to an increasing demand for affordable and practical music-production equipment (Moog Archives). The Moog synthesizer afforded artists an unprecedented ability to efficiently generate and manipulate sounds to be used in their production. In the ensuing decades, the concept of electronically generating new sounds has been developed and popularized.

Many commercial DAWs are equipped with virtual instruments and effects generators built into their individual systems, but these internal programs are either incompatible or difficult to use with other hosts. In order to solve the issue of this incompatibility, virtual studio technology (VST) was developed. Trademarked by Steinberg Media Technologies GmbH, VST is a "proprietary digital computing system to perform the various tasks performed in a recording

studio” (White, 411-421). Virtual Studio Technology provides a common computational standard that allows any VST-powered plugin to be used by any host that supports the VST format. Individual hosts are still developing plugins specific to their own programs¹, but VST has become the overwhelming industry standard and powers nearly all the third-party virtual instruments that dominate the world of sound design. This allows producers who use virtually any DAW or host program to take advantage of the extensive market of virtual instruments.

When using a plugin as a source for a component of a computer music piece, there are two primary routes a producer can take: presets and sound design. First, presets. The vast majority of plugins used to generate new sounds are equipped with both a library of presets and the functionality to alter them as the producer sees fit for their work. It would be an exercise in futility to attempt to describe the scope of these presets as they could be a version of quite literally any sound imaginable.

Many companies have found success through the development of virtual instruments. Spectrasonics, for example, was founded in 1994 by acclaimed composer and sound designer Eric Persing. Spectrasonics specializes in the development and sale of virtual instruments and sampled sound libraries and has grown into one of the world’s leading developers of music software. Featuring six programs – Omnisphere (their most popular and successful), Keyscape, Trilian, Stylus RMX, Tribute, and Legacy – Spectrasonics offers a diverse and powerful array of VST powered plugins (Spectrasonics).

Omnisphere 2.6 (the most recent version of the program as of this writing) is a massively popular VST that comes equipped with 14,806 preset sounds accumulated through consistent

¹ This provides added flexibility outside of the core, universal capabilities of VST and allows for more harmonious integration with the host program.

updates since its release in 2008. These presets range from rumbling basslines, to acoustic guitars, to complex arpeggios, to atmospheric pads designed for cinematic scoring. These presets require no manipulation and can be immediately incorporated as a component in a piece of computer music.

Moreover, there is a wealth of independently created banks of Omnisphere presets available for purchase and download online. This utility and availability of sound presets is true for an enormous market of virtual instruments. Many companies apart from Spectrasonics such as Native Instruments, Steinberg, IK, Sonivox, reFX, and others develop powerful instruments and presets to be used by the masses.

Along with presets comes the added dimension of flexibility introduced by sound design. Defined by Rajiv Agarwal of AudioShaper as “the process of recording, acquiring, manipulating, or generating audio elements” (Agarwal), sound design can be used by any virtual instrument to alter a preset or create a new sound from scratch. An entirely separate thesis can be written on the complexity and power of sound design, but it is still worth noting that these virtual instruments wield the capability to alter waveforms in order to manipulate sounds in any way one sees fit. This can become a massively intricate endeavor, so it is fortunate that complex sound design is in no way required to produce high-quality computer music, and gently tweaking presets offers an artist unlimited options to actualize their creativity.

The primary drawback of virtual instruments is that they are often quite expensive. For example, the price to download the latest version of Spectrasonics’ Omnisphere is \$499. These high price points significantly deter universal accessibility to the most popular (and powerful) virtual instruments, but cheaper and free options are available and common. With a mindful ear

and effective audio processing techniques (to be discussed later), a free virtual instrument can be just as powerful as an expensive alternative.

Components

The sounds procured from the sources discussed in the previous section resemble the functionality of raw materials in the manufacturing of physical goods. Like physical goods, music contains intermediate “raw materials” – to be referred to as components – which are processed into a piece of music. Both physical raw materials and musical components possess independent value but ultimately are combined by the artist to create a finished piece that is greater than the sum of its parts. An example of multiple components combining to create a completed musical piece can be found here:

<https://soundcloud.com/justin-reed-938177505/justin-reed-thesis-components-example>.

With the boundless spectrum of musical genres and styles (not to mention the difficulty of defining that which constitutes music), it would be impossible to compile an exhaustive list of all these musical components. To the contrary, if you narrow your scope to a single song, it is relatively easy to pinpoint and assess the components that comprise it.

One important note regarding these components is that, to many individuals who specialize in their production, they can be “final products” in their own right. As demonstrated previously, there is an extensive network of creators who specialize in the production of these intermediary components and are content to stop their work there and pass them on to producers in the ensuing steps of the supply chain. On the other hand, if your goal is to produce a complete and polished finished product, the simple acquisition of these is insufficient. Following the procurement of these sounds comes the process of using them to produce a final piece.

Audio Processing

The most common method of executing this process is by using a DAW to configure one's chosen audio components into a completed work through composition, arrangement, and mixing/mastering. There is an extensive volume of literature pertaining to the science and technology of each of these steps that does not fit within the scope of this thesis. Instead of providing a manual for their completion, each of these steps will be presented with a formal definition, a brief description of their functionality and purpose, and notes pertaining to their accessibility or lack thereof.

Composition

As defined by Allen Forte, the process consists of two parts: "...the ordering and disposing of several sounds...in such a manner that their succession pleases the ear" and "...the rendering audible of two or more simultaneous sounds in such a manner that their combination is pleasant" (Forte). In order to play their role in a musical piece, individual sounds must be laid out into melodies and patterns through the interface of the artists' chosen DAW. This is perhaps the most subjective, yet crucial, step in the entire process of creating computer music. An artist can procure sounds of the highest quality that perfectly align with the concept they wish to bring to life, but an inability to arrange those sounds into enjoyable melody and patterns will result in a lousy final product. (Of course, the definition of an "enjoyable" pattern is incredibly subjective and depends on idiosyncratic preferences.)

A lack of technical skills and/or comprehension of music theory *could* be a barrier to universal ability to create high-quality computer music discussed throughout this thesis. Fortunately, however, there is a wealth of tools and information at the disposal of artists who

struggle with these aspects of music production. Online tutorials exist to explain the intricacies of DAWs and to teach music theory. Moreover, software-based DAWs use note-drawing interfaces that allow users to click in their melodies on desired notes as opposed to playing them on a keyboard or other instrument. Additionally, DAWs include tools and settings that serve as poka-yoke-like² error-proofing by highlighting or filtering notes within a chosen key or scale. Ultimately, this step is where an artist has the most agency in affecting the quality of their productions, but any lack of technical or musical skill is certainly surmountable.

Arrangement

Once an artist has composed the melodies and patterns that will comprise their piece, they must then arrange them in a coherent progression. Defined as the “musical reconceptualization of previously composed work” (Cook), arrangement converts standalone melodies into a final piece. This functionality is the cornerstone of most DAWs and can therefore be easily completed within a user-friendly workspace.

Post-Production (Mixing/Mastering)

Mixing and mastering are post-production processes that can elevate the quality of a finished audio product. Mixing refers to the process of combining separate tracks into a singular audio product. This is accomplished by adjusting the volume levels of component tracks, altering the stereo shape of sounds (thereby shifting the locational origin of a sound as perceived by the listener), and manipulating the audio waveforms through effects like equalization and compression³ (Huber and Runstein). The result of a successful mixing process is a more

² “Poka-yoke” is a common supply-chain term that refers to methods of preventing errors in the production process.

³ Equalization is an effect used to alter the spectrum of sound frequencies transmitted through the audio product. Compression is the process of shortening a sound’s dynamic range of volumes by increasing the volume of quiet frequencies and reducing the volume of loud frequencies. Both of these effects can be achieved using equalization or compression plugins.

coherent, balanced arrangement of sounds with reduced interference resulting from competing frequencies.

Mastering, involves the process of preparing an audio product to be exported in a manner that ensures maintained quality upon its distribution. In *Audio Mastering as Musical Practice*, Matt Shelvock enumerates various practices that may be performed throughout the mastering process. These include editing minor flaws, reducing noise to minimize unwanted clicks and hums, adjusting the stereo width, volume adjustment, compression, and more (Shelvock).

One important note regarding these practices is that they do require a high level of technical skill and at least a fundamental understanding of audio frequencies and sound processing. However, mixing and mastering are not necessarily required in order to casually produce a piece of computer music. Though, if an artist aims to professionally pursue the production of music, these methods of post-production quality enhancement are vital to competing against other aspiring artists.

In an interview regarding his experience as an aspiring artist, University of South Carolina student, electronic music producer, and DJ Nikita Madorsky explained his thoughts on this post-production process. With a robust history of production, multiple original releases, and growing notoriety among peers and listeners, “DJ Nikita” has a strong understanding of what it takes to be a successful artist. One of the predominant requirements to achieve this success, according to DJ Nikita, is a tedious and careful post-production process. “Lots of people can produce good music,” said Madorsky, “but mixing and mastering is what really sets apart a great artist from a good artist.”

Like the production of the sound components that comprise a song, post-production processing can be outsourced to those who specialize in this field. In fact, many audio engineers like Bernie Grundman, Steve Hoffman, and George Marino have attained notoriety for their accomplishments in mixing and mastering. This is yet another example of the supportive network of musical professionals that provide services and tools to supplement underdeveloped areas of other artists' skill sets.

Final Product

Once an artist sources their audio components, composes melodies and patterns, arranges those melodies and patterns, and enhances the quality of their work through post-production, the result will be a finished piece of computer music ready to be shared and distributed. One simple, yet vitally important quality of this final product is that it is simply an audio file. It is a massless, non-competing, replicable version of an audio product that can be distributed at virtually no cost to an infinite number of recipients. This characteristic enables an artist to take advantage of the internet's distribution channels in order to share their work. However, these same characteristics can result in negative consequences like piracy and other forms of the unlawful downloading and sharing of digital audio that prevents an artist from receiving compensation for their work.

As discussed previously, a "finished product" is that the definition of the term is subjective to the corresponding party's relative location on the supply chain. To a producer, this could be a complete musical piece. For other previously discussed roles in the supply chain of digital music, a finished product could be a sample pack, a vocal loop, or a preset for a plugin. Regardless of their position and expertise, each of these role players can upload and share their

products online⁴. Though these figures play an important role, it would be impossible to enumerate each specific distribution channel for these are innumerable niches an individual can fill in the network of music production. Accordingly, the following sections will focus primarily on the distribution of completed musical pieces.

Downstream: Shifting Commerce and Culture

Overview

A downstream supply chain refers to the process of supplying customers with a finished product. In this section, we will explore the various channels available to an artist to be used for the distribution of their music as well as the manners in which listeners interact with and share that music. Finally, we will discuss how these channels for distribution and interaction are contributing to various commercial and cultural evolutions within the music industry.

Distribution

In terms of strictly digital music content, the two primary channels for distribution are streaming platforms and social media. These channels will be discussed and compared to “traditional” methods of distribution.

Streaming Platforms

According to a study performed by the International Federation of the Phonographic Industry (IFPI), 47% of the global recording industries 2018 revenues came exclusively from streaming⁵. An additional 12% of 2018 revenue was generated by other digital means thereby raising the total portion of digitally generated global recording industry revenue to 59%. The

⁴ This can be accomplished by using websites like Splice, Looperman, and other crowd-sourced media-sharing platforms.

⁵ This 47% share nearly doubles the next largest contributor, physical sales which accounted for 25% of 2018 revenue.

same study found that, at the end of 2018, there were 255 million global users paying for a digital streaming subscription (IFPI Facts and Stats). On top of these 255 paying users, there still exist 4+ billion active internet users who can access unpaid streaming services⁶. With these levels of popularity, access, and significance, independent artists possess unprecedented power in terms of their ability to reach potential listeners by uploading their work to these streaming services.

Artists with access to platforms like SoundCloud and YouTube⁷ can upload their music for free (though both have upgraded premium options). Such platforms sustain themselves by converting crowdsourced content into revenue-generating visits and data. Paid subscription services are more difficult to access, but independent artists can use a variety of affordable services – like Distrokid, a paid subscription service that uploads an artist’s work to paid streaming platforms for just \$19.99/year – to have their music uploaded to these premium platforms. These methods allow the artist to bypass financial roadblocks and institutional gatekeepers that have historically prevented the music of independent artists from being heard by a wide audience. This allows for increased exposure and the freedom to produce a more sincere expression of their creativity.

This reach is particularly effective for younger audiences who have grown up accustomed to using streaming services to listen to music. In a survey on music listening and interaction habits, 79% of the 291 respondents under the age of 30 stated that they use at least one streaming service to listen to music on a near-daily basis. For this reason, genres popular among younger

⁶ Though access does not equate to use, the potential remains for these active internet users to be converted into listeners.

⁷ A notable caveat here is the barrier created by government censorship like that of YouTube in China. Though the platform can still be accessed using a VPN, it is not immediately available to the nearly 1.4 billion citizens of China.

demographics like hip-hop and EDM have been particularly influenced by the availability of streaming platforms.

Social Media

Social media, the other predominant method of digitally distributing music, integrates an interesting array of functionalities beyond that of a typical streaming platform. Social media platforms like Twitter and Instagram offer a unique ability for an artist to market themselves, interact with listeners, and incorporate other types of media into their self-promotion. Whereas streaming platforms bring attention to an artist's music, social media brings attention to the artist as an individual. Subsequently those followers and fans can be directed to streaming platforms where the artist's catalogue is available to be heard. Shown in Figure 1 is an example of an artist using social media to promote their work.



Figure 1: DJ Nikita on Instagram

Recent years have seen countless artists use a strong social media presence as the foundation for their rise to fame. A notable example of an artist achieving commercial success through these methods is Lil Nas X with “Old Town Road.” Lil Nas X purchased the independently produced instrumental for \$30 and recorded the song on the same day. After going viral on various social media platforms, “Old Town Road” eventually rose to #1 on the Billboard Hot 100 charts in April of 2019. Now, Lil Nas X maintains a strong social media presence with 4.5 million followers on Twitter and 6.3 million followers on Instagram. When he decides to release new music, these millions of digital fans will be quick to learn of his new work. Artists like DJ Nikita with burgeoning regional followings feel capable of finding similar traction. When asked if he believed he could one day become a premier producer of electronic music, DJ Niktia

stated, “Yeah, I really do. Of course, you have to put in your 10,000 hours, but if you work at it, there are so many opportunities to have people find and listen to your music.”

Interaction

Once an artist has used streaming platforms and social media to share their music online, their work is ostensibly finished. However, there still exists the component of listener interaction. The nature of digitally streamed music allows it to be quickly and limitlessly shared from one listener to another. Of course, this requires listeners to possess a device that allows them to access these links and files, though this barrier is decreasing in prevalence. According to Statista, 2018 saw approximately 1.56 billion smartphone sales, and there are roughly 3.5 billion smartphone users in the world (as of 2020). Furthermore, according to Digital 2019, 56% of all worldwide website traffic was generated through mobile phones (TechJury 2019). These statistics demonstrate that the possession of streaming-capable technology is not entirely universal, but it is vastly and increasingly common. This enormous social network of consumption is the driving force of amassing popularity.

In a survey of 311 American respondents under the age of 40, 253 indicated that one of the three primary methods they use to discover new musical artists is through suggestions from friends. 255 included the use of streaming platforms in this list, and 160 listed social media. One characteristic common among each of these three responses is that they facilitate further sharing and interaction. Suggestions from friends inform and influence the sharing of music among social networks, streaming platforms use listening history to algorithmically suggest new music, and both streaming platforms and social media speed up sharing and popularizing a song and/or artist.

These relationships pertaining to social networks and music have resulted in the development of a social culture surrounding music. The music you listen to is far more than a simple preference, but rather a reflection of your identity influenced by your peers and your surroundings. This introduces the potential for any musical project to organically and exponentially gain traction and popularity and enables independent artists (with a little bit of luck) to grow in popularity and radically increase the number of listeners to their music.

Case Study and Conclusion

Electronic music producer and University of Kentucky medical school student (not to mention my personal guide during my original foray into digital music production) Madison Sands beautifully embodies the concepts discussed throughout this paper. Sands, a trained pianist, vocalist, and daughter of two musicians, first began to produce digital music in her high school years. Of course, her musical background came in handy, but the technical aspects of her digital productions are otherwise self-taught. Thanking YouTube tutorials for the bulk of her expertise and crediting a tight-knit community of electronic music producers for her popularity on SoundCloud, Sands was able to create her own music, amass popularity online, and ultimately signed track deals⁸ with Vintage Records, High Intensity Records, and Warner. Now, she balances her med school studies with her love of music production which she continues on her personal laptop.

Apart from her personal success, Sands believes that the accessibility of the supply chain of digital music will empower historically marginalized or outcast artists. In an interview, she stated that, “Providing everyone with the tools they need allows anyone to break down

⁸ A distribution contract with a record label for a single song.

stereotypes. Now there isn't a 'specific' type of person that makes each genre because anyone can do it." In an electronic music industry that, for a long while, was largely dominated by men, Sands perfectly represents this concept of self-empowerment by achieving such remarkable success, even as a self-taught high school student.

These concepts are not unique to Madison. Aspiring music producers throughout the world are tapping into the resources discussed in this paper in order to fulfill their personal music goals. Be it the enjoyment of casual production or the hope of attaining fame and glory, people who possess a computer, have access to the internet, and demonstrate a desire to learn are entirely capable of taking advantage of the remarkable accessibility of the supply chain of digital music production.

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Appendix

