I Knew You Were Trouble: Digital Production in Pop Music and Its Implications for Performance
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Chapter 1: Introduction

“The relationship between process and product defines ‘performance’ in the western ‘art’ tradition”¹

Although the Brill Building era of songwriting is over, its hit-making process survives today in the composition of digitally produced popular music. While there is no longer a large hit-making community under one roof, production credits in much modern pop music feature the same set of names—Max Martin, Shellback, Benny Blanco, amongst many others—working in varying degrees of isolation or collaboration, an informal “Virtual Brill Building.”² Internet-mediated exchanges of material allow producers to work collaboratively without gathering in one place. Furthermore, the ability to record with digitally produced sounds and effects rather than relying on musicians to play physical instruments allows these songwriters to create music faster and more independently—many contemporary industry giants intertwine the roles of engineer, producer, and songwriter³. But these freedoms, introduced by digital production, create a set of problems in moving a song from studio to stage, especially for the post-2010 strain of pop music influenced by Electronic Dance Music (EDM).

To see this, we imagine a producer working on a new song. Their Digital Audio Workstation (DAW)⁴ allows flexibility that a more traditional style of songwriting does not: you can both hear and see music at the same time—one can hear audio while also watching waveforms and MIDI data go by⁵—speeding processes⁶ of rerecording, overdubbing, and “comping”.⁷ Pen and paper notation

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allows only a visual conception of composition and analog recording devices advance a composition to audible material, but DAW composition allows these processes to occur simultaneously. It allows simple quick digital manipulations without wrapping up an artist’s time in erasing and rewriting or rerecording.

Though this difference seems small at first, time saved by flexible digital shortcuts allows more material to be produced. One of these shortcuts is the auditioning of digital instruments using synthetic timbres to create music without the time (and money) of hiring musicians to perform changes made along the way. In a genre such as pop, focused on perfecting melodies for catchiness and backing tracks for groove, this quick digital auditioning process is a key development. With less time spent producing an individual track, more variations can be auditioned and more potential tracks can be produced. This allows a producer to “market test” various versions of a song with peers and collaborating artists, ultimately choosing the best piece of music out of a varied collection to pursue further rather than to sticking with a single one that may be less effective.⁸

Our imagined producer begins a new song in a DAW, arranging music digitally. Maybe there is a physical instrument like a guitar on hand to record easily, but perhaps our producer wants sounds that are not physically available in the room with them. A Wurlitzer keyboard; an electric bass; a drum kit—they begin the digital timbre auditioning process. Modern DAWs are loaded with presets and plugins that make these available in just a few clicks as long as the user has a MIDI controller available. A performance on a physical MIDI
controller sends performance data to the DAW, which maps the data to any selected sound, ultimately allowing a producer to create a full track from a series of layered MIDI performances. But producers often find themselves wanting more variation than performances on the default instrument-modeling patches provide: maybe the kick needs to be punchier; the bass needs more sub-bass frequencies and less actual string sound; the Wurlitzer is not quite the harmonic texture they were looking for.

They now find themselves going deeper into the capabilities of the DAW, editing the functionality of synthesizers, samplers, and effects on their channels. Our producer works each sound source until it sits in the mix as intended. In each edit, they also consciously avoid the familiarity of DAW presets; development of one’s own “sound” in production is key to standing out—the more one explores manipulations of digital timbres beyond pre-designed patches, the more unique they sound amongst other producers. As such, many find themselves becoming experts at coaxing exactly the sound they want out of commercially available digital synthesizers and virtual instruments. With producers influenced by the ease of such customizations, music produced this way features synthetic sounds whose only connection to a physical reality is that they were originally performed on a physical MIDI controller. The sound sources themselves exist entirely digitally and have been generated to create a customized palette of textures that fit a song’s aesthetic.

Now we skip ahead on the timeline. The producer has recorded the song and refined its digital manipulation. A singer has been added to the track, and it
has all the makings of a hit. In the ideal world in which it is a success, charts, and creates a fan base wanting more, what is next? The next step of course predates the concept of recording and production; it is the realm of live performance. Here is where a roadblock lies. The producer spent so much time iteratively auditioning and changing various digital details of the song that the music itself lost connection with a physical reality that could otherwise serve as a potential map for live performance. And it is not just digitally synthesized timbres’ lack of direct translation to a physical instrument—it is how they are deftly mixed together, placed in an artificial space, and glued together by large-scale EDM/pop idioms such as noise sweeps and side-chain compression. Each digital manipulation was another step away from physical action that could potentially create that sound without the aid of computers. Live performance now involves tradeoffs between physical immediacy and sonic accuracy, audience expectations versus audience perception.

The use of the studio as a compositional tool—creating sounds unique to the studio—dates back to recording revolutions of the 1960s pioneered by artists like the Beatles and the Beach Boys. But today’s DAW-mediated pop production utilizes an even greater degree of sound synthesis and manipulation. With earlier uses of the studio as a creative agent in popular music, physical instruments were still the focus and thus were the source of most aural material even if heavily edited. But with modern uses of a DAW as a compositional agent, non-physical sound sources abound. In performance of such music, one must negotiate between the possibilities and restrictions of electronics and audience
expectations of what they will witness on stage. The success of digital production shows that its results are desired, but there is no definitive way to bring them to a physical live setting the same way a traditional performance ensemble can with their repertoire—these produced sonic textures were created as a result of time invested in designing and mixing sounds through trial and error and close listening. In live performance there is no time to listen iteratively or to fine-tune every parameter.¹²

The results of this problem of time have lead performers of electronically produced music to adopt new performance styles to accurately reproduce the recording. Performers of EDM and EDM-influenced pop music often employ pre-recorded backing tracks, triggered sonic events, and/or control surfaces that process or produce musical material on a large scale rather than creating it note-by-note.¹³ However, the resulting lack of one-to-one connection between performance action and sonic event can occasionally be disorienting. Jennifer Iverson lays out a description of this kind of relationships in her article “Mechanized Bodies”:

In purely digitally produced music, there is little to no discernable connection between the body and the resulting sound. That is, whether I push play on my laptop with the grandest rhetorical flourish or with the most economical movement, the sound will be the same. This is not true of acoustic instruments (and some electronic instruments), where gesture is deeply correlated to attack and envelope.¹⁴

This disjunction between physical performance action and sonic result can be a challenge to audiences that may not be familiar with what each visual performance gesture with an electronic device is doing, and the loss of that
perceived physical connection can lead to a loss of audience connection to the performance overall.

Furthermore, the main cultural destination for pop music has shifted from live performance to playback of the recorded track in dance-centered spaces, so more compositional thought goes into how the recording will sound replayed than how it will be performed. Thus much of what defines modern pop music is not the composition in a traditional sense of chords and lyrics, but rather the arrangement of a song using large-scale effects—these arrangement effects become an inherent part of the composition. The arrangement is easy to craft in the digital studio, as simple as clicking iteratively to try out new ideas. Live though, it requires a tradeoff. Using traditional instruments creates an aural disconnect between the physical instruments played and the digital sounds and effects they cannot quite mimic. Using buttons, sliders, and computers on stage instead produces more accurate sonic results but often at the expense of visual connection with the audience.¹⁵

Why is it important to investigate these disconnects? Why not simply adopt the practices that already take advantage of them? The main “problem” these disconnects derive from is the hours spent iteratively working with the same recorded performance so that the computer can execute all sound generation and effects in a single pass when bouncing down the track. Live, there is only a single pass on a brand new performance. There is no substitution for the time, care, and attention to detail put into producing a recorded track. As Mark Katz describes in his book *Capturing Sound*, “tangible differences between
tape and performance cultures have a profound effect on the music itself,” a concept he dubs “The Phonograph Effect.” The incorporation of recording and playback equipment into performance to more accurately recreate digitally designed music creates this disconnect. Examining the ways this disconnect is manifested can lead to ideas of how to close the gap. With a less noticeable gap, perhaps the stigma some “real musicians” attach to electronic and popular music could be lessened.

In the following chapters I investigate how these digitally produced tracks are approached in a live setting and what we can learn about production and performance from examining successes and failures in attempting to bridge these two realms. In Chapter 2, I describe the production cycle of a modern electronic pop song in terms of four “spaces,” discussing the effects of a change in cultural emphasis from live performance to dance floor playback. Chapter 3 provides a detailed breakdown of common digital production techniques used in electronic pop music, and Chapter 4 explores many of these techniques in the context of actual songs, seeing how they work in tandem with each other as well as how they evolve over time. Chapter 5 discusses different ways popular artists face live performance challenges that many of these techniques pose. Finally in Chapter 6, I talk about ways I have integrated some of what I have learned into my own live performance recreation of digitally produced pop music. In spite of working with a more limited set of resources than a professional production company, the project had its own set of successes and setbacks that provide concrete examples of the issues discussed in earlier chapters.
DAWs are computer applications like ProTools, Logic, and Ableton Live that generally have four main capabilities working in tandem with each other: the ability to record audio directly in from an instrument or interface and apply digital effects, a sequencing function to organize and/or record MIDI performance data, digital instruments to convert MIDI data into synthesized sound, and an arrangement interface to visually organize and edit all of the above in a sequential manner.

“Comping” is the production term for compiling many takes of the same piece of music into one final take by choosing the best parts from each. This is most commonly done in vocal recording, where line-by-line (or even word-by-word), a producer and artist choose the best-performed phrases to make it onto the final track.

MIDI (Musical Instrument Digital Interface) is a protocol that allows digital music equipment and computers to communicate with each other, carrying instructions for note values and parameters to be carried out by a sound-generating source, whether a DAW or physical synthesizer instrument.
Chapter 2: Spaces in Digital Pop Production

"Like a lot of [Top 40 radio] songs, it takes place in 'da club,' where Pitbull oils his way around the floor, calling women 'Dahling' and remarking on their shapely behinds. The club is both an earthly paradise where all sensual pleasures are realized, and the arena in which achievement is measured.”¹

The composition of modern pop music recordings can be described as involving three basic spaces: the recorded space, the produced space, and the playback space. The recorded space is the immediate space in which the performance is recorded, the produced space is an artificial space simulated to perceptually surround sound sources in a finalized track, and the playback space is the collection of sites ranging from cars to headphones to clubs where these recordings are encountered by the public. Along with these three spaces, we consider concert performance as a fourth space tangentially related to this chain. Progressing through these four spaces, we will outline the root of the problems in translating a digitally produced electronic pop song into a live performance.

One of the largest influences on pop music today is Electronic Dance Music. As EDM is intended for the dance club more than a concert hall,² communal physically engaging spaces like clubs and parties are more central to encountering this music than performance venues—and there is less sense of a physical performance underlying the recording than there is in other music.³ The electronic pop that derives from EDM has similar characteristics. This, together with the ease of consumption via digital marketplaces, has made the performance space less important to engaging with popular music. As a result,
the playback space has become a more central focus for the songwriting process than concert performance.

The recorded space is where physically embodied performance takes place with instruments and voices, where recorded moments of live performance are collected for the produced track. The recorded space is in fact quite produced to begin with: microphone selection and placement drastically alter the perception of the space as performances within it are captured in audio. On a recording, this space is manifested in, for example, the audible room reverb accompanying a voice in a large hall, the dry isolation booth in which a guitar amp is recorded, or the entirely digital (and thus effectively silent) space inside a computer where programs synthesize timbres in a DAW. This space also includes social and psychological factors that affect performances in the studio environment. But because the produced space, where sequencing of recorded material and other digital manipulations occur, masks much of the recorded space, we rarely get a glimpse inside the sound and “aura” of the recorded space unaltered. With so much created and edited within the digital confines of a computer, the clearest window into the recorded space on a finished track is often the vocals. And even an artist’s voice’s location in the song is not tied to much beyond the produced space:

The artists occupy a central place in the songs, but more as vocal personalities than singers. The voices belong to real human beings, for the most part, although in some cases the vocals are so decked out in electronic finery that it doesn’t matter whether a human or a machine made them...Their insights into the human condition seem to extend no further than the walls of the vocal booth.
The aural footprint of the physical space the artist occupied while recording their voice is lost to production, as are the other physical spaces occupied by various musicians involved.\textsuperscript{6}

Where the recorded space I described is a space of physical action, the produced space is the one no physical object or person is able to inhabit. It exists only as an audio effect; it is the location all sound sources on a produced track \textit{allegedly} occupy. The illusion of the produced space is mostly built on time-based signal processors: building up delays to create the impression of reverberation in a physical space\textsuperscript{7} or delaying a sound from one side of the stereo field to the other to define a sound’s location.\textsuperscript{8} What we perceive listening to the track is the illusion that it is a recording of a “real” situation.\textsuperscript{9} And just as the digitally created artificial space masquerades as a real space, the virtual instruments that space glues together are designed “convincingly enough that the listener can engage with the underlying composition, without being unsettled by a non-expressive rendering of its ‘performance.’”\textsuperscript{10}

There are three main playback spaces in modern pop music—headphones providing an intimate and personalized listening experience, dance-based clubs and party atmospheres, and radio-mediated car speakers—and producers must create one track that interacts with the different environments in a similar way. Headphones give the purest rendering of the produced space, the most direct movement from mp3 data to sound perceived by the ear. With few outside factors interfering in this playback space, the produced space must be a cohesive and full environment on its own so as to engulf the listener in the
headphones space. Those listening to various electronic pop hits from the past decade rarely hear the produced space as incomplete. It communicates a full visual picture in this intimate playback space of speakers close to one’s ears.\textsuperscript{11} Though the produced space must be complete and all encompassing to exist in headphone listening, it must also be versatile enough to blend with its ultimate cultural destination, playback for a dance floor. One notable change in popular music in recent decades is an increased focus tactile sounds, those that are felt as opposed to just being heard. Sounds included in the music played in these dance spaces often live in the intersection of aural and physical perception—for example, precise amplitude envelope modifications available in most DAWs allow producers to create sounds that not only stand out of the mix audibly, but also physically strike the listener’s body when played loudly.\textsuperscript{12} The success of a pop song is often directly related to its ability to inhabit a communal playback/dance space, and by extension that success is dependent on its ability to physically interact with dancers.\textsuperscript{13} Dance culture in modern pop and EDM derives in part from Disco culture,\textsuperscript{14} where an “escape from reality” for a night of dancing was central. This musically saturated environment was the focus, not how the music was produced. People did not go to discotheques to see Disco performed—they went to hear the tracks played, dance, and meet people.\textsuperscript{15} With today’s social dance culture retaining similar priorities, there are plenty of ties between aesthetics in Disco and those of modern pop. DJ-ing for dance floors in Sweden is where Denniz PoP, founder of pop song factory Cherion Studios, honed his craft of
producing hits by seeing which songs and parts of songs made “the dance floor boil.” With the dance floor as the final goal for a produced track, the “ideal club sound is heavily mediated: treated, compressed and equalized in emphasis of the body.”

Car speakers contain a bit of both of the previous two playback spaces, retaining the intimacy of private listening but also privileging loudness and physically felt frequencies like social dances spaces. The important way car speakers mediate pop music is through top 40 radio. It is an important point of contact for much pop music, especially new songs. And since top 40 radio encountered through car speakers is often the first place people hear new pop songs, it is important that the production of songs engage with the car environment mediating both intimacy and felt frequencies.

Dance spaces and radio stations repeat a relatively small selection of pop songs. They play what people are hearing everywhere else already since familiarity tends to encourage positive response and “mimics a kind of social communion” in public dance spaces. Knowing what’s coming next and “lean[ing] forward when listening imagining the next bit before it actually comes,” is an integral part of the physical enjoyment of music. Knowing the playback space favors music that is familiar and repeatable, producers create tracks reminiscent stylistically of others and use repeated hooks that create familiarity even upon first listen.

This progression of spaces is the norm in modern pop—one captures sounds live or digitally in the recorded space, erases the recorded space as much
as possible for a cohesive artificial produced space, and tailors that produced space for engagement in the playback space. Moving from DJs in Disco to user-created party playlists, dance culture has excised the role of the traditional performer. But since democratized access to huge libraries of music for low costs has made concerts the economic focus of the music industry, much of the money that remains in music is found in touring and ticket sales. This creates a conundrum; the performance space is no longer an integral part of the music production process but is more important than ever in the sustainability of an artist’s career.

Given the ease of cheap access to music in modern playlist culture, it is notable that tours and concerts are still a draw for fans. Playlist creation allows a listener to craft an online identity based on their music taste as well as share music with friends instantly. With full albums playing a far smaller role in consumption than singles and playlists, many fans of particular pop artists only know the artist’s hits, not the rest of their catalogue. So what is enticing about attending a show with unfamiliar material in between the hits and without the variety of the multiple artists found on a club or party playlist? Clearly even in an mp3 world, there is still interest in witnessing “the real thing”.

But pop concert reviews reveal a lack of focus on the actual music. Musicians other than the main artist, such as the “seven-piece band tucked away” at a 2015 Taylor Swift concert, rarely receive mention. Instead, the focus is on social aspects of the show, such as an artist’s command of a large audience. Sometimes reviewers will take a negative tone, such as one who
claimed Justin Bieber was performing a dance “between reality, performance and what audiences will accept in exchange for their money,” referencing unenthusiastic engagement with the crowd compounded by a performance accompanied by pre-recorded backing tracks. These reviewers nonetheless acknowledge that many crowds seem to enjoy these concerts regardless of how the music is being produced live and perhaps the music itself is not the central focus. But plenty of people are not swayed by stardom and visual distractions, claiming that pop concerts are riddled with inauthenticities. The way visual overload attempts to distract is considered cheating by some—even when musicians are present and visible, there is often audible musical augmentation not entirely accounted for by bodies visually creating music. Backing tracks and guide tracks\textsuperscript{25} abound to make up for difficulties created by the production-for-playback-rather-than-performance approach taken in composition.

Not much blame can be placed on the artist for not recreating a track in a way considered authentic by all; the performance space is simply different. The only performance the original track was designed for was the one where all recorded and MIDI tracks fire off at the same time as a DAW bounces them down for distribution. The potentially unlimited number of instruments, the digital-with-no-physical-equivalent sound sources, and large-scale time-based effects possible in the produced space cannot be translated directly to a physical form; it is usually impossible to render an exact replica of a digital performance note-by-note on live instruments due to the sheer number and complexity of sounds and effects. But if one just plays the recorded track at a concert without any form
of live performance, people could go to a club instead for the same effect and spend less money. Consequently, artists performing their digitally produced material take a number of approaches to reconciling digital production aesthetics with the expectations audiences have for live concerts. With this in mind, there are two key broad decisions an artist makes in preparing each track for the performance space.

One decision is how accurately the performance will sound like the recording. Early in recording history, there was less of an expectation that a recorded song would sound the same live—before integration of digital equipment, both the recorded space and the playback medium (vinyl, tape, etc.) were inevitably audible on a track, and as such the main focuses of the recording were harmony, melody, lyrics, and rhythm as opposed to anything related to sound production. With older music traditions, a recording is a documentation of a specific performance. In this context, there is less expectation that a concert sounds just like the record since it is a different performance.

There are two major changes in recording that make accurately performing a digitally produced pop song difficult. First, there is a greater weight on the *recording* of a song as what fundamentally defines it, not the “underlying” composition—more of the musical identity of a song is found in the mixing and sound engineering here than in other genres, using production parameters that usually are secondary as a central artistic focus. There has certainly always been an art to engineering a piece of music, but in much modern pop, devices such as EQ and compression take on additional roles in shaping the contour of the songs.
They now have rhythmic implications (such as side-chain compression) or arrangement capabilities (like EQ sweeps).

This question of sonic accuracy to a recording often revolves around how much technological equipment will be integrated into performance to gain control of these “secondary” production parameters as well as to produce timbres just like the digitally designed ones on the released track. One live solution that solves both these problems is the use of digital DJ equipment, having evolved from the original DJ tradition of turntablism.29 This usually means leaving behind production of individual note-by-note events and instead controlling large-scale effects with knobs and sliders.30 This way, large numbers of digitally synthesized timbres can be produced without a human performer having to trigger each note. The performer instead focuses on the arrangement, often triggering many sounds or events at once with a single move. DJ equipment utilizes arrangement parameters like equalization to bring to life the large-scale effects from the original recordings with the confidence that, with a computer producing all the notes, the sound they are working with is predictable enough to apply effects reliably. Furthermore, as Mark J. Butler observes in his book *Playing with Something That Runs*, “freedom from continuous concentration on producing ‘the notes’ ” allows the digital DJ performer to be a “better listener,” with the ability to let equipment continue to produce sound while stepping outside the performance briefly to experience it as an audience member for better self-correction.31
Digital DJ performance brings up the second decision: the physical immediacy of the performance. With sound sources invisible to the audience when digitally contained in equipment, there is less of a visual sense of what produces each sound. This creates a feeling of what R. Murray Schafer calls “Schizophonia,” the mismatch between aurally and visually observed events.\(^{32}\) Though it can be understood that buttons and faders a DJ uses are affecting the sound produced, it is not as clear in cause and effect as, for example, a drummer hitting a cymbal and the resulting metallic sound ringing out. Furthermore, the technologies used in these performance situations are more commonly associated with recording (mixing knobs and sliders) or even everyday non-music tasks (laptops), leaving audience members even more unsure how particular gestures on these technologies apply in performance.\(^{33}\)

Schafer discusses two aspects of schizophrenia arising from music technologies. One is how “modern life has been ventriloquized” as the relationship between a sound and its source is erased.\(^{34}\) As with the invention of most new technologies, the advent of sound recording was met with both fear and wonder;\(^{35}\) sounds and voices could now be removed from the place or person of origin and put elsewhere. By the time of Schafer’s “The New Soundscape” in 1969, recordings and playback were an accepted part of life; there was no more fear and wonder, just sound as usual. This shift is what favors the playback space over the performance space today—recordings have become an accepted technology, and they have taken over as a dominant form of engagement with music to the point that, as Schafer observes, “It is more natural
for us today to listen to electrically reproduced music than to listen to live music, which begins to sound quite unnatural.”

The second subset of discussion on schizophonia is even more important to digitally mediated performance:

Every sound has a manner of preparation (the pianist raises his hands, etc.) which is a mimetic advance signal. If it does not have this (a radio suddenly switched on behind one’s back) it surprises us as much as would a birth not preceded by pregnancy.

Though this metaphor is a bit dramatic, he does capture the anxiety produced by hearing a sound without any visual preparation. A performer’s physical preparation for each sound signals to the audience what they are about to hear. This is similar to a listener’s familiarity with a song allowing them to “lean into” it knowing what’s coming next. The lack of the “mimetic advance signal” due to the removal of human note-by-note performance can be disquieting.

With this sense of confusion about what is actually being performed and how, modern pop concerts, especially those that elect to use more DJ or backing track-oriented style as opposed to a live band, feature choreography, light shows, costuming, and other forms of visual overload. Because of the use of technologies with musical effects often unclear to the audience, there is a greater weight placed on proving the “liveness,” of the moment. The tactic is to bombard the crowd visually to distract from the lack of perceivable musical performance action.

Not all anxieties are tamed by distractions though. The stigma attached to electronic performance relates to other “inauthenticities” in performance spaces. Most would argue that lip-synching is inauthentic in some way—it is always
scandalous when someone is revealed to be doing it. As many see it, why should pretending to perform sounds you yourself are not physically creating be any different? There was uproar in 2014 after it was revealed The Red Hot Chili Peppers’ guest performance during the Super Bowl Halftime show was partially prerecorded—video showed both the bass and guitar had no cables plugged into their output jacks, and fans criticized the inauthentic performance.

Thus it has been established that pretending to create sounds while they are actually from a recording is morally reprehensible. But what of DJs, who do not claim to be the source of every note-by-note event but do claim to facilitate the live diffusion of various recordings? There is no lie perpetuated in this case, but it is still a source of discomfort for some. Especially to students of more traditional instruments who have only a rudimentary understanding of DJ performance, being only the mediator and not the creator of sounds still appears to be cheating as a performer since less work appears to be put in.

In performance, physical gesture visible to the audience designates when “there is a distance to be traveled.” In exaggerated terms, there is a physical hardship behind the physical coaxing of sound out of a traditional instrument that is not present when pressing buttons or turning knobs. In that sort of practice, the performer is engaging less directly with the music, and is thus considered to be less present in the music by some. The lack of a performer’s presence can be interpreted as insulting—“(studio) recording has shattered forever the auratic integrity of the musical moment.” A digital DJ performer’s
lack of participation in the “gestural vocabulary” audiences associate with music performance can exacerbate this.\textsuperscript{44}

This performance space anxiety can run even deeper too, running into a both melodramatic and real question of existence. Physical gesture is a sign of “humanness” and “expressivity” in performance, and the removal of expected performance gestures can also imply a removal of humanness.\textsuperscript{45} The fact that this perceived loss of humanness is facilitated by the technology behind computers and DJ equipment only intensifies this concern. The fear even extends beyond visual events right to the musical material itself—the seemingly perfect performances given by computers both in studio and on stage are inherently inhuman. “Minute variations in timing, pitch, intensity, and timbre...characterize a human performance,”\textsuperscript{46} and computer algorithms fundamentally lack these minute variations that signal to an audience the performer is in fact human. Critics argue for this reason that electronic music is cold, mechanical, and lifeless.\textsuperscript{47}

The irony present in this kind of critique is that it often derides certain technologies while sparing others without realizing it. Just as in the world Schafer described where we have become accustomed to the removal of the sound-producer from the sound itself, we have so normalized the amplification of sound that it is not considered an issue at all. Electric guitar amplification in its early days was just as controversial, and the hypocrisy apparent is that many who deride pop for its integration of technology are often the same who use equipment like this without realizing they themselves are integrating
technological mediation. In fact, beyond individual instrument technologies, the mediation of a Public Address (PA) system is present in most live music to electronically amplify sound sources. There are at least three pieces of technology at work here, but modern concertgoers do not have any schizophrenic difficulty hearing a voice much louder than one would expect given the distance from stage to listener. We have culturally accepted the visual connection between a singer’s microphone and amplification of their voice, even though the sound becomes electrical signal in between.

As the fourth space in the chain discussed at the beginning of the chapter, the performance space straddles a schizophrenic divide creating two complementary questions of accuracy. One is the accuracy with which the digitally produced tracks are reproduced in the space. The other is the degree to which a physical connection between the sounds heard and the actions taken can be experienced, causing electronic performers to grapple with the expected association of gesture (Schafer’s “mimetic advance signal”) with sound events in performance. With these two questions in mind, we can investigate production and performance with a close eye on how decisions made within affect each possible perception.
Described more in depth in Chapter 3, the stereo field, or stereo image, of a track is a facilitation of different sounds appearing to come from different directions by utilizing two separate audio channels (left and right).

In contrast, classical music most often has the recorded space preserved as the produced space rather than replaced, leading most classical musicians to view a commercially available recording as a “snapshot” as opposed to the more “movie” style (mediated with large amounts of editing and production) of popular music; Arved Ashby, *Absolute Music Mechanical Reproduction*, (Berkeley: University of California Press, 2010), 211.

Klein, “Feigning Humanity,” 33.

Individual interviews in response to listening for the implied “space” in produced pop songs through headphones, compiled in my MUSC300 podcast, often paint different conceptions of what the space is, but never complain of the space being disjoint or incomplete; MUSIC300 Wesleyan University, “The Imagined Performance Space in Pop Music (Adam Rochelle),” SoundCloud, digital audio.


Gilbert, *Discographies*, 47.

Ibid., 10.

Ibid., 9.

Seabrook, *The Song Machine*, 44.

Gilbert, *Discographies*, 135.


Ibid., 394.

Ibid., 282.


Guide tracks are pre-recorded vocals tracks played alongside a live singer to augment or harmonize with the live vocal performance.

Gilbert, Discographies, 38.

The converse of this is shown by musicians like the Beatles who delved deep into using the studio as an agent in composition and simply retired from live performance—a live recreation of the studio process was not even a concern once the focus became non-performance-based recordings.

This distinction is the same differentiation that copyright makes between the composition copyright (which one must adhere to when using a song’s chords, lyrics, melody, etc.) and master copyright (which one must adhere to when using the master recording of the song);

Katz, Capturing Sound, 31.

Katz, Capturing Sound, 127.

Butler, Playing with Something That Runs, 70.

Katz, Capturing Sound, 108.


Butler, Playing with Something That Runs, 6.

Schafer, The New Soundscape, 44.

Ibid., 44.

Ibid., 45.

Ibid., 51.


Butler, Playing with Something That Runs, 105.


Gilbert, Discographies, 112.

Wyers, Sound, Music and the Moving-Thinking Body, 56.

Gilbert, Discographies, 113.

Butler, Playing with Something that Runs, 66.

Klein, “Feigning Humanity,” 23.

Ibid., 25.

Gilbert, Discographies, 112.

Fundamentally, there are three parts to the system: something to convert sound waves into electrical signals (a microphone), a device to increase the electrical signals (amplifier), and a piece of equipment to convert the increased electrical signals back into sound waves and send them out to the audience (a loudspeaker);

Chapter 3: Digital Pop Production Techniques

“Time-based signal processors are used in more complex ways than to simply fabricate spaces. They can simulate both real and imaginary spaces, create alternate sound worlds, and impact greatly on textural and spatial attributes of a recording, thus greatly influencing a track’s overall shape.¹

Chapters 3, 4, and 5 are a sequence discussing common digital pop production techniques and their specific implications for live performance. This chapter introduces concepts with isolated audio examples (available in Appendix A), chapter 4 presents a number of songs to show these techniques in context, and chapter 5 considers live performances of some of those songs, dissecting how each artist decides to bring them to the stage. These techniques are distinct from compositional concepts like chords and melodies; rather, they are like orchestration and even concert venue selection done with purely digital actions. As we will see, these concepts identified are those that create challenges for sonic accuracy and physical immediacy in a performance context. These techniques can be broken into three categories that present distinct performance problems: Artificial Spatialization, Timbral concepts, and Large-Scale Temporal effects.² Each technique discussion is accompanied example audio tracks included in Appendix A.

Artificial Spaces

In an article entitled “Configuring the sound-box,” Dockwray and Moore discuss four dimensions of recording perceived by a listener as a function of space: Stereo Field, Dynamics, Frequency Spread, and Time.³ We can associate
each dimension with the production techniques used to create them, which are respectively: Stereo Imaging, Compression, Equalization, and application of Reverberation and Delay. These effects are not new (in fact Dockwray and Moore specifically focused on music released 1965 – 1972), but each has applications relevant specifically to digitally produced pop music. The impact of these effects is compounded by a DAW’s ability to layer and recombine them almost endlessly and almost noiselessly. This makes their use far more prominent than when the expense of physical pieces of machinery limited their availability and tape hiss limited their layered reuse.

**Stereo Image** [examples 1 & 2]

While the creation of a stereo sound image dates back to the Walt Disney's *Fantasia* in 1940, digital production has intensified control over the effect. Stereo imaging makes use of two audio channels to create a sense of location and directionality for sound sources in a mix, as opposed to a single channel where all sounds come from a single source.⁴ Physical sound comes from all angles to a listener, not just from the front; mimicking this dispersion of sound sources across the field by panning tracks adds a realistic flavor to the mix. In addition to hard-panning (sending a sound entirely to just one of the channels), sending a sound to both channels with slight differences in volume and time can create more nuanced perceptions of direction and depth. A producer can then emphasize certain elements with central placement, leaving others off to the sides. By doing this, they reduce clutter without turning
individual sounds down in volume, an important possibility in music with many layers.

**Compression** [examples 3 & 4]

The dynamic range of a piece of audio, the ratio between the loudest and quietest sound present, is often greater than that of the device capturing or replaying it, especially in early forms of sound recording. The dynamic range of audio equipment is limited by the magnitude of its power supply and inherent noise, so compression techniques were developed to adapt physical sound to the constraints of the recording medium.

Most compressors contain two important parameters: threshold and ratio. The threshold determines at what volume (decibel level) the compressor begins to decrease gain, and the ratio determines the magnitude of the decrease. Compression generally reduces loud signals so that softer signals can be amplified to increase the clarity of quieter parts relative to the noise inherent in recording and playback. While its original use was simply to make audio signal audible in the context of bad radio reception, poor quality playback, or other technological noise, it was soon discovered that compression could be musically useful in achieving a certain “loudness” aesthetic. Increasing perceived loudness is a recurring goal in pop music production to compete with the increasing loudness of the public collective listening spaces the music often inhabits. With social music spaces like parties and clubs full of other sensory
distractions, a piece of music perceived as louder than the surrounding noise gets more attention.

**Equalization** [examples 3 & 5]

Equalization (EQ) is a technology originally designed to compensate for—or “equalize”—uneven frequency responses in telephone lines that distorted the transmitted signal. Related musical EQ expands the concept beyond purely equalizing a signal, now referring to the general molding of the frequency spectrum of a signal, boosting and cutting frequency ranges as desired. Digital EQs are able to exert precise control over specific frequency bands in a signal, cutting those that are overwhelming in a mix and enhancing the ones that are less audible. EQ allows producers to fit each sound source into the overall mix in a way that does not overcrowd parts of the frequency spectrum needed by other sounds. Precise digital plugins allow quick and powerful applications to clear up dense mixes arising from the digital ability to layer sound sources almost endlessly—this helps produced pop mixes sound less overwhelming even though they contain a lot of audible material.

EQ is also useful in the accentuation of frequencies desired in dance centered playback spaces for their physical impact, namely extreme highs and lows. Enhanced low frequencies create a greater visceral impact while enhanced high frequencies intensify the “presence” of the sound. These alterations made easier by digital EQ manipulation help sounds occupy the intersection of aural
and physical perception, where certain frequencies “‘bleed’ across a range of sensory modes such as hearing, touch, and proprioception.”

Delays and Reverberation [examples 6 – 9]

Delays and reverberation provide distinct ways to define perceived spatial properties of a sound. Delays are individually distinguishable instances of a sound repeated after it is first heard, often imitating echoes reflecting off walls surrounding a sound source. Reverberation (Reverb) is the buildup of many delays such that they are individually indistinguishable and are heard as a cohesive tail off the original sound. Reverb and delay exist all around us in physical spaces, and they shape our perception of the size and shape of a space. In recorded audio, these effects suggest the space the recorded and produced performance takes place in.

Pop production makes constant use of these time-based spatial effects. Since artifacts of the recorded space are generally excised, we hear a devised artificial space catered towards a specific interpretation. Reverb-less spaces are often used to enhance the intimacy of a sound source, while large cavernous reverbs and delays increase the perceived physical size of a track’s space. Schafer, upon observing the physical discomfort people feel in anechoic chambers (rooms completely devoid of reverberation), hypothesized that “the reason human beings find such sounds disconcerting is that they imply a world without air.” Perhaps the lack of reverb in many pop songs’ verses creates a
figurative asphyxiation that heightens the reverb-laden release when the chorus or drop arrives.

**Timbral concepts: Design and Blend of Synthetic & Non-synthetic Textures**

Another application of a DAW’s processing power is the creation of new sounds and precise modeling of familiar physical or electronic instruments entirely digitally. The ease of selection and manipulation this provides has in some ways necessitated the use of synthetic textures to keep up with the pace of production and complexity of soundscapes in the modern pop industry. It has also influenced specific timbral aesthetics common across the subgenre of EDM-influenced pop.

A focus on these instrumental textures often influences the composition of a “Drop,” one of the more novel form elements in modern pop. Borrowed from the EDM idiom, a drop appears in much pop music as a release of built up tension, usually featuring an instrumental line with occasional lyrical interjections. The drop, as it has a central focus on instruments rather than vocals, puts an emphasis on the removal of the artist as an actor. It is often the most high-energy and dance-centric part of a song, stealing the traditional role of the chorus, which in turn then serves as a build towards this release. Choruses in pop and rock styles historically serve as a recurring refrain that mark high points in the energy of a song accompanied by sing-along-type lyrics (and in modern pop songs without drops, they still do), but in these contexts the recurring refrain referred to as a chorus is a stepping stone between low-energy
narrative verse and high-energy instrumental drop. Though conceptually a drop is possible without electronics, digital production serves to make the drop section as climactic and tactile as possible. [example 10]

**Synthesizers and Samplers** [examples 11 & 12]

As the ease of use of digital synthesizers made their sound an expected part of pop music, pursuit of “not real” sounds in these ways became an integral part of composition. An important effect of synthetic sound in pop is that traditional ways of differentiating instruments stops working—as synthesizers both analog and digital combine many signals to create the audible timbre, we end up hearing multiple sources of sound (the original waves) as one timbre. Sometimes the individual oscillators are quite audible in an individual synth, and other times two or more utilized synths are so complementary that their individual identities blend and appear as one. Frequency and time-based effects can further undermine individual instrumental identities by blending them together. Without the knowledge of “the number of instruments in the room” that recording of a more traditional performance ensemble might inherently provide, there is a less clear conception of how many sound sources are creating the timbral palette we hear in electronic pop.

This blend of sounds most commonly exists in the category of synthesizer sounds called “pads.” Though “pad” is an amorphous term essentially defined in opposition to other categories such as leads and basses, most synthesizers’ preset banks have a pad section full of complex but often subdued sounds. Unlike a lead synth designed to cut through a mix and sound its best
monophonically or a bass designed to sound best in low registers, a pad is usually an unassuming blend of sounds that fills out the background of a track, most often in a harmonic role.

**Real Timbres (in opposition to Synthetic Timbres) [examples 13 & 14]**

Just as artificial reverb may be added to a track to fake the presence of air, producers often make use of physical instruments in their highly electronic tracks to ground what otherwise are almost entirely digital compositions. With both samplers and standard recordings of instruments, the use of a recognizable instrumental timbre (or even synthesizer that adeptly models a real timbre) is something for a listener to grab onto if lost in the artificial world of the digital track. Voice and “real” sounds like this are thus usually the central aural focus of a song.

Even when not the central focus, bits of “real” instruments find their way onto tracks, especially non-lyrical vocalizations. Though “oh”s, “yea”s, breathes, and sighs have been mainstays in rock and pop music as long as the genres have existed, in digitally produced music the ease with which they can be grabbed from a vocal track and placed in different locations expands their role. They are often repeated as more of a textural element than a melodic one, sometimes serving to reinforce rhythmic figures and other times relegated to a repeated part of the underlying beat of the song. These vocalizations nested within a predominantly electronic sound track can provide a sense of “realness” the track may be missing.
Breaking Down of the Traditional Drum Kit [example 15]

This is a subset of synthetic and sampled sounds that deserves special mention. The modern pop aesthetic derives from older rock, jazz, and R&B traditions that almost always utilize a drum kit as the central source of rhythmic identity rather than non-drum kit percussion. Thus, it is notable how much of modern pop breaks down the traditional drum kit by its timbral roles and creates new “kits” mimicking those roles. Essential parts of drum kits are usually divided into three categories: the low-frequency role typically occupied by a kick drum on beats one and three or on every beat, the snare role that “responds” in the gaps between kick drums generally on beats two and four, and the pulsing role of a hi-hat in eight or sixteenth notes.

A common application of this role-substitution practice is replacing the traditional “two and four” response of the snare drum with claps or snaps, fitting the same timbral category as a snare. A natural extension of the 80’s gated reverb snare sound and other synthetic snares popularized by 808 drums, claps rose to prominence in modern pop as part of the “signature sound” of Swedish pop factory Cherion Studios in the 90’s. Similarly, the pulse usually performed by a hi-hat or ride cymbal in rock music is often replaced by a tambourine or percussive synthesizer. The kick is usually such a low tone that its exact timbre is not as noticeable in the overall mix, but actual kick drum samples are often replaced by digitally designed sounds built of off a high frequency attack (modeling the beater hitting the head of the drum) followed by a low sine tone that models sound resonating inside the drum.
Large Scale Temporal Effects

This final category is derived from the power of a DAW to act as both a composition tool and an arrangement tool, since audio and MIDI data are a score for how the computer is to perform music when the track is played. Because a producer can arrange these pieces of note-by-note information on a large scale, they can direct the flow of performance over time with sounds and effects outside the main sound sources, just as an orchestra conductor coaxes swells and decrescendos out of their musicians who themselves are producing musical material.

Loop-Based Composition [example 16]

The most natural large-scale compositional technique is loop-based composition. In its most common form, a producer loops musical material repeating throughout a section behind a sung melody instead of individually recording a new performance each iteration of the cycle. In some cases, the loop that defines a song from the beginning remains while new material is added on top of it to establish a section change rather than writing and recording an entirely new background. With the premium placed on familiarity, one can see the advantage and practical appeal of an approach that reuses material as much as possible. Ultimately, looped material relates back to the dance-based playback space: rhythm and repetition (especially pulsing rhythms) are inherently connected to corporeal reaction\textsuperscript{16}–it is easier to dance to.
A common critique of digitally produced music is that it is highly robotic and inhuman with events quantized to a grid temporally and notes perfectly on pitch in a manner so precise no human musician could perform them. What is claimed to be lacking is the emotion and expressivity a human inherently exerts in their music through small deviations from perfection. One of the places this difference is clearest is in the transitions between sections of a song. When moving from a quiet verse to a dramatic chorus, a traditional rock band exudes notable excitement in their playing as the transition approaches, palpable in energetic idiosyncrasies in their performance. In electronic production of digital instruments, looped material does not contain this sort of energetic variation. Rather than doing detailed programming to coax this very nuanced human action out of a mechanical performance, producers add different transitional devices over the loops to smooth the changes between sections of a song.

There are four general kinds of transitional devices: EQ Sweeps, Filter Cutoff, Noise Builds a.k.a. Wind, and Noise Releases. EQ Sweeps and Filter Cutoffs both affect sound sources already producing material, while Wind and Noise Releases introduce an additional sound source. These effects mark structures in a manner similar to large-scale dynamic variation in other music.

EQ Sweeps are a high-pass filter applied to one or more instruments, creating a lift to drop into the next section. The filter often has a high level of resonance so that the movement of the filter is prominent. As a transition approaches, the hi-pass is low, letting almost all frequency content through; it
then slowly rises, rolling off more and more of the signal until only the very highest components are audible. Typically, the next section begins with a sudden release of the filter so that the build from full-frequency to just-high-frequencies is followed by an instantaneous drop back to the original frequency range. This releases the built up tension and disguises the mechanical sounding motions that may occur in the transition otherwise.

Filter sweeps work in an opposite manner, usually based on a low-pass filter that either starts low and moves up or starts high and moves down as a new section approaches. It is a common device found in introductions, slowly filtering material in, or during a bridge section, where high frequencies are tamed only to be climactically released as the final chorus approaches. The use of cutoff is particularly poignant in pop music because it simulates the leaking of low frequencies one might hear from outside a club or party, the very spaces these songs are designed to be played back in—often the “stepping outside the club” effect is added to simulate leaving and re-entering a dance space to evoke that relatable physical experience.

Wind introduces synthetically generated noise as a transition approaches. Often, it begins low in volume and reaches its peak right before the transition only to disappear as the new section drops in, similar to an EQ sweep. Wind is often accompanied by an EQ sweep of its own to add more movement to the transition. A common alternative to the noise sweep is a reverse cymbal sample. The timbre of a crash cymbal (or artificially synthesized cymbal sound) played in reverse has a lot of the same properties as a typical noise build.
A noise release is slightly different from the previous three since it occurs after a transition. Sometimes the drop from EQ-sweep or Wind sweep with a hard stop is too sudden, and thus slowly fading noise is put in after the transition to cover any potential holes in the transition and the loss of material from removing wind. The noise release has similar properties to one role of the crash cymbal in rock music—they are both noise timbres that can be played at the beginning of a cycle to mark a transition, decaying over time to allow for other elements of the mix to regain prominence after the transition has been completed. Of course in this light, some of these noise-based transitions are also instances of percussion substitution.

**Side-chain Compression** [examples 22 – 25]

Side-chain compression is a compression-based effect with rhythmic implications. This particular technique alters the dynamics of tracks based on the signal of a separate track. The product of side-chain compression is the “pumping” or “pulsing” often heard in EDM and EDM-influenced pop music, typically ducking sounds in volume on quarter note beats with a kick drum and releasing to louder volumes on the off-beats. More nuanced than simply playing notes or chords on off beats, side-chain compression is a creative way of accentuating a physical pulse.

Overuse of compression in its standard role can accidentally create a rhythmic pulse in a mix when applied across many or all instruments. This is especially true in music with a loud kick drum that, when sounding, produces a
large transient that triggers the compressor to reduce the volume of everything else each time the kick is hit. In a lot of pop, this effect is purposely exaggerated. Rather than just trying to get a kick to overload a compressor on the whole track, the kick drum audio is specifically fed into the side-chain input on compressors affecting tracks a producer wants to “pump” with the beat.

There are a number of variants on this practice, the simplest being side-chain compression applied to harmonic textures with a kick drum on every beat. When combined with anticipated rhythms in side-chained harmonic material, this allows chords to arrive on a “breath” in between beats when the harmonic timbres are louder, before their dynamic range is squashed by the kick drum on a beat. Alternatively, some producers desire the breathing and pumping side-chain compression sound on its own without a kick present—for this a kick-like signal is sent only into the side-chain input. That way, the listener does not hear that particular kick but does hear “breaths” in the compressed signals every time the hidden kick sounds.

These three categories of techniques make up most of the production toolkit for EDM-influenced pop songs, and their individual modes of application are what present live reproduction problems. Artificial Spatialization techniques create the cohesive produced space one hears on a track, but in a live performance the space of the venue itself (including individual musicians’ locations) often contradicts the environment heard on a track. Digitally synthesized sounds create a problem of instrumentation, both because physical
instruments are often unable to recreate them and because it is often unclear just how many digital sound sources there are to recreate. Finally, large-scale temporal effects applied over multiple instruments and over periods of time greater than a note-by-note basis do not line up with performance gestures of individual note events on individual instruments with which audiences are familiar. As we move into specific songs, we will see how the iterative layering and interaction of all these effects can compound on each other.
Artificial Spatialization: Stereo Image, Compression, Equalization, Reverb/Delay
Timbral Concepts: Synthesizers and Samplers, Real Timbres, Breaking Down the
Traditional Drum Kit
Large-scale Temporal effects: Loop-based composition, Transitional Devices,
Side-chain Compression.

1 Bennet, “Time-based Signal Processing and Shape,” 17.
2 The 3 categories presented each include a number of techniques:

3 Ruth Dockwray and Allan F. Moore, “Configuring the sound-box 1965—1972,”

4 Barry Blesser and Linda-Ruth Salter, Spaces Speak, Are you Listening?:

5 Rick Jeffs, Scott Holden, and Dennis Bohn, “Dynamics Processors – Technology

6 Gain is a measure of increase or decrease in the amplitude electrical signal; in

7 Kyle Devine, “Imperfect Sound Forever: Loudness Wars, Listening Formations,

8 Ibid., 168.

9 Vesa Välimäki and Joshua D. Reiss, “All About Audio Equalization: Solutions and

10 Garcia, “Beats, Flesh, and Grain,” 64.

11 Blesser, Spaces Speak, 156.

12 Schafer, The New Soundscape, 46.

13 Oscillators are electric circuits that produce period vibrations in the form of
electric current, which can then be translated into audio signal the same way
regular audio that is translated into electrical signal through a microphone is
translated back through speakers. Oscillators in synthesizers generally can be
manipulated to create a wide range of sound depending on a number of
parameters including sound waves to imitate;

14 Seabrook, The Song Machine, 16.

15 Ibid., 64.

16 Gilbert, Discographies, 59.
Chapter 4: Electronic Pop Production in Context

“Because of its ever-increasing electronic mediation, the creation of popular music has moved toward an increasing ‘fusion of instrument and recording device’. One consequence of this trend has been a blurring of the boundaries between electronic effects and the sounds on which they operate...these effects have become integral to certain sonic identities.”

Musical genre is a porous construction, so none of the concepts discussed in chapter 3 are unique to modern pop. But their use helps distinguish the particular subgenre of EDM-influenced pop music that is my focus. For example, one can hardly consider the modern pop landscape without acknowledging Beyoncé, both the music she creates and the social influence she exerts. Yet, despite her music’s presence in the same playback spaces as the EDM/Pop subgenre, it is quite distinct in its approach to production. Rather than pulling from the EDM style, her music draws from R&B and Hip-Hop traditions. Production there favors physical instruments and their samples over synthesized sounds, and songwriting favors expressive narrative over the subordination of lyrical content to melody-driven hooks. Furthermore, Beyoncé’s music maintains and enhances her identity as a singer and social force beyond the recorded space, often not the case with artists in this EDM/electronic pop tradition. The cultural significance and racial subtext to these stylistic differences are self-evident, but they are beyond the scope of this thesis.

EDM and EDM-influenced pop music of course existed before the period investigated here. But 2010 is a convenient starting point as it marked a period of transition in the prevalence of its aural footprint. Skrillex’s debut EP My Name Is Skrillex released in 2010, brought EDM (specifically dubstep) to the forefront
of popular culture, influencing other producers in and out of pop. Skrillex and his ilk are often used as the benchmark of the popularity of EDM overall, equating the rise and fall of his music to the rise and fall of EDM itself as well as its infiltration of pop culture and pop music.\(^3\) After dubstep’s popularity subsided, Skrillex and other EDM producers began working on pop-oriented projects such as Justin Bieber’s 2015 album *Purpose*. These collaborations further fused EDM and pop practices.

To contrast with other branches of modern pop, I will go through a number of songs to review chapter 3’s production techniques in context. This will help to establish how the digital production style of the electronic pop subgenre distinguishes it from other musics and show the evolution of these practices over time. Paralleling the incremental adaptation of EDM-style production in popular music overall, one of the most notable transitions into the electronic pop aesthetic in the last decade is that of Taylor Swift.

Only recently did Swift become a full self-declared pop star. Before 2012’s *Red*, she was a guitar-playing country-pop singer. When she decided to work with seasoned pop producer Max Martin on three tracks for *Red* (“I Knew You Were Trouble,” “We Are Never Ever Getting Back Together,” and “22”), she signaled a turn in her repertoire.\(^4\) Production as an instrument made a notable appearance in each song, a stark contrast with the rest her repertoire. Dropping the guitar from her image in 2014, Swift released *1989*, an album she widely declared her first official pop album.\(^5\) As this time she worked with Max Martin on all the album’s tracks, digital pop production techniques were highly
influential on the overall sound. By examining a song from each of these different points of her career (pre-Red, Red, and 1989), we can see where different techniques found their way into her music.

“You Belong With Me” (2008) is an example of Taylor Swift’s original country-pop-rock aesthetic. The instrumentation is: acoustic and gritty electric guitars, acoustic drums, an electric bass playing a pulsing root notes bassline, and other country instruments such as violin and banjo filling out the background. Techniques of electronic pop production are notably absent—reverb is relatively contained, instrument timbres are easily distinguishable and “real” sounding, and there is nothing as iconically digital as noise or EQ sweeps.

“I Knew You Were Trouble” (2012) from Swift’s album Red does initially appear to have similar country-pop potential, beginning with a rhythmic electric guitar, an acoustic guitar, and a pulsing root note electric bass that soon joins. In addition to the slightly-too-frantic-to-be-country pace though, the noise sweep and release that bring the song to its pre-chorus gives away the song’s more digital intentions. The pre-chorus only exacerbates this aesthetic by utilizing a classic EDM-type snare drum fill: constant eighth notes beginning filtered down with a cutoff effect that lifts as the transition approaches.

The chorus is brazenly different from anything Swift had released before, especially in how the chorus behaves like an EDM drop. Released during the peak of dubstep popularity, its halftime tempo and dynamic bass synths clearly show a desire to update Swift’s aesthetic to current fashion. In contrast to her earlier repertoire, “Trouble” began to employ the dance floor aesthetic with a
heavier backbeat and greater emphasis on synthetic sounds and bass frequencies. These songs point towards a more bodily oriented experience of the music instead of an emotional connection established through lyrics. The emphatic "oh"s on that hit with the synth and kick drum punches at the peak of the chorus also show the composition leaning towards an emphasis on rhythmic and corporeal parts of the track rather than lyrical and emotional ones during the central moments of the song.

In 1989's “Style,” (2015) every timbre aside from the vocals is obviously synthetic or electronically modified. This extends to the main guitar riff that is processed with a cutoff filter sweep in the introduction. There is considerable use of percussion substitution as well: the pulsing hi-hat role during the verse is filled by a synth side-chained to the quarter note kick, and that pulse is subsequently doubled by a tambourine on the chorus. Another percussive device propelling the song is a reverberating clap that accompanies every fourth snare hit, marking the end of each drum loop. With these amongst other digital artifacts present on the song and across the album, “Style” is representative of the EDM-influenced pop aesthetic Taylor Swift adopted in recent years.

Where Taylor Swift evolved over time to take on the electro-pop aesthetic, artists like Katy Perry began their pop careers at the front of the wave of electronic-sounding production, working with Max Martin from the very beginning. “Last Friday Night (T.G.I.F)” (2010) and other singles from Katy Perry’s album Teenage Dream contain a rock band instrumentation. Though passing as a normal “live band” song, it exhibits humble appearances of many
digital production techniques that would eventually be used far more noticeably such as in the later Swift songs.

The main instrumental hook is a chord progression featuring a guitar, a slap bass-style string pop every couple bars, and a conventional drumbeat. Though these drum and percussion timbres are at their core perhaps programmed and synthetic, there are no timbral substitutions, so they at least appear “real”. The only obviously digital timbres are the synthesizers that arrive on the chorus, serving mostly a background and textural role unlike the engulfing synths of later songs. One of their subtleties is their interaction with stereo image and time-based space effects. The low buzzing bass synth is panned in the center, but the stereo spread is quite thin—that is, it is mixed such that it is perceived in the center only, not on all sides as well (like the guitar is).

Similarly, the softer gliding synth that appears in the 2nd half of the chorus is panned to the side, providing additional content but not stealing much attention.

Other production techniques are applied in subtle forms as well. One is an evolution in the produced space over the course of the song; the verses are dry and close to the listener while the choruses have a bigger feel with much more reverb. Similarly, small reverse cymbal swells can be heard approaching transitions. They are not as attention grabbing as large noise sweeps, but they play the same role in generating excitement for a chorus that reuses material from a looped verse. Overall, this song shows a time of transition in pop from a realm of simply digitally produced but live-sounding music to a broader integration of EDM practices.
We now turn to 2016 by which many of the techniques assimilated from EDM had become even more pronounced. Two widely successful 2016 examples provide contrasting ways to look at this development: SeeB’s Remix of Mike Posner’s “I Took a Pill in Ibiza”\(^\text{10}\) and The Chainsmokers’ “Closer.”\(^\text{11}\) “I Took a Pill in Ibiza” is notable because a comparison with the acoustic original\(^\text{12}\) provides a number of answers to the question “what digital techniques are needed to make a hit electronic pop song?” Comparisons in the chart successes show that things SeeB did to electrify the acoustic original did exactly what they wanted. “Closer,” #1 on the Billboard hot 100 for twelve weeks, became a ubiquitous party song to close out a year in which The Chainsmokers broke out with a number of other hits.\(^\text{13}\) In contrast to “I Took A Pill in Ibiza,” “Closer” was written by the producers themselves, as The Chainsmokers are one of many who now merge the identities of pop artist and producer.

The differences between the original and remix of “I Took A Pill in Ibiza” are considerable. The only recorded material they have in common is the vocal track, which is sped up and quantized into a swing feel in the tropical house-style remix. Not even the chord progression is the same—the majority of the original is I V IV I, while the remix replaces the first I chord with a vi. The original version is centered sonically on Mike Posner’s acoustic guitar, maintaining a singer-songwriter atmosphere. There is very little reverb present—the opening vocals contain a very potent tight room sound, locating the music in a very small and perceivable space. Even when other instruments come in, the small room
sound is still very noticeable. This closeness through lack of reverb creates a sense of intimacy that supports the lyrical content.

The remix on the other hand is emphatically electronic. A couple of synth textures put through low-pass filters open the song harmonically, and that filter releases slowly as the chorus approaches. Even though there is no percussion until the build and drop, there is still side-chaining to an inaudible quarter note kick that acts as a source of pulse in the percussion-less sections. There is a long reverb tail on all sounds, especially the vocals—this produced space is enormous and unidentifiable, as are most of the instrumental timbres. Wind and noise sweeps are prominent in every transition, acting almost like an additional percussion instrument. When drums are finally present, a tambourine fills the role of the hi-hat, and the snare is limited to small fills in the background while beats two and four are filled by electronic snaps. In the drop, the main melodic content is a pitch-shifted sample of the first syllable of the chorus, linking it personally to the rest of the song. In the second half of each drop, that melody is joined by a reverb-drenched marimba texture tucked into the background as another “real” timbre accompanying the pseudo-real sound of the vocal sample. The kick drum is unapologetically four-on-the-floor when it enters, matching the quarter note side-chaining that was already present prior to its entrance. In sum, SeeB utilized most almost every technique from chapter 3 in a single remix.

“Closer” utilizes a similar set of production techniques to make a pop song with utmost simplicity: it loops the same 3 chords throughout and has a drop melody made up of just 3 notes. It opens with a filter cutoff over musical
material that has a distinct quarter note pulse, but upon dropping into the verse the song it eschews an expected use of pulsing side-chaining in order to take advantage other sparser rhythms. Rather than “four on the floor,” the song greets the listener with a less constant quarter note rhythm in alternating groups of two and four. This open rhythmic structure allows an evolution that occurs each verse: it begins with open space for the lyrics and eventually develops more varied clapping rhythms to fill the space. The song also makes modest use of EQ sweeps and wind building into choruses and drops, using nothing too overwhelming but nevertheless paying homage to the EDM roots of the producers themselves.

The song compounds the rhythmic sparseness of each verse with very little reverb use in these sections. Where other songs (like “Ibiza”) fill all gaps with large reverbs to engulf the listener, the producers here chose to leave those rhythmic spaces jarringly dry. Even when more instruments are present, everything is relatively tame as if there was special care put into making sure nothing stood out. The chorus makes similar statements—no harmonies (just octave doubling) on the already simple melody. Everything except the lead synth in the drop section sounds tailored to be “inoffensive,” blending together indistinguishably. Though the song features many techniques used in “I Took a Pill in Ibiza,” the hypnotically repeating chord progression and 3 note melody allow the listeners to get lost in the few things that do stand out without being overwhelmed, in opposition to the bombastic electronic EDM textures one finds on pieces of music like the SeeB release.
9 Katy Perry, “Last Friday Night (T.G.I.F),” *Teenage Dream*, June 6th, 2011, digital audio [example 29].
10 Mike Posner, “I Took a Pill in Ibiza (SeeB Remix),” *At Night, Alone.*, February 26th, 2016, digital audio [example 30].
12 Mike Posner, “I Took a Pill in Ibiza,” *At Night, Alone.*, June 22nd, 2015, digital audio [example 32].
13 Gary Trust, “The Chainsmokers’ ‘Closer’ Tops Hot 100 for 10th Week, Tying for Longest Reign This Year,” *Billboard*, October 24th, 2016.
Chapter 5: Digitally Produced Pop in a Live Setting

"Musical sound has a direct relation to the body in acoustic music. We need bodies to produce sound on acoustic instruments because we need the body’s energy to create vibrations by striking the drum or piano key, blowing into the wind or brass instrument, bowing or strumming the string, activating the vocal chords with air...

Electronic sound, on the other hand, does not seem to have the same direct ontological relationship to the body as acoustic sound. What makes electronically produced sound? The answer is complicated: the sound issues forth from a speaker, which has amplified and converted the information received from a computer, which read a complex file assembled from millions of bits and bytes of information. Theoretically, there is a human with a body behind the creative process, determining what the sound should sound like.”¹

The iterative layering and alteration of musical material central to pop production, generally encountered in the context of dance-centric spaces where one engages with playlists of assorted pop recordings, define listeners’ expectations of how the music is to sound. These layerings and alterations are generally unavailable in concert though, and adapting a song to a purely traditional performance practice would not provide the right sound—the sound sources present in a standard rock band or folk group for example are incapable of reproducing certain digitally designed sounds, both their timbre and number. But an attempt to retain the aesthetics of the highly produced original track by means of less traditional performance styles utilizing backing tracks or digital DJ equipment suffers a loss of immediacy as the music produced does not correlate note-by-note to performance gestures the musicians make on stage.²

While the focus of songwriting may have moved from performance to recording, the economics have moved from recording to performance. Pirating websites, low-royalty-paying streaming services, and modern singles and
playlist culture encouraging audiences to engage with smaller portions of an artist’s work have lowered the value of digital music and thus require artists to rely more on touring revenue. The shows must be worth an audience member’s time and money to attend, which usually means finding a compromise between sonic accuracy and physical immediacy that is as inoffensive as possible to all dispositions. This usually means starting with sonic accuracy, using whatever technology necessary to recreate each track, and then making a spectacle out of the concert to distract from the disconnection between the actions performed and music that results. Even with a live band present, visual distractions abound, giving live musicians the freedom to use extra effects on a non-note-by-note basis and utilize accompaniment tracks to fill out arrangements beyond what the band is capable of producing.

This chapter focuses on the staging and performance of modern electronic pop music. It will investigate how live pop shows are approached by various artists, framed by the spaces discussed in chapter 2 as well as the digital production techniques in chapters 3 and 4. Links to videos of discussed performances are included at the end of this chapter. Given the typical use of spectacle, concerts become about more than just musical performance. The visually engaging pieces of a concert are often more prominent than musical material—as such, pricing and desirability of seating derive more from how well the performance can be seen rather than how well it is heard. Increased mediatization makes attending a concert “often roughly the experience of watching a small, noisy TV set in a large, crowded field.” Thus the event itself
further stratifies the performance, adding to the many degrees of technological separation between performance and audience.

Taylor Swift’s transition from country to electronic pop is found in both the production style of her recordings and the staging of her concerts. Looking at a 2009 performance of “You Belong With Me,” one sees a staging of the country rock song exactly as one would expect based on the recording.\(^5\) All sound sources on the original recording make an easy transition to the stage—every instrument identifiable on the track (electric guitar, banjo, etc.) is present in a physical form, playing the same notes and sequences performed on the recording. Analog effects present on the original, such as a guitar run through a wah pedal, are readily performed on stage with the same equipment. There are no elements of visual spectacle like pyrotechnics, quickly moving lights, and backup dancers. Other than Swift herself, there is no distinguishable costume aesthetic on stage.

Moving forward a couple years to 2012 performances of the digitally influenced “I Knew You Were Trouble,” the staging has changed significantly.\(^6\) Though a live band is still present, it is no longer the focus of the performance as it was in 2009. Not only is there a plethora of costumes and choreographed dancers, but also the set is built such that the band is hidden next to a grand staircase set in the center. The active light show and constant dancing across the stage takes attention off the stationary band.

The performance begins with a dramatically choreographed violin intro, the violinist spotlighted on the runway with the rest of the band in darkness.
None of the band members are actually accompanying the violinist, so orchestral textures audible underneath the violin must be from a prerecorded track. But with the drama of the choreography and the physical space taken up by the massive sound of the backing track (that no doubt is felt by the audience as physical bass frequencies), the lack of physicality involved in producing those sounds is not missed. Furthermore, it could be argued that the ethereal nature of the introduction is intentionally created to locate the violinist alone in the fictitious space of the song, leaving her somber renditions of the melody to invoke the solitary angst of the song to follow. That argument might say if there were physical musicians visually performing the background track with her, the simulated aloneness may be lost to visual movement behind her.

The band itself does not seem to be equipped to produce the rest of the background sounds audible in this section anyway. There is a single keyboardist (Taylor Swift’s music director David Cook) and no string players aside from the main violinist, so there is not even the correct instrumentation to produce the numerous synthesizer and orchestral sounds of the introduction on a note-by-note basis. Cook, with a computer clearly visible on his keyboards, can control backing tracks relevant to each part of the show. Given these aural decisions, it is clear why the visual staging decisions followed—it was decided to put the band in darkness fort his intro so that they could create a piece of music that was not restricted by the limitations of live sound production with their band’s instrumentation. Though this intro was not on the original recording, it pays homage to production practices utilized with synthesized sound, namely the
“one real timbre” technique. Most sound in the background is clearly synthetic and has no physical instrument associated with it, but the violinist who is visually embodying her performed sound brings a sense of humanness to the accompaniment.

When the main body of the song begins, the lights go up and the live band is revealed. With the verse of the track featuring a rock band aesthetic, it is very easy to transfer to stage with guitar, bass, and drums. But the rest of the track poses a problem for the live band that gets solved by the accompaniment track again. As things get more electronic, especially in the choruses, the choreography and lighting grow in intensity to follow what is likely a shift to a more backing-track-oriented performance to allow for the digital and dubstep flavored sounds. From the second chorus through the extended breakdown—which is the most digital sounding portion of the performance—Swift and her dancers are out on the runway, directing attention away from the band back on the main stage.

2015 performances of “Style” advance staging choices in “I Knew You Were Trouble” to a new extreme. Here, similar to the violinist in Trouble, Swift herself is the only one illuminated and mobile. Three large screens surround her to display her performance to the far reaches of the festival crowd, and large LED panels around the stage complement the image. While the band was visible but stationary in the background in the “Trouble” video, here it is entirely in darkness. Only audience members close to the stage can see the musicians and occasional close shots projected on the video monitors reveal them—their subliminal presence reassures the audience against any fear of non-humanness
in the music while remaining visually obscured enough to allow for subtle backing track incorporation. Swift spends most of this song out front in theatrical solitude, calling attention to her alone-ness in the emotional content of the song while remaining the unequivocal center of attention.

With Swift’s evolving electronic pop performance styles in mind, a comparison of performances of the two songs from 2016 discussed in chapter 4 is revelatory. Mike Posner’s performances of the remix of “I Took A Pill in Ibiza” focuses on a physically present band, while the Chainsmokers enact a more direct translation from track to stage in their performances of “Closer.” Swift’s later performances are somewhere in the middle of this spectrum, while Mike Posner and The Chainsmokers exemplify opposite extremes in the performance of EDM-pop music.

Mike Posner seems to feel no need to visually obscure instrumentalists. Where Swift dropped the acoustic guitar from her image for pop stardom, Posner still keeps it central to his performance style. He and his band's instruments are all visible from the audience and additionally are not overtaken visually by dancers or lighting effects. As such, the band is much more accountable for the music they are producing—it would be far clearer to an audience if they were using a backing track than if their physical performance actions were less visible. But Posner has no intention to “trick” the audience into believing backing-track performance the way some EDM-pop shows do. Aware that fans likely want to hear the chart-topping danceable remix of “I Took a Pill in Ibiza” as opposed to the slow and less-popular original, his performance stems
from the remix’s arrangement (the tempo, swung feel, and drop) while minimizing its reliance on digital effects. Perhaps most notably, the recorded track covers his voice in reverb surrounded by somber synths, but his relatively dry voice live accompanied by a warm acoustic guitar provides an entirely different setting for the song.

The form from the remix remains relatively intact, featuring drum-less verses and the instrumental post-chorus drop, but the textures audible during those sections are quite different. Instead of the reverb-laden synthesizers that fill the harmonic role of the remix, his singer-songwriter style is apparent with acoustic guitar verses. Where other instruments come in on the remix, sounds do arrive in the performance as well. Here though, rather than layered synths side-chained to the kick, there are synth pad textures from the keyboardists unaffected by the kick drum, as well as some additional guitar arpeggios. Electronic handclaps and snaps from the remix’s arrangement are covered by a drummer’s sample pads, which, centrally integrated with his kit visibly rather than hidden off to the side, maintain the visual experience of instrumental performance without electronics.

The drop takes a number of liberties as well, including the drums no longer attempting to mimic the percussion of the EDM production. Where the remix took advantage of percussion substitution to create a beat with claps, snaps, and tambourine, the live drummer digs into a more rock-like drumbeat, bringing his physical energy to the drum part. The drummer’s additional live energy provides the rhythmic propulsion lost with the absence of side-chaining.
This example shows how EDM manages with so few drum and percussion sounds because of other rhythmic elements—such as side-chaining—in the mix that keep it moving. The drummer also fills in for the lack of digital transitional devices, using crash cymbal hits in place of noise releases and typical rock builds and fills in place of the wind builds that generate energy in the remix.

Without side-chaining present, the chordal instruments on stage are left to create their own sense of rhythmic propulsion just as the drums did. While the keyboardist does take on some of the exact background synth lines from the remix, the rhythmic guitar strumming is a new feature and creates propulsion not originally present. While it may not accurately reflect the large and sparse nature of the drop in the recording, it allows the guitarists to visually embody the energy of the drop they are performing simply by playing their instruments emphatically. Whereas EDM performers using digital DJ equipment often follow the trope of jumping up and down during a drop to embody the energy of the section (in a way that is purely meant to communicate enthusiasm to the audience rather than actively affecting the sound in some way), the physical nature of live instruments present in this scenario allow them to play and emote with the same motions.

The melodic layer of the drop in this performance is the saxophone. While it would have been possible with another keyboardist to play back the same melodic vocal sample line found in the recording, Posner again seemed to prefer a more visually emotive arrangement. Utilizing a saxophone, whose breathy texture recalls the timbral quality of a vocal sample, the arrangement showcases
that main melodic line through a musician who is able to be up front on the stage, moving with the line rather than a more visually obscured sampling performance part.

The Chainsmokers’ performances of “Closer” take the opposite route, aiming to sound more like the original EDM-pop track they produced as opposed to trying to create an arrangement that allows for individual instrumentalists to carry the song through visual interactions with instruments. Taking on a similar style to Taylor Swift’s later performances, the musicians present in this particular performance are entirely in the background and are furthermore blocked for the most part by smoke machines. Most of the performance is spectacle; with one half of the duo singing, the other is up front with keyboards simply so he is visually prominent as a member of the group.

Watching the background musicians and listening to the sounds they are allegedly producing shows that a backing track is being used; one of the most obvious giveaways that the musicians are for show is the presence of a full drum kit while the drum sounds heard are quite electronic and eerily too similar to the original track. There is a complex palette of sounds present in the audio (not to mention the numerous effects like occasional side-chaining and filter sweeps), but there do not appear to be enough musicians to be creating all those sounds. The other giveaway is when Alex Pall leaves his keyboard bank (at 3:22) to hype up the audience for the rest of the song—none of the audible keyboard parts disappear, so he must not have been producing any audible material in the first place. Most Chainsmokers performances actually involve no live instruments at
all, just digital DJ equipment further obscuring the connection between
performance gesture and produced sound. A reviewer of a different
Chainsmokers performance that was overall quite enamored with the affair
nevertheless admitted:

In the end I didn’t really see the Chainsmokers doing much. Well,
musically that is. They certainly danced on the somewhat
neglected switch-boards, strutted the runway, constructed crowd-
pleasing shenanigans and brought their posse on stage. They
clapped, they danced, they truly jammed out – but I’m not really
sure how much they actually played the music – which one could
notice since they were elevated so high above the stage.

Going on to rave about the light show and how it was a central part of the
experience, he does not seem dismayed by the lack of musical
performance. So when an event becomes about more than just the music,
people like this reviewer see pre-determined tracks as entirely excusable.
So despite resulting in a lack of perceivable musical performance, this
choice has the best chance of meeting audience expectations for a
particular show, especially in regards to difficult-to-reproduce digital
sounds and effects.

The takeaway is not necessarily that one approach is more authentic than
the other, but that a range exists between complete visual embodiment of
performed sound and a more sonically accurate performance that lacks
physicality. This is closely in line with complaints that electronic pop music—
where pop artists lean towards spectacle taking prominence off the roles of
musicians and relying on background tracks—leave fans of traditional rock or
jazz musics feeling cheated. While an approach like Posner’s that sacrifices much
of what made the EDM remix popular might be disappointing to pop and EDM fans who want a more technologically mediated sound, others may applaud his use of fully live instruments.

One of the most extreme examples of spectacle in pop is the tradition of Super Bowl Halftime shows. As it is one of the most-watched televised events of the year, an incredible amount of work and detail is put into the production of a succinct less than 13-minute show—and of all organizations, the NFL has the money to fund quite a spectacle. One can see the strides halftime shows have taken as production technology advances by looking at the differences between the first pop-star halftime show (Michael Jackson’s in 1993) and any from the recent decade. Lightshows, backup dancers, costumes, and guest appearances are commonplace now, where Michael Jackson’s era of Halftime shows contained a simple performance with few theatrics outside the main artists themselves.

2017’s Halftime show featuring Lady Gaga took many Super Bowl concepts to new heights. In the trend of one-upping previous years’ performances, Lady Gaga began the show on the roof of the stadium with LED drones over the skyline behind her in an American flag formation. The quirk of this, as one article reviewing the show pointed out, is that safety regulations would not have allowed drones above the biggest sports event of the year—as such, the portion featuring drones had actually been filmed a week earlier. The performance people watching the televised event will remember featured a prominent piece that was never actually part of the performance, not witnessed by those physically present.
Lady Gaga’s music itself has a tendency to be quite digital, making extensive use of synthesizer-based sounds even before they were commonplace in pop. But a combination of NFL production support and musicians she has been performing with since the late ‘00s\(^2\) allowed the show to reproduce her hits with relative accuracy. For example, the original 2011 recording of “Born This Way” features prominent quarter note side-chaining.\(^3\) In her Super Bowl performance of the song though, there was not the same dynamic compression on every beat—in order to create the same sort of pulse, instruments playing lower frequencies play on the beat and the higher ones play on off-beats. Similarly, the keyboardist playing synthesizer bass notes plays a root note on the beat and then the same note an octave up on the off-beat in between. This approximates the side-chaining effect by understanding listeners’ expectations of the frequency content in each moment of the song. Accustomed to the side-chained original, listeners expect to hear mostly low frequencies on beat (as side-chaining pushes everything else out of the way for the low kick drum) and high frequencies between beats where the lack of a kick drum releases the compressor on high synthesizers. This approximation of the pumping side-chaining allows the music to be performed without worrying about actually linking various instruments the way they are connected in DAW production. In a recording, the kick drum track influences the final sound of all the other tracks, which live requires more complex routing of signal than just sound source to mixer to amplifier. Given the tightly choreographed and high stakes nature of the Super Bowl show, surely anywhere complex signal flow can be simplified with
approximately the same effect is appreciated, especially when any potentially audible differences are disguised by the production quality. This solution is not specific to Lady Gaga, as many musicians of all levels have stumbled upon this side-chaining approximation, but her use of the technique in a Super Bowl performance shows the professional legitimacy of such decisions.

Over the course of this chapter, we have looked at four particular examples of choices made in the live performance of digitally produced pop music. Taylor Swift moved through her career retaining a live band but moving them further and further into visual obscurity as the sounds became more digital and electronic. Mike Posner made a transcription of the EDM remix of his song live, substituting physical instruments for synthetic elements and reconceiving the musical material where necessary. The Chainsmokers played almost entirely from a backing track with musicians on stage to create an illusion of performance of what was essentially exactly the released track in order to sound in performance as audiences expected from the recording. Finally, the concept of Super Bowl Halftime Shows, and specifically Lady Gaga in the 2017 Super Bowl, exemplify the extremes of spectacle in pop performance, most notably where the video spectacle presented on live television was entirely disconnected from the actual performance.
1 Iverson, 157.
3 Seabrook, The Song Machine, 282.
4 Auslander, Liveness, 8.
5 Taylor Swift performing “You Belong With Me” live at “Sound Relief” in Sydney, Australia in 2009. Many videos of this performance exist and one is linked here: <https://www.youtube.com/watch?v=Str59XDQp6U>.
6 Taylor Swift performing “I Knew You Were Trouble” live on her 2012 “Red Tour.” Performances of this song are almost identical across most videos of this tour. A high quality video of the performance (without the violin intro) can be found here: <https://www.youtube.com/watch?v=4UhNsKHxKP8>.
And a different angle featuring the violin intro (but with cuts in the song itself) here: <https://www.youtube.com/watch?v=QMWJ--9ZZGY>.
8 Taylor Swift’s performance of “Style” live at Radio 1’s Big Weekend festival in 2015, video linked below; performances of this song on other parts of the 2015 “1989 tour” feature similar stagings as well: <https://www.youtube.com/watch?v=bAANn21OVe0>.
12 Vandemast-Bell, 241.
18 Lady Gaga, “Born This Way,” Born This Way, February 11th, 2011.
Chapter 6: My Own Digital Pop Production and Performance

“This is not a pop song, but it could be if you like it”¹

While writing this paper, I designed and performed my own concert of electronic pop music.² Without the budget for intricate light shows, backup dancers, or other forms of spectacle, I wanted to perform pop music with as much physical connection between performance gestures and sound as possible (the “Mike Posner” style), while also attempting to bridge the “sonic disconnect” between highly produced recordings and live instrumentation. This meant having all sound sources connected to note-by-note gestures on stage but then processing them through a computer to apply digital effects. I also used this opportunity to compose songs in the electronic pop idiom so that I had an intimate knowledge of each feature of a song when translating it to performance. Sound examples are listed in Appendix A, and tracks 33 – 39 are the EP, *Aquacats*, created as part of this project. Appendix B charts which production techniques are applied in which included songs. Appendix C diagrams our approach to staging the concert where the EP was performed live.

My songwriting partner, Max Luton, and I began writing pop songs and comparing them to current hits. I found many of the pop production techniques discussed in chapter 3 this way—for example, it was when assessing why a drum beat of mine was not sounding “pop” enough that I discovered the plethora of songs using timbre-based percussion substitution. For many of the techniques, the act of producing songs using them helped me understand their musical implications before diving into technical research for this paper. I found the line
between the traditional senses of production and composition blurred by digital production—the auditioning and designing of synthesizers, close editing of MIDI data, iterative changes to effects, and fine tuning of transitions ultimately took more time in the “composition” process than chord/melody/lyric composition itself. Most comfortable with Logic X, I wrote almost everything in that DAW. Using a combination of Logic’s built-in synthesizers, external keyboards, and a 3rd party digital wavetable synthesizer called Serum, I became very familiar with a number of different pop sound designing processes.

The first digital composition tool I (as well as most budding EDM producers) discovered was side-chain compression. As is audible in our first songs (“Pop is 4 the Kidz” and “80 Days”), I was not immune to the false sense of professionalism it gave to a mix. Though I later discovered ways to design a pop song’s environment other than making it pump heavily, side-chaining a bunch of synthesizers to a four-on-the-floor kick initially felt like I was most of the way to a perfect song! In later songs like “Clueless” and “Sex on the Beach”, I found it was just as effective if not more so to use side-chaining subtly or not at all.

Spatial effects also played a large role in my composition process. My early production assumed the “cover everything in absurd amounts of reverb” school of thought inspired by releases like the “I Took a Pill in Ibiza” remix. But I soon became interested in the development of space over the course of a song—where the space initially heard changes with the narrative structure. Songs like “Jealous” by Nick Jonas, “Closer” by the Chainsmokers, and “Dangerous Woman”
by Ariana Grande served as inspiration for exploring a changing space in my own production.³

We intentionally gave little thought to performance while composing and producing. That way, the concert would be a separate consideration of moving songs we knew intimately piece by piece to live performance. From the DAW files of our original compositions, we decided what processes were inherent in each sound source and determined a live equivalent. Armed with techniques discovered this way, we also integrated a couple pop cover songs into our set to try to discern what was most important for live reproduction of songs we knew less intimately.⁴

Since the goal was to reconcile physical and aural disconnects as much as possible, we began by designing a performance that required as little computer aid in creating sounds as possible—we knew digital manipulation of sound was integral to many effects, but as a baseline we wanted each individual note-by-note event to be visible to the audience even if it was a digitally triggered sample. Thus we started with instruments that could accurately reproduce required note-by-note events instead of relying on a backing track. The performance group was a six-member ensemble: three keyboardists (doubling as singers), a bassist, a drummer, and a percussionist*.⁵ Most sound was produced locally on each instrument and run through a laptop (via an M-Audio eight track interface), processed digitally through effects controlled by other equipment on stage, and then sent out to the audience [stage diagram].
Most digital manipulation and MIDI control was done through a combination of Logic X and Max/MSP. All sound sources except voice and percussion were processed independently by the computer. It is relatively simple to assign single MIDI controller sliders and knobs to parameters in Logic, but we found that an additional Max/MSP patch I designed was helpful for interpreting MIDI signals with more complex destinations. For example, I wanted wind sweeps to be controlled by a single slider, but in order to create an effective sweep there were many points on the wind track's EQ that needed to be moved at the same time with varying rates. The Max patch interpreted the single slider's values before sending separately calculated MIDI signals to multiple parameters in Logic.

Song parameters were assigned to successive measures of a single Logic session. For instance, most instruments were side-chained to the kick drum in “80 Days” but only one keyboard was side-chained in “Closer”. Moving the Logic “play-head” to the measure denoting Closer turned off the relevant compressors on all channels except the one keyboard. As much as possible we kept keyboard effects on the keyboards themselves, leaving more computing capacity for effects that had to be implemented with Logic. This reduced the potential for glitches and latency and allowed local troubleshooting for most technical issues.

Keyboards have complex implications as a feature of electronic performance due to their hybrid of physicality and technological mediation, so there were a few things to consider when choosing to use three keyboardists to play the electronic sounds in our songs. Whether the sounds are sampled or
synthesized, audiences understand the performance gestures of playing a keyboard as producing the sounds they hear. A keyboard playing sampled instruments is not very different from a DJ pressing buttons, but it is more readily accepted as an instrument than computer buttons associated with everyday computer use. So, although we used number of digital keyboard sounds, we felt comfortable that we were maintaining their connection to intelligible performance gestures.

We designed three distinct keyboard stations with rotatable personnel depending on the needs of the song. The three keyboardists doubled as singers, so whoever was singing lead was given the simpler keyboard assignment. The rotation helped us maximize the use of the equipment we had without need for extra people or technology. The central station had a MicroKorg analog-modeling synthesizer that took on most “lead synth” roles and was occasionally used to create noise for wind sweeps. These sweeps were necessarily accompanied by a sweep of the modulation wheel that, though small, provided a visible gesture that could be associated with the contour of the wind. The stage right station was the Roland Jupiter 50, which we used for most of the pad sounds in the set. While recreating the potentially unlimited layering of textures from a DAW, the J50’s sound layering capabilities were useful so that a single keyboard could produce many sounds. The J50 also provided a more intimate relationship with parameter changes, such as on “80 Days” where we used the J50’s cutoff filter rather than Logic’s. In addition to reducing the load on Logic, it allowed the performer to make the visual gesture of turning a knob while the
audience heard the filter being lifted. The J50’s D-beam, allowing Theremin-like hand gesture control of volume, was also a perfect sound-embodies physical gesture device we utilized a number of times. The stage left station had two keyboards, a Nord Electro 4D and an Akai MPK Mini. The Nord was used mostly for piano sounds, and the MPK controlled digital lead synths in Logic when multiple sounds needed to be controlled at once (such as in “λ” where the lead synth and bells play a line simultaneously).

Most bass parts in modern pop songs are low synthesizers not even pretending to be bass guitars, so a fourth keyboard station for bass would perhaps be the most sonically accurate way to perform bass in this genre. For the sake of audience perception of physical immediacy though, we wanted a bass guitarist’s movements to embody the low end. Digital manipulation of the electric bass guitar became important in approximating synth bass sounds from our produced recordings. I used a guitar multi-effect pedal’s MIDI ports to allow the bassist to control effects implemented in Logic—the pedal implied effects to a the guitar-like instrument, telegraphing the level of humanness in a technically mediated performance. Logic’s EQ, octave doubling, and bit-crushing helped the bass imitate the heavy buzzing synth bass important to the drop in “λ” or the end of “80 Days.”

The choice of drums over drum pads required some thought. Similar to bass, the sonically accurate thing to do would be to use a drum pad full of exact drum samples from each track—as each song’s digital drums are different, using a single live drum kit throughout the performance does not sound as much like
each original track. Furthermore, due to the size of our intended performance venue, we would not be able to fully mic the drums and digitally process them. But, again our preference for physical immediacy led us to use a live drum kit. We decided that the live energy of a drum kit as well as the uneven dispersal of sounds would bring these electronic songs’ into the performance space more effectively.

The final station, the percussion* station, is what made much of the live digital aesthetic work [percussion* diagram]. Because of its important and complex implications, we wrote out notated scores for the station to keep track of its many tasks [percussion* score example]. The first component of the station is an assorted set of percussion, bringing instances of percussion substitution to the stage when relevant in a song. The sample pad adds other electronic sounds, such as 808-style handclaps, that are inherently digital in origin, and naturally assigned to sample pad buttons. The sample pad also included sounds that were purely samples in the original mixes (such as the vocal sample on the intro of “Pop is 4 the Kidz”).

The next part of the percussion* station is the side-chain pedal. A drum trigger hooked to a kick pedal served as the signal that triggered various compressors in Logic. As mentioned, those compressors were turned on and off depending on the song, and the use of separate compressors allowed us to tune the effect slightly differently for different tracks while sharing the same trigger. Though the actual kick drum could have been the trigger, I decided it was important to have the trigger be its own entity. First, the signal from the drum
pad was relatively constant and predictable in how it would interact with each compressor, while a live mic on the kick drum would be unpredictable. Second, side-chaining often occurred in places where there was no kick drum present in a recording—the physical separation of kick and trigger allowed us to have the side-chaining occur rhythmically independently. Finally, this separate pedal assigned a physical object to the act of side-chaining that otherwise could have seemed like a digital manipulation with no direct human control.

The third component of the percussion* station is the NanoKontrol2. It was linked via MIDI to Logic as well as Max/MSP to interpret signals that we wanted to have more complex implications. With its sliders and buttons, the percussionist* was able to exert large scale digital effects over everything going through the computer including cutoff filtering, EQ sweeps, and wind sweeps. [NanoKontrol2 diagram]

Since panning is central to an effective mix, I wanted sounds in the concert to be clearly located. For instruments with specific positioning in the mix (such as the bells on “Sex on the Beach” off to one side), we used speakers separate from the PA positioned by the relevant instrument or controller. Sounds that were either central to the mix (like vocals) or lacked a particular directionality (like all-encompassing pads) were diffused through the main PA for the same reason. The location of each signal was controlled through song-by-song automation in Logic.

The one part of the production process we had less control over was the overall mix in the space—we were at the mercy of the acoustics of the space.
After processing, everything from the computer was sent to the mixing board for
the sound engineer to apply a final layer of sound design, especially in EQ. To
save computing power and simplify routing, we sent vocals to the board directly
rather than through the computer, and we used a vocal effects pedal to add
common digital effects like delay and doubling.

I also wanted a piece of the repertoire to stand in clear contrast to the
performance described up to this point. The performance of “and now, for
something completely different,” inspired by Wesleyan’s Toneburst Laptop
ensemble, allowed me to move a digitally produced EDM song to live
performance without considering “real” instruments at all. Using Max/MSP
patches, the piece was performed by the six members of the band typing keys on
laptops. Each band member generally played the same role sonically as their
performance instrument, but all of their samples were exactly the sounds used in
the original recording. Since directly copied samples were used but performance
gestures (aside from typing) were not taking place, the balance swings to sonic
accuracy over visual immediacy.10 The irony of this arrangement is that although
computers are usually involved in the performance of EDM songs like this, they
generally simplify performance by producing sounds on their own while one or
two DJs manipulate overall arrangement effects. Dividing up tasks amongst six
musicians in our context in fact made the performance more difficult, since the
simplification provided by computer mediation is lost when instead of an
internal clock synching events, timing relies on humans “playing” computers
along with other human performances. The implementation of a click track heard by members of the group drastically improved the cohesion of the piece.

Of course, I am not the first to grapple with the question of live performance of electronic pop music, and there are a number of not-quite-pop musicians already pioneering these kinds of performance styles. Goldfish, a Jazz/EDM duo from South Africa, integrates live instruments (saxophone, upright bass, and keyboards) into their EDM performances.\textsuperscript{11} Drum machines produce most rhythmic elements in their concerts, but the rest of the sounds are layered on top iteratively with other instruments, often improvisationally in the jazz style.

Youngr is similar, building pop songs based on loops with live instruments.\textsuperscript{12} Visually, the keyboards, guitars, and control surfaces all surround him with a drum kit in the center that usually serves as the high point of each song energetically—synthetic drums or percussion loops help build up the track, but he usually plays an explosive groove on the live drums for the chorus or drop. In line with my decision to use live drums in my own performance, he utilizes the excitement inherent in live drums visually and aurally. The physicality implied is much more human than robotic synthetic drums and serves as the peak of intensity in most of his songs.

EOTO is a duo utilizing numerous control surfaces and live instruments to do entirely improvised EDM performances.\textsuperscript{13} Michael Travis loops keyboards, guitars, and basses, while Jason Hann plays a live drum kit as well as using a number of vocal effects. Once again, we see the use of a live drum kit for EDM—
in an improvisational context like this, it allows Travis to build up a piece of music looping live instruments while Hann changes and builds with it so the underlying beat evolves with the rest of the music, unlike most loop-based performance. As everything is to a click, they have special control surfaces that can communicate complex tasks to the computer, such as “glitching” to repeat specific beats building tension towards a drop as one might have in a highly produced EDM song.

With a larger budget, more computer power, and more time to program, I would love to combine my “live production” techniques with many of these other approaches as well. Like Youngr and EOTO, I am interested in running a live drum kit fully through a computer to retain the energy of physical drumming while allowing the sonic flexibility of digital manipulation. The drums were one of the most difficult pieces to lock in in the performance itself, especially since the concert space responded to the drums much more actively than the rehearsal space. That said, it was clear that the live drums augmented by percussion and digital samples was visually engaging for the audience.

In terms of gestures overall, it seemed like many enjoyed the more intimate live production that watching each digital process take place provided. In addition to just more time spent honing the complex effects, I think it would be interesting to consider the D-Beam model of parameter control found on the J50 as something that could be designed to control almost everything in the group, creating a very gestural control of parameters globally.
Given the more direct interaction between musician movement and sonic result, it could more intuitive for an audience to see than a knob or slider.

Another simple tactic is a universal click track and musician-specific in-ear monitors—though it would have been more time consuming to get our band accustomed to the click and hooked up to personalized monitors, it certainly would be helpful on a professional level for locking into the same groove. With so many potential digital variables, helping the musicians hear each other and the intended tempo certainly would reduce errors.

Finally, a stress-reducing and organizational possibility would be to leave digital control up to a new member of the group entirely, taking some of the live troubleshooting out of my hands and large-scale effects from the percussionist* and combining them with the role of the sound engineer. Though we were not able to work with our engineer much before the show, a deeper level of this type of performance would involve the engineer (with the added layer of digital control) knowing each song intimately and having a more active role in the performance—alternatively, as each song naturally gives more tasks to some musicians than others, this control could rotate between musicians; this would give responsibility for the totality of the sound to different members of the band at different times and require all to better understand how they can affect the mix. Though the “live production” in the concert was relatively smooth, the largest recurring problem was a bug in assignment in one of the NanoKontrol2 faders—in two instances, a filter cutoff sweep was brought downward but did not release it when the fader was brought back up; the result was some parts of
songs having large synths cut down to just low frequencies until I realized what
had happened and fixed it on the computer manually. With more democratized
control (and perhaps a global panic button that releases all currently operating
arrangement effects), these types of problems could be identified and fixed faster.

The arrangement and rehearsal process was its own endeavor, and I
learned a lot for future attempts of the same concept. Just as in producing, there
were often one or two main aesthetic choices to be made that set an
arrangement apart from others—each lead to the design of new pieces of
technology. Our first couple of originals needed a live side-chaining control;
buzzing bass drops as in “λ” encouraged me to hybridize live and synthetic bass
sounds; covers like Ariana Grande’s “Dangerous Woman” challenged me to come
up with a creative solution quick spatial changes. Ultimately, difficulties and
successes in translation relate to the three categories from chapter 3: Artificial
Spaces, Timbral concepts, and Large-Scale Temporal effects. Artificial Space
effects were the most difficult, since the performance space itself was hard to
tame. Though we had control over individual instances of reverb digitally, the
room overall won out for overall control—more time in exact design of the
performance space would likely be more effective for these things than just
digital mediation. Timbral concepts posed the problem of recreating sounds that
originally came from a non-physical object; the solution was iterative work with
each sound source and digital effects to make live sound sources sound like the
produced ones. Finally, Large-Scale Temporal concepts posed a problem because
they were applied over more than one note and more than one instrument; this is where the computer's control of most sounds was most helpful. Effects like side-chaining, filter cutoff, and EQ sweeps could be run over most combinations of anything on stage under the control of various gesture-connected technology the percussionist* had available.

Though we almost always rehearsed all at once as a regular band would, an alternative approach would be to rehearse like one produces: working one-on-one with each instrumentalist individually to iteratively work on their part until it sounds as desired, and then play together to get the mix right. It would then be simply producing with real musicians playing the instruments instead of a computer. It takes more time and work to customize, but ultimately would lead to what some might consider a more authentic pop performance.
1 A line from the chorus of "Pop is 4 the Kidz," the opening track on the pop EP "AquaCats" that accompanies this project.
2 The performance took place on April 7th, 2017 in Wesleyan University’s World Music Hall.
4 We ultimately settled on covering Jon Bellion’s “All Time Low” (Capitol, May 13th, 2016) for its sample-heavy composition in juxtaposition to our many synthesizer-heavy songs, The Chainsmokers’ “Closer" because of its ubiquitous prevalence in contemporary pop culture as well as this paper, and Ariana Grande’s “Dangerous Woman” for its distinctly different style from anything else in our set (it contains a far slower tempo and is in a rock-like 12/8 feel) as well as to grapple with a live equivalent of its space-changing properties (see endnote 15).
5 The group consisted of Max and I as well as Torie Davids performing keyboards and vocals, Gabe Leeman on bass, Jonah Wolfson on drums, and Becket Cerny at our percussion* station.
6 Though Ableton Live is touted as the be-all-end-all for digital live performance, time constraints and our familiarity with Logic lead us to stick with what we knew—and despite Ableton’s more intuitive layout for live performance, Logic handled live processing well once we designed the signal flow.
8 Ibid., 72.
10 An additional “opposition” piece performed was “Runaway Train" which mimicked the singer-songwriter style of pop often produced by artists like Ed Sheeren and Justin Bieber—with just an electric guitar and voice, the transition to stage was obviously much easier than the rest of the EP we produced.
14 A witness of the performance noted to me: "Part of what makes it so unique and special is that it feels raw and real and we can see it. Like I’m sure Ariana Grande has side chaining and samples and automation and everything when she plays...live but you can’t see what’s going on and it’s all to click track so there is probably a bunch happening that doesn’t get seen. But watching performers actually play each part is what makes it so fun. I’m so into it.”
15 Every 4th snare hit of the song is accompanied by both a lead up reverse snare sound and followed by a large reverb tail in contrast to the tight and dry snares...
on all 3 other hits. Though this potentially could have been accomplished by the drummer press-rolling into every 4th snare and having the sound engineer apply reverb each time it occurred, I decided to separate the sound sources of the “normal” snare and “huge” snare for both visual differentiation and simplified control. In addition to adding a reverse snare sample to the sample pad to play leading up to each necessary hit, I gave the percussionist a second snare drum and ran it through a large reverb patch in Logic. This way, since every 4th snare hit was bigger than the rest, the gesture of both drummers hitting the snare at once on each of those 4th snares visually embodied how much larger that particular sound was than the other snare hits in the song.
Track List of Included Musical Examples in Appendix A

Most examples are excerpts from songs or short loops designed using basic Logic X presets. Recommended to listen in headphones, especially for panning-related effects.

CD of tracks included OR audio examples can be found at: <https://www.mediafire.com/folder/zp6d3p5gkziju/Adam%20Rochelle%20Senior%20Thesis%202017%20Audio%20Appendix%20A>

1. A clip from “Sex on the Beach” (from the EP accompanying this project) in mono; all sounds come from one direction.
2. The same clip from “Sex on the Beach” except in stereo; sound sources are dispersed across the stereo field.
3. A basic synth and drums groove with no effects applied
4. The same synth and drums groove with compression applied to each instrument and the overall mix; notice especially how certain parts of the drum kit are punchier.
5. The same synth and drums groove but with some EQing applied to each instrument; notice how the three instruments feel less like they are competing for attention than they are in track 3 since they each now occupy different frequency ranges. Additionally, bass and presence have been boosted a bit.
6. A sine tone melody with no effects
7. The same sine tone melody but with reverb
8. The same sine tone melody but with delay (no reverb)
9. The same sine tone melody but with reverb and delay
10. An excerpt from “Sorry” by Justin Bieber (Def Jam, October 23rd, 2015), which uses its lyrical chorus as a build towards the instrumental drop.
11. A single digital synthesizer (designed in Serum) with a few layered effects, sounding like multiple sound sources
12. Two digital synthesizers that are different in timbre and frequency content, but still sound like one sound source when played together. After they play together, they each play the chord progression separately to show what they sound like independent of the other.
13. The chorus of “Problem” by Ariana Grande (Republic, April 28th, 2014) featuring a prominent saxophone line.
14. The chorus of “Jealous” by Nick Jonas (Island Records, September 8th, 2014), featuring a vocal “woo” integrated with the drum beat on each 2nd and 8th beat of every 16 beats (listen for it panned to the left channel).
15. A simple drum beat where every 4 bars one of the roles is switched out to a percussion instrument of a similar timbral category to show some examples of how this effect often appears.
16. Excerpts from the verse, pre-chorus, and chorus of “Boy Problems” by Carly Rae Jepsen (Interscope, June 24th, 2015) showing each section
iteratively layering new material on top of the same fundamental sonic loop
17. A simple but abrupt transition from a “verse” loop to a “chorus” loop
18. An EQ sweep over the simple loop transition
19. A filter cutoff sweep over the simple loop transition
20. A wind sweep over the simple loop transition
21. A noise release following a wind build over the simple loop transition
22. Synth chords and kick drum without side-chaining
23. Synth chords and kick drum with side-chaining
24. Synth chords on their own (for comparison)
25. Synth chords side-chained to an inaudible kick

Chapter 4 Song Study Excerpts

26. Excerpt from “You Belong With Me” – Taylor Swift
27. Except from “I Knew You Were Trouble” – Taylor Swift
28. Excerpt from “Style” – Taylor Swift
29. Excerpt from “Last Friday Night (T.G.I.F.)” – Katy Perry
30. Except from “I Took A Pill in Ibiza (SeeB Remix)” – Mike Posner
31. Excerpt from “Closer” – The Chainsmokers
32. Excerpt from “I Took A Pill in Ibiza” – Mike Posner

AquaCats EP (also at https://soundcloud.com/aquacats203a)

33. “Pop is 4 the Kidz”
34. “Clueless”
35. “Runaway Train”
36. “and now, for something completely different”
37. “λ”
38. “Sex on the Beach”
39. “80 Days”
## Appendix B

A chart of each song from the EP associated with this project and the production techniques discussed throughout this thesis.

White boxes indicate relatively insignificant applications; lightly shaded indicates significant uses; dark shading indicates techniques that are integral to the original idea behind the song's composition.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Pop is 4 The Kidz</th>
<th>Clueless</th>
<th>Runaway Train*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stereo Image (panning)</strong></td>
<td>Some voices and synths are panned to the sides to call attention to particular parts</td>
<td>Especially on the last choruses, various quick panning changes for the “glitch” EDM feel</td>
<td>Just slight panning on harmony voices</td>
</tr>
<tr>
<td><strong>Compression</strong></td>
<td>Compressed for the typical “loudness” aesthetic in electropop music</td>
<td>Used a multipressor to compress and raise the lower frequencies of the track since the featured slap bass is actually mostly mids</td>
<td>Only slightly to bring this relatively quiet song up to the volume of the rest of the EP</td>
</tr>
<tr>
<td><strong>EQ</strong></td>
<td>EQ to fit each sound into the mix, especially on the lead synth to bring out high frequencies for presence and removal of low frequencies as to not interfere with the pads and vocals</td>
<td>Mostly EQ work with the slap bass track to help it fit in because it is so active and overlaps with a lot of the other sounds</td>
<td>No</td>
</tr>
<tr>
<td><strong>Reverb/Delay</strong></td>
<td>Large open space reverb right from the first verse; quarter-note delays on the last word of selected lines</td>
<td>Reverb noticeable only on the marimba until the final chorus; delay only used prominently on bridge</td>
<td>Medium empty space reverb to fill the relatively sonically clear track</td>
</tr>
<tr>
<td><strong>Synthetic Sounds</strong></td>
<td>Yes (everything but vox)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>“Real” Timbres</strong></td>
<td>Just the piano on the bridge</td>
<td>Yes; marimba, piano, and slap bass</td>
<td>Yes; the song is made up of almost entirely the prominently featured guitar</td>
</tr>
<tr>
<td><strong>Percussion Substitution</strong></td>
<td>Yes; tambourine on choruses in the hi-hat role</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Loop-based Composition</strong></td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Transitional Devices</strong></td>
<td>Yes; cutoff filter on the intro and wind sweeps in most transitions</td>
<td>Yes; noise releases after most transitions, and occasional reverse piano swells that act like noise builds</td>
<td>No</td>
</tr>
<tr>
<td><strong>Side-chain Compression</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

*For the "Artificial Spatialization" techniques, this chart only refers to instances in which the techniques are used in a way notably relevant to the digitally-produced pop style. The chart assumes that most production on the EP used some degree of each of these techniques to get a mix to a professional level.

**It is assumed voice counts as a non-synthetic timbre (and most tracks have vox), so this chart references only non-vocal "real" timbres.

***Though small instances of looping occur throughout, this chart only refers to notabe large-scale instances, such as verses and choruses containing the same underlying looped material, or long verses progressively layering material over a loop.

*“Runaway Train” was composed to stand in opposition with the rest of the EP and subsequent performance; the simple singer-songwriter composition involved very few digital production techniques to the same degree as in other songs, and therefore the transition to live performance was quite simple.

**Composed specifically for the laptop-style performance discussed in chapter 6, this stands in opposition in a different manner as it utilizes the same sort of electronic production as the other songs but is certainly EDM rather than pop, showing how the digital aesthetic remains even though the underlying compositional changes define it as a different "genre."
<table>
<thead>
<tr>
<th>and now, for something completely different**</th>
<th><strong>λ</strong></th>
<th>Sex on the Beach</th>
<th>80 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes; especially to take on the EDM/glitch aesthetic</td>
<td>Voice central during verses and choruses but off to the side for interjections in the instrumental drops</td>
<td>Each of the many sounds specifically panned to fit into the mix in a different location</td>
<td>Mostly just for background vocals; additionally the subtle synth lines on the 2nd verse are panned far</td>
</tr>
<tr>
<td>Compressed to accentuate the pumping of the already in place from the side-chain compression</td>
<td>Compressed and limited aggressively, especially each time the drop hits in order to increase the perceived impact; also, verses were originally very quiet so compression was important in making the overall volume contour of the song not too extreme</td>
<td>Only to tame the loud transients of the clap/snare</td>
<td>Compressed for the typical loudness aesthetic in electropop music</td>
</tr>
<tr>
<td>Bass frequencies boosted to fit the EDM style, and very specific band peaks to imitate the precise sounding nature of glitch tracks — additionally, the intro uses bandpass EQ to simulate a &quot;telephone&quot; type frequency range</td>
<td>Intentionally very bass heavy (and presence-heavy on the lead synth) as this is the song on the EP that most intensely attempts hybridizes EDM and pop</td>
<td>Each sound source specifically EQ’d to fit into the mix. Additionally, the intro uses a bandpass filter to create a &quot;radio&quot; effect (perhaps implying sitting on a beach listening on a small portable sound system?)</td>
<td>Lots of bass accenulation</td>
</tr>
<tr>
<td>Modest reverb throughout; more open reverb on the marimba-only bridge</td>
<td>Large open space reverb right from the beginning</td>
<td>Yes; medium reverb on the main vocals, larger reverb on ethereal backing vocals, and &quot;room&quot; reverb applied to the spoken bridge to imply a candid/casual (aka not-overproduced) conversation</td>
<td>Large open reverb space right from the beginning on both vocals and certain percussion instruments; in the bigger moments of the song everything inhabits this same large space</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes (almost everything)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Yes; unintelligible glitch-style vocal samples and and a marimba-like synth</td>
<td>No</td>
<td>Yes; guitar and metallic bells</td>
<td>Yes; piano and electric piano, though not very prominent</td>
</tr>
<tr>
<td>Yes; claps instead of snare on some sections</td>
<td>Yes; shaker and tambourine are the 16th note pulse, and a clap augments the snare</td>
<td>Instead of snare and shaker instead of hi-hat on the prechorus (and then in addition to the hi-hat)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Yes; reverse cymbals and noise builds at the end of most 8 bar cycles</td>
<td>Yes; drastic wind and EQ sweeps before each drop</td>
<td>Yes; lots of reverse cymbals and noise releases throughout, and wind and EQ sweeps during big transitions</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes; and notably at times where there is no kick present</td>
<td>Yes, but applied only to one of the pedals and only subtly</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Appendix C

Diagram 1: Stage set up view from the front

Diagram 2: Stage set up view from behind
Diagram 3: Percussion station

Diagram 4: NanoKontrol2 effect labels
Example of a page of a percussion* chart, with references to all 3 parts of the station
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Discography

*Songs directly discussed or that were highly influential in my research.*


