PROGRAMMED ‘TREASURIES OF ELOQUENCE’: A RHETORICAL TAKE ON PRODUCTIVITY AIDS IN AUDIO ENGINEERING SOFTWARE

Inauguraldissertation

zur Erlangung des Bi-Nationalen, Dualen, Akademischen Grades

eines Dr. phil. und PhD,

vorgelegt dem Fachbereich 05 – Philosophie und Philologie

der Johannes Gutenberg-Universität

Mainz

&

vorgelegt dem College of Arts and Sciences

der Georgia State University

Atlanta

von

Thomas Breideband

Atlanta und Mainz

2019

Tag des Prüfungskolloquiums: 8. Mai 2019

PROGRAMMED ‘TREASURIES OF ELOQUENCE’: A RHETORICAL TAKE ON PRODUCTIVITY AIDS IN AUDIO ENGINEERING SOFTWARE

by

THOMAS BREIDEBAND

ABSTRACT

This project examines the influence of productivity aids in digital audio production software on matters of professional expertise, user experience, and workflow. The research is based on both the public reflections of 25 leading audio engineers about the state of the craft and the field as well as close content analyses of the most widely used software solutions for music mixing. Using the practical tenets of the fourth canon of rhetoric, memory, as a heuristic lens and emphasizing its role as an arbiter of professional expertise, this study contextualizes memory as both recollection strategy and programmed practice. It examines the extent to which embedded productivity aids take over the work of audio engineers and what effects this has on the craft and its community of practitioners. The study culminates in a larger argument about the potentially detrimental effects of automation on creative practice and promotes an appreciation of memory and recollection strategies that inform a pedagogy of critical reflection and active engagement—especially in view of higher education where students prepare for their careers post-graduation.

INDEX WORDS: Rhetoric, Memory, Software aids, User experience, Workflow, Professional development

PROGRAMMED ‘TREASURIES OF ELOQUENCE’: A RHETORICAL TAKE ON PRODUCTIVITY AIDS IN AUDIO ENGINEERING SOFTWARE

by

THOMAS BREIDEBAND

A Dissertation Submitted in Partial Fulfillment of the Requirements for the

Bi-National Dual-Degree of Doctor of Philosophy

in the College of Arts and Sciences, Georgia State University

&

in the Fachbereich 05, Johannes Gutenberg-Universität

2019

PROGRAMMED ‘TREASURIES OF ELOQUENCE’: A RHETORICAL TAKE ON PRODUCTIVITY AIDS IN AUDIO ENGINEERING SOFTWARE

by

THOMAS BREIDEBAND

Electronic Version Approved:

Office of Graduate Studies

College of Arts and Sciences

Georgia State University

May 2019

ACKNOWLEDGEMENTS

First and foremost, I want to thank my advisers who accompanied me on this exciting and tumultuous adventure and who helped me steer this ship of a study safely into harbor with their encouragement, their guidance, and their mentorship. A big thank you also to the other members in my committee whose constructive comments and feedback ensured that I never strayed from my path. I also want to thank my grad student colleagues and friends who were with me along the way and who would always help me re-hoist the sails after each encounter of rough and stormy weather. And thanks to the one closest to me who stood by my side as I was charting out the paths of ideas that have found their ways into this study. You know who you are.

DEDICATION

To my late parents watching over me, and to my friends who always believed in me and were there to lift me up whenever I felt I had lost my way.

TABLE OF CONTENTS

LIST OF FIGURES

1 THE DISRUPTIVE EFFECTS OF SOFTWARE AIDS IN AUDIO ENGINEERING

> "All knowledge depends on memory, and we shall be taught to no purpose if whatever we hear escapes from us. It is the power of memory that brings before us those multitudes of precedents, laws, judgments, sayings, and facts of which an orator should always have an abundance and which he should always be ready to produce. Accordingly, memory is called, not without reason, the treasury of eloquence."
>
> -- Quintilian, *Institutes of Oratory*

> "Remembering the past has value insofar as it serves action in the present or future. Thus what is remembered should be that that enables the individual to carry out activities, to predict, to plan."
>
> -- Katherine Nelson, "Remembering"

> "*Remembering* is just another word for choosing."
>
> -- Daniel Lanois, *Soul Mining*

It is difficult to imagine, but there was a time when memorization and recall of information was really a necessity; it was not an optional skill to have. In fact, it was a prerequisite for being able to go about one's day and do so constructively and productively. I remember such a time. I memorized phone numbers of friends and relatives, for example, and could easily recall several at any given time. I would know by heart how to get from one place to another because of the directions I had archived in the recesses of my memory. There was no need for a computer. In fact, around that time the computer was something only my late father would have access to at his workplace. Only when I was in my early teens did the computer become a part of the household, set up for the entire family in the living room. Today, I often look back with a certain sense of nostalgia at the types of memory feats I was able to accomplish back in the day. Now, if prompted I could only really recite my own phone number. I usually remember an address only for as long as it takes to input the

information into my GPS navigation app of choice. And while the computer remained a stationary living room accessory during my childhood, today I choose not to go anywhere without a fully-fledged and far more powerful computer that fits neatly into my pocket. With the smartphone, I do not have to memorize or remember because it is 'smart' enough to remember for me, and I take solace in knowing that my information is stored, that it does not disappear, and that I have access to it whenever I please—in that sense, memorizing might not be a skill worth developing anymore, and so I may (finally?) indulge in the bliss and convenience of forgetting. This juxtaposition of my personal past and today's digital present came back to me many times over the course of the research and writing process for this book, and I came to appreciate the very unique lens I had been given as a child of the early 1980s—the unique opportunity to live through these dramatic and revolutionary leaps in technological progress.

Technological progress has fostered in us an appreciation of the immediate and the instantaneous over the distant and the delayed; we value, and even crave, the instant gratification. But despite the arguably negative connotations of an overdependence on technology, I am still happy to leverage the immense capabilities of my smartphone to store all kinds of information. I take no immediate issue with the notion of relying on the GPS navigation app to get me safely from one place to another and, mind you, I appreciate the convenience of carrying around a full-fledged computer in my pocket. But does this current technological climate require critical reflection and constructive response? I believe so. I consider it imperative to pause for a moment and reflect on what it means when our technological surroundings promote an intensified experience of the present, a devaluation of memorization at the expense of a conscious valuation of human memory and recollection. Such an appreciation—at least for the context of this study—has become under even more scrutiny when we concern ourselves with the professional workplace where feature-rich and

sophisticated productivity software solutions are not merely in use, but are increasingly taking over human labor.

Of course, digitalization has already had profound effects on many industries, especially in manufacturing where digitally controlled machines have taken over many of the low skill and repetitive jobs such as assembly line and warehousing work. However, we are now also starting to see that digital technologies permeate the workplace of the office—a context of work where creativity and critical thinking skills are essential for success. In some cases, productivity software solutions do not just aid humans in their day-to-day work, but they conduct work independently so that the human professional ends up merely fulfilling roles pertaining to quality control. Take for example the field of journalism, known as a very human-centered profession. A major news story breaks, and reporters hustle to draft the copy. At least that has been my assumption so far. But in the months leading up to the 2016 American presidential election, I came across a blog post from the Washington Post PR department that gave me reason to pause. Headlined "The Washington Post to use artificial intelligence to cover nearly 500 races on Election Day," the blog lays out how a proprietary artificial technology software called 'Heliograf' has taken over much of the human labor of text composition. Heliograf's bot-written texts enable its reporters, as the Post justifies, to stay ahead of the now all-to-common rolling deadline i.e., the sheer amount and rapid succession of breaking news coverage related to major cultural, social, and political events.

'Bot-written text' was the line that gave me pause. While I was aware of artificial intelligence technologies such as IBM's Watson and their capabilities to conduct work independently, I still considered A.I. more of an exotic development in tech. Admittedly, I was oblivious to the already existing breadth and scope of A.I. deployment in professional work environments. As a university instructor who considers it his responsibility to prepare students for their professional lives after graduation, I began to wonder what it is that I should

prepare my students for when more and more of today's work can be accomplished automatically with A.I. equipped technologies that are only going to become more sophisticated in the future. Where does the working human professional fit into this future equation?

I realized that it was less a question of the blurring lines between subject and object, between human and machine, but more about staying in charge of one's (creative) professional practice. Given my own training as a researcher of rhetoric, culture, and technology I have become quite cognizant of the profound differences between my own undergraduate experiences and those of my students. For example, I had to remember academic style guide conventions for text composition out of necessity when I was a student in the early 2000s; today, various browser tools such as EasyBib.com provide a viable alternative to the drudgery of memorizing stylistic conventions because they all promise to do this critical task on behalf of writers. With merely a few pieces of information such as author name, title, and publication year, the webtool spits out in split-seconds the bibliographical reference in any of the major style guide formats. Moreover, memorizing grammar rules and language mechanics was a pivotal element for my own success as a student, and I remember putting in significant amounts of time and effort into expanding context-specific vocabularies to improve my academic writing skills; now, software tools such as Grammarly deploy smart algorithms capable not only of correcting issues pertaining to grammar and mechanics, but of providing suggestions for 'improvement' that relate to content, context, style, and even intended audience. Albeit these 'machine learning'-enabled productivity aids still show their limitations—a wrongly suggested word, a lack of understanding linguistic idiosyncrasies, etc.—the convenience that these tools offer is undeniable. It should not come as a surprise that these kinds of tools came up frequently in class—either because of a student question or because of my own pedagogical inclinations. I would then caution my students against

relying too much on these tools, and instead advocate for the importance of the personal learning process. And yet, I wonder if I would be willing to disregard these tools if I was a student today. I speculate, but it is quite likely that I would have opted to substitute the personal discipline and determination that I needed to commit to learning language rules and stylistic conventions with the convenience of letting algorithms do that portion of the work for me.

But does mere availability justify use? Should we recognize any type of aid that is deployed via digital technologies fair game? I suggest that in the long run these shortcuts through software may come at a price. When we experience today's digital aids capable of disrupting established knowledge development and practice conventions, then a critical reflection about the lure of bliss and willful forgetting is helpful and necessary. Otherwise, convenience may quickly turn into complacency, and the development of personal proficiency stops at the surface-level of experience. But experience must be relational, as American education reformer John Dewey put it—involving a reflexive and active connection between the self and the external object. Professional experience, therefore, mandates the (pro)active and reflective engagement of the individual with external objects—in this case, with digital software. These and other related questions I will aproach in this study from the perspective of rhetorical scholarship, a field of scholarship as well as professional practice that is not only grounded in the relationality of experience, but has always had—as we shall see—an interesting connection with technology and technological progress.

In rhetoric, we look to long-standing definitions of rhetorical practice that gauge expertise through the ability of the individual to find the available means of persuasion; we utilize the concept of the rhetorical situation to identify the context and the elements involved in a given communicative act; and we foreground the concept of agency to examine the

human condition. Does our current scholarship provide answers on the digital workplace and the ramifications of digital aids on professional practices? Not enough. While recent scholarship has, indeed, examined rhetorical processes against the backdrops of technological progress, these explorations have only given hints to the alleged pervasive influence of software on professional practice. Lori Emerson's *Reading Writing Interfaces* (2014) is one such example. Emerson looks at the challenges that digital writers face and have faced historically in connection with writing technologies and the alleged invisibility of ubiquitous computing and multi-touch hardware. Emerson's book is insightful because she fruitfully combines media archeology with user design theory, and her overall goal is to examine how software solutions limit and create certain creative possibilities.

The situation is slightly different when it comes to the topics of audio and sound, which will also provide the backdrop for my own rhetorical inquiry. In the field of rhetoric, sound is considered not merely as one among a variety of semiotic modes in multimodal composition (see Yancey), but more importantly, it is theorized as a productive analytical mode and pedagogical practice. Chief among the theoretical foundations of what researchers have labeled 'sonic rhetoric' are: a 1999 special issue of *Enculturation* on "Writing/Music/Culture" edited by Thomas Rickert; both print and online companion issues on "Sound In/As Composition" in *Computers and Composition* from 2006 and edited by Cheryl Ball and Byron Hawk, a 2011 special issue of *Currents in Electronic Literacy* on sound edited by Diane Davis; and the 2013 online journal *Harlot of the Arts* special issue of creative works on Sonic Rhetorics, edited by Jonathan Stone and Steph Ceraso, (see Rickert 1999, Ball and Hawk 2006, Davis 2011, Stone and Ceraso 2013). These foundational publications have shaped a new branch of research with both analytic studies as well as creative works (see Bowie 2012, Ceraso 2014, Elbow 2012, Halbritter 2013, Rice 2006, Rickert 2013, Sayers 2012, Selfe 2009, Stone 2015). In particular, rhetorical studies in and of

sound have influenced our definitions of literacy. In 2006 for example, Hocks and Comstock define sonic literacy as "the ability to identify, define, situate, construct, manipulate, and communicate our personal and cultural soundscapes" with the understanding that the engagement of students with sound yields a "a critical process of listening to and creating embodied knowledge" (n.p.). Using the installations of sound artists, Hocks and Comstock then translate their understandings of sonic literacies into powerful and productive sonic pedagogies where rhetoric is regarded as an active, embodied, and dynamic engagement with sound.

As studies in sonic rhetoric have shown, sounds can offer researchers unique access to the features and elements of lived experience which, according to Rickert, strongly inform every rhetorical situation, including our very sense of self and the world (1999, 20). However, this project charts a different path. Rather than examining sound as compositional practice, this project utilizes the context of sound production and manipulation to investigate the state of current productivity aids in digital audio production software and assess their influence on questions of professional expertise, user experience, and workflow. Sound production, for the purposes of this study, becomes a stand-in to craft a broader argument about the potentially detrimental effects of automation on creative practice. What I take from the field of rhetoric, then, is the heuristic lens through which I mean to develop such an argument; and that heuristic is the fourth canon of rhetoric, memory, as it is described in foundational Greek and Roman treatises of rhetoric.[1]

[1] This is an approach not unfamiliar to rhetorical scholarship. For instance, in Rhetorical Delivery as Technological Discourse (2012), Ben McCorkle discusses the history of the rhetorical canon of delivery by reading it against major technological advancements in the context of communication and writing. In addition, Thomas Rickert references a number of foundational Greek philosophical concepts such as *kairos* (the opportune moment), *chora* (space or place), as well as *periechon* (the surroundings) and how they have been repurposed by modern and postmodern thinkers to explore how we reason and how we act. I pursue a similar strategy to examine how we memorize and how we often (choose to) forget.

Interestingly, the tension between memorizing and forgetting and its relationship to technology have been part of the field of rhetoric really from the very beginning. In a famous passage in the *Phaedrus*, for example, Plato criticizes the invention of writing, claiming that "those who acquire [the technology of writing] will cease to exercise their memory and become forgetful; they will *rely* on writing to bring things to their remembrance by external signs instead of by their own internal resources" (96, emphasis mine). The technology of writing, it seems to Plato, conflicts with the personal exigency to cultivate and train one's ability to memorize. Classical thinkers were very cognizant about the power of memorization and its role in shaping professional expertise and practice, so much so that memory became one of the five classical canons of the discipline. Therefore, memorization and recollection played pivotal roles in the world of rhetorical practice. Practitioners considered memory a productive and foundational element because memory provided public speakers with a set of distinct strategies to store, retrieve, and adapt knowledge to the exigencies of shifting communicative situations. Memory, West explains, encouraged "grasping the elements of somebody else's argument, organizing new statements as they were read or spoken, recalling the specifics of a tortuous system of laws, [and] responding fluently to unexpected questions, objections, or turns in a discussion" (483). More than a mere 'retrieval system' for information, the canon of memory also mediated between the internal world of the mind and cultural exteriority, a skill that professional speakers were instructed to train so that they would be able to respond quickly, creatively, and persuasively to all kinds of communicative circumstances.

Moreover, the fourth canon of rhetoric aligns with conceptions of creative inspiration and agency. As Mary Carruthers puts it, in classical rhetorical theory, "the proof of good memory lies *not* in the simple retention of large amounts of material; rather, it is the ability to move it about instantly, directly, and securely that is admired" (19, emphasis mine). As both

art and technique, memory was not regarded a passive condition of human experience but a dynamic construct, ever-evolving, always changing and adapting, and in this sense an expertise-denoting skill that aided professionals in mediating between themselves and their audiences. Classically trained speakers well understood the power and pedagogical value of a trained memory, and in this sense, we may consider the fourth canon of rhetoric essential in contributing to the formation, cohesion, and flourishing of a vibrant culture of public speaking in classical times.

Over the course of many centuries, however, the canon of memory fell into disuse, both professionally and pedagogically. Its arguably most famous dismissal appears in Edward Corbett's *Classical Rhetoric for the Modern Student*, and (unfortunately) it has found its way into each of the handbook's four editions:

> The fourth part of rhetoric was *memoria* (Greek, mneme), concerned with memorizing speeches. Of all the five parts of rhetoric, *memoria* was the one that received the least attention in the rhetoric books. The reason for the neglect of this aspect of rhetoric is probably that not much can be said, in a rhetorical way, about the process of memorizing; and after rhetoric came to be concerned mainly with written discourse, there was no further need to deal with memorizing. (22)

Corbett's dismissal is grounded in a view that the canon of memory has become obsolete and unnecessary within literate or post-literate societies. And his view (still) remains prominent in the field today. George Kennedy explains that the disappearance of memory over the years stems from its "absorption under disposition and, most often, to the western world's shift from orality to literacy" (qtd. in Reynolds 245). From the angle of technology, memory's devaluation in rhetorical practice is most often explained through the emergence and sophistication of various technologies for archiving and storing information. Understood as

an external resource of and for memory, technologies like the printing press, the computer, and the Internet have increasingly de-emphasized the need for memorization as a necessary skill. According to Sharon Crowley, writing and subsequent storage technologies are considered "much friendlier than memorial composition to modern notions like the sovereignty of the individuals (and hence authors) to language conceived as a representative medium for thought, and to method as a means of inquiry" ("Modern Rhetoric" 41). Indeed, we could take comfort in the sheer power of today's storage technologies. However, today's technologies have moved beyond offering mere storage capabilities, but they have become so sophisticated that we can use them to outsource labor.

Our public, scholarly, pedagogical, and technological perceptions of a deprivileged memory very much reveal the precarious relationship between professional practice and technology use. For one, this relationship is already quite memorial: digital technologies emphasize a "copious accretion of knowledge" and they function, in reference to Jay D. Bolter's work on technology, as "writing spaces" where memory can reside seemingly indefinitely. These digital spaces of compositional practice, reminiscent of Plato's famous wax tablet metaphor or Freud's mystic writing pad, designate programmed spaces displayed and constraint by the computer screen where (creative) professionals create, distribute, and receive knowledge. This relationship is being leveraged more and more through transactional principles so that professional memories become public, distributable, and marketable. We should, therefore, consider a more practical and workflow-based conception of the fourth canon of rhetoric. This will allow us to work through the implications and ramifications of external memory technologies so that we may gain a more nuanced understanding of their deployment and implications for professional practice.

Pursuing a conversation about the prospect of memory to investigate professional practice and technology use is a departure from established ideas in the field of rhetoric as a

discipline, albeit the last twenty years have shown a resurgence in studies of the fourth canon, which I find encouraging and motivating. Still, by and large, studies of the fourth canon reside at the periphery of our scholarship; our field (still) understands memory as mere rote memorization mostly because the discipline of rhetoric and composition picked up a somewhat truncated model of memory from Scottish Commonsense Realists. Scottish philosopher Alexander Bain considered memory a passive ability of perception rather than an active and deliberate effort towards reasoning and meaning-making (Allen 1993, Crowley 1993, Gronbeck 1993). In this study, I will be paying considerable attention to this very tension between memory as passive storage and arbiter of (creative) practice.

Classical conceptions of the fourth canon i.e., from ancient Greece to the Medieval period, become essential again for 21st-century assessments and investigations of professional practice and technology use, including the teaching of digital skills. As the "treasury of eloquence," classical rhetorical theory embraces memory as the animating principle of rhetoric proper. It provided access to all the other rhetorical tools and strategies, including the other rhetorical canons—invention, arrangement, style, and delivery. Therefore, I argue that a renewed appreciation of the fourth canon can aid both current teachers and learners in dealing constructively and efficiently with work environments that are in a constant state of change and progress. Memory, Thomas Wilson notes in arguably the earliest complete work on rhetoric in the English language, should be "cherished" because it holds both matter and words together (Franklin 128). For Wilson, the practice of memory is foundational of and for rhetoric, and he argues that nothing is possible without the imaginative realms of memory. I extend his assessment by showing how a practice of memory may continue to be a foundational consideration for any type of professional practice enabled by today's digital technologies. In view of this, this study presents a new way of looking at the changes brought about by the digital revolution. I provide a lens through which we may investigate

professional communities and the extent to which they reconcile the inclusion of the latest digital tools into their workflow while maintaining a level of control and independence over the production of content. Various groups of professional (creative) practice have been dealing with digital change, some in technophilic, others in techno-nostalgic ways. One in particular, the professional audio production community, has dealt with the implications of technological change like no other. In fact, audio mixing is a line of work whose history is inextricably linked to technological progress. It will, therefore, serve as the principal historical and workplace case for this study.

Professional mixing practitioners, called mixing engineers, make both technical and aesthetic judgments in the course of mixing a piece of music. For this, they rely on their professional experience i.e., on approaches and techniques they have developed, fine-tuned, and most importantly memorized: not merely in order to meet the demands of shifting mixing situations (genre, instrumentation, listening medium, etc.) but also because many of the analog technologies of yesteryear do not allow engineers to save, store, or archive settings as opposed to current digital mixing technologies. For each new piece of recorded music that is ready to be mixed, engineers start the mixing process (mostly)[2] anew. As a community, engineers have found ways to reconcile technological advancements with professional practice conventions and traditions. Yet, the current moment and the sophistication of digital technologies has pushed the community into what we might label 'crisis mode'. As Schmidt Horning (2004) notes, the audio production industry has historically been characterized by the accumulation of tacit knowledge acquired through working in a recording studio. Because of the digital revolution and the rise of the sharing economy, however, many studios have

[2] I use mostly as a modifier here because engineers do, in fact, rely on so-called 'go-to-settings' for various mixing situations. For example, many engineers develop a sense of the sonic characteristics of certain equipment and particular settings that they find pleasing. Famous American mixing engineer, Chris Lord-Alge, for example is known for brightening up various instruments by boosting 8,000 Hertz on the equalizer section of his SSL large-format mixing console.

gone out of business for financial reasons, thereby eliminating the most prominent, traditional opportunity for many to learn the craft and develop professional expertise. A recent documentary called *Sound City* (2013), written and directed by Foo Fighters front man and former Nirvana drummer Dave Grohl, memorializes the traditional recording experience. "The film," according to Neil Genzlinger's review in the *New York Times*, "becomes a chronicle of the slow death of the studio, an analog operation, whose heart was a Neve soundboard that recorded on tape, which by the 1980s had begun to be supplanted by digital technology" (n.p.). Grohl's directorial debut is instructive as it shows how analog recording equipment like the famed Neve mixing console that he bought when Sound City studios closed has played a significant role for the careers of many bands whose music many of us so fondly remember.

Costly music mixing hardware has given way to more inexpensive digital software programs and the latest digital tools for music production employ complex and smart algorithms that promise to conduct mixing tasks with a level of sophistication and precision that would have required many years of training and professional development in the past. One such piece of software called Neutron was released in early October of 2016 by renowned American audio technology company iZotope. Similar to already available audio processing software, Neutron features a comprehensive set of essential sound-shaping tools for audio signal processing. These include equalization to adjust the tonal quality of a recorded sound as well as compression and limiting to create consistent sound levels for both individual instruments and the whole track. As a software solution for music mixing, Neutron is capable of handling almost any sound processing task, and the included mixing features are neatly packaged together within a single, scalable, and highly customizable graphical user interface. However, and this is where Neutron became an industry first, the company equipped the software with a 'smart' algorithm called 'Track Assistant' designed to analyze

recorded sounds and automatically recommend as well as apply genre- and instrument-specific mixing parameter settings.

Not surprisingly, a debate ensued in the audio mixing community about the merits and potential pitfalls of iZotope's product release. Many expressed their views on major American online discussion forums that cater to this community such as *Gearslutz.com* and *KVRaudio.com* as well as in the comment sections of videos on *YouTube* that showcase and/or review the product. One group praised the 'Track assistant' for charting a technological path forward towards making the craft of mixing a less time-consuming, and thus more efficient activity. Given how people in this service industry work under constant deadlines, one can see the potential benefits to efficiency provided by technology. Another group of audio professionals and especially educators, however, expressed profound concerns. A feature such as the 'Track Assistant' and other technology-assisted processing tools would provide a problematic incentive for novices to succumb to a shortcut mentality with regards to professional workflow, a worry that is frequently raised in the context of digital technology use. In other words, iZotope's latest product release would tempt average users to neglect the daunting and time-consuming task to learn the craft, to develop an approach to mixing, and to memorize mixing techniques and strategies. Some audio mixing veterans even went so far as to announce the death knell for the profession.

Interestingly, these concerns stem from and speak to more significant issues brought about by technological developments which have influenced communities of professional practice in the course of the last two decades. Current digital technologies designed for productivity purposes refuse the instrumental function of technology. In fact, they have become more enmeshed with knowledge-making in the twenty-first century so that the boundaries between form and content, user and message, and to some degree self and machine have started to blur. In the field of audio production, technological advancements

have accelerated this trend in the last two decades. Prior to the computing revolution in the course of the late 1970s and early 1980s, professional audio recording and mixing equipment was exclusively hardware-based and quite costly, not only in terms of acquisition but also maintenance. Now, all that an engineer needs to record and mix a professional-grade record is a laptop, a microphone, and a digital audio workstation software program—investments that dwarf the six-figure price tags of professional recording studio equipment in the past.

The centerpiece of today's recording studio is the digital audio workstation (DAW), which is an all-in-one software application that provides a visual interface and a collection of functions whereby recording, sound generation, editing, and mixing can be undertaken in the digital environment. Significantly, all the work that goes towards the creation of a mix, which used to be restricted to the space of the recording and mixing studio, can now be generated and controlled entirely inside a DAW. Software solutions produced by companies founded in the 1980s (Steinberg's *Cubase*, Avid's *Pro Tools*, and others) and tech start-ups of the 1990s and 2000s (Image-Line's *Fruity Loops*, Ableton's *Live*, Apple's *Logic Studio*, and Presonus' *Studio One*) have played pivotal roles in changing the professional landscape of music production. Current professional software can recreate the sonic quality of the costly hardware devices of yesteryear, thereby providing a viable pathway towards professional audio recording and mixing practice.

This seismic shift brought about by advancements in computing has had two significant effects on the audio production community. First, it upended traditional patterns of training, knowledge management, and knowledge transfer. For decades, the industry had relied on an apprenticeship system in various levels of formality where in-house engineers would mentor and train the next generation of engineers via extensive direct supervision. The digitization of audio production tools has exerted, according to professionals, an alienating and disruptive effect on the entire community because the stark decrease in training facilities

now forces many who are eager to seek work in the field to teach the craft of mixing to themselves. As Grammy Award-winning engineer Ed Cherney explains:

> [G]uys like me and a lot of my contemporaries served apprenticeships in studios. We worked under engineers that started in the '40s and '50s and built the gear that they used and went from big bands to symphonies to rockabilly and country, then eventually to rock and roll; guys who saw the technology evolve. Sitting behind the Bruce Swediens, the Phil Ramones, the Al Schmitts—we learned how to listen. We learned what worked and what didn't and how to use that stuff, more than just reading the manual. But when you're at home, you're on your own—you usually don't have a mentor, and you never really sit behind somebody who's been there, done that, has 30 or 40 years experience, and knows how to make great records. (*Behind I* 210)

Second, the traditional recording studio was not only a place of learning, as Cherney states, it was also an important and fertile ground from which creative techniques and principles of audio signal processing emerged and where engineers developed their personal styles of music mixing. For example, one very common, yet non-traditional technique in dynamics processing called 'parallel compression' originated in recording studios in New York in the 1970s and early 1980s. It is often referred to as 'New York' style compression and is widely used in today's professional mixing; yet, it remains a technique that requires more advanced knowledge and understanding of audio signal processing. Therefore, the traditional recording studio was not merely a dedicated place of production and learning for many years. It also functioned as an invention laboratory where professionals would continuously try out new approaches to sound manipulation to develop and extend their professional skills palette.

While digital audio workstations and third-party mixing software still offer access to established mixing techniques and principles, these techniques and practices are nowadays

often packaged in extensive libraries that package mixing approaches in the form of stylized, readymade settings. Former recording engineer for Whitney Houston, Michael White, who has been working in audio production for more than thirty years and now offers various online video classes on mixing, considers the current state of technology a dilemma for the entire industry. In lesson five of his expansive series of mixing tutorials on YouTube called *Fundamentals of Mixing* (2016), in which he discusses the supposed "secrets" of great mixing engineers, Mr. White states: "[Nowadays], people are trying to learn how to make professional records without having ever had an ear, an eye, or a place on *watching* people do it year after year, and never having really experienced being a part of that process [of mixing] for years on end and making a living doing it" (my emphasis). As an engineer whose training has followed the classical route of apprenticeships at traditional recording studio facilities in the United States, Mr. White sees current learners of mixing at an initial disadvantage. He clarifies his position in the following way:

> When you start to mix a song you can get a lot of videos [online] that talk about how to get a great bass sound or how to get a great kick drum or drum sound, and so you can copy / paste all the approaches from all these different videos that you put in, you paste it together in your song and you listen to it, and in the end maybe it [the isolated instrument] sonically sounds good. You say, "wow that's a great snare sound, and that's a great bass sound, and that's a great vocal sound." And it [the whole song] sounds like shit. And you say: "why does not this work, you know? I followed this technique; I followed this way of doing things." The 'secret' of great mixing and great mixers is that they understand fundamentally that everything [i.e., each instrument in a piece of music] is in relationship to everything else. ("Fundamentals 5")

He concludes, “the settings [for any piece of audio equipment] are not what is the most important thing [in mixing]. [Instead, the secret of great mixing is] the way that they [professional mixing engineers] set it [a particular effect] up, the way that they *fashion the mix and design the mix in their head* so that the piece of gear that they used was most effective” (my emphasis). What Mr. White alludes to—especially in the segments emphasized—is that digitally distributed techniques do not promote an agency based on instrumental or technical mastery. Instead, the power of software in shaping practice lies in its potential to provide access to the professional knowledge and expertise of others. Interestingly, today’s conceptions of professional practice seem to focus less on retaining actual information or knowledge, and more on knowing how to access and find information. However, the success of music mixing (in fact, the success of any creative activity) lies in the ability of the engineer to craft a mix that resonates and appeals to an audience of both clients and consumers; mixing crucially relies on the innate and learned ability of the engineer to develop professional knowledge i.e., to be capable of evaluating the raw audio material for a song, to imagine the finished song, and to tackle both sonic problems as well as leverage creative opportunities. In other words, the moving of faders, the turning of knobs, and the setting up of effects in the course of a mixing session merely imprints the already imagined mix onto the raw audio material, thereby reinforcing the procedural relationship in audio engineering work between technology (both hardware and software) and an embodied and active memory.

The current dilemma in the field of audio engineering illustrates the subtle and continuing encroachment of software into professional work environments, a trend that we can also recognize in other creative industries such as photography, film, and to some degree the field of writing. What makes an audio engineer successful, then, is personal commitment: to develop mixing skills, to store and commit approaches and techniques to memory, to retain

them, and to leverage memory as a (re)source to imagine and invent appealing mixes. So, while a feature such as Neutron's 'Track Assistant' seems, at the outset, a welcoming addition for non-traditional engineers as the software can treat recorded audio on behalf of the user, it may compel users to neglect the importance of developing their own professional expertise. In essence, what we are dealing with is an agency-submission dilemma brought about and negotiated through human-software interaction. As the debate surrounding Neutron's 'Track Assistant' illustrates, many audio professionals emphasize the importance of memory training for creativity and imagination.

Mr. White's sentiment echoes a concern concerning the notion of loss that many who work in the field of music production have expressed: loss as an unintended effect of the digital revolution on matters of expertise and professional development. By the same token and jumping back roughly 2,500 years, Plato's famous denunciation of the invention of writing expresses not merely a relationship between memory and technology, but one that is also seemingly conditioned by loss: by offloading knowledge into prose humans would lose the exigency to cultivate knowledge themselves, and in the process, surrender agency. We can see that the art of memory fell into disuse because each major milestone in technological history came to be regarded as an aid to human memory. Now is the time, I propose, to revisit the fourth canon so that it may serve as a critical lens to assess the effects of technological progress. Not only may we consider Plato's concerns about writing prophetic and capable of helping us chart a trajectory for the status of memory in the history of technological developments, but we can also employ the art of memory as a filter to discuss ways of retaining control over a creative process that is enabled through software.

The digital revolution has upset many of the traditional conventions of professional practice, knowledge development, retention, and transfer within various communities of (creative). Financial entry barriers have all but disappeared for users, and this has created new

markets for software technology where companies also cater to laymen and non-traditional users. The audio production community, in this sense, becomes an excellent paradigm for investigating the consequences of technological progress. Further, mixing is a creative activity not unlike composition and writing. Similar to concepts we find in rhetorical scholarship, a mixing engineer takes raw audio material, analyzes the information, engages in invention, and then decides how to arrange, style, and deliver the content to an audience consisting of clients and music consumers. Therefore, I imagine my findings to be applicable to other (creative) forms of composition and production such as photography and cinematography i.e., other lines of work where software solutions have permeated creative practice and where the analysis of software artifacts through the filter of rhetorical memory may give us a better sense of the state of expertise and professional development. While I also consider my research relevant to inquiries into the field of software-enabled writing—after all, I am using word processing software to compile this study—artificial intelligence has, so far, not permeated this line of creative practice as much just yet.

Utilizing the fourth canon of rhetoric as a critical filter to examine the world of mixing rather than composition made sense for several reasons. First and foremost, today's digital writing aids are (still) not as 'smart' and able to compensate for a lacking in skill as the ones that mixing practitioners can already access today. Grammar and style correction tools such as *Grammarly*—albeit able to offer highly nuanced suggestions with regards to diction and style—*Reverso*, and *Ginger* still reside in the universe of editing and revisions rather than drafting. These and other widely available digital aids do not contain algorithms that are able to engage in their own 'decision-making' like iZotope's *Neutron* software, for example. Second, while the *Washington Post's* Heliograf software mentioned earlier offers such capabilities, it is only used at that particular newspaper. Digital aids in mixing are widely available, and this opens up an educational dimension to this research as well. Access

to the tools of mixing used to be restricted, either economically or professionally. Now, everyone can purchase relatively inexpensive digital software that, in many cases, is also used in today's professional recording studios. In addition, the decline in recording studio facilities over the last twenty years has created a void for professional skills development. Thus, the community of mixing practitioners is ahead of the field of writing in terms of having to confront a crisis of expertise and having to find alternative ways of knowledge transfer: the field of audio may function as a canary in the coal mine of sorts. Third, major developments pertaining to digital technologies in mixing line up well with my age group. The digital revolution in mixing really began in the early 1980s, around the time I was born and, thus, I can add to this work my unique perspective of belonging to a generation that can well remember a time before digital tools became widely available. Last but not least, using audio mixing instead of writing as a case to discuss a canon of rhetoric adds a new layer to the expanding list of works that apply rhetorical scholarship to answer questions that reside outside the field of rhetoric and composition and, thus, show the interdisciplinary strength of our discipline. For this work, then, the canon of memory becomes the means to infer the histories of technologies, to highlight current trends in professional (creative) practice, and to suggest potential remedies.

The history of audio engineering provides a deep and comprehensive case to illustrate what many in the field of creative production are calling a dilemma. As Goodwin already observed about the end of the 1980s, "the most significant result of the recent innovations in pop production lies in the progressive removal of any immanent criteria for distinguishing between human and automated performance" (263). It is worth referring once more to the controversial debate surrounding the release of iZotope's Neutron at the end of 2016. Its release sparked hundreds of comments submitted by users who identified themselves as novices in the field of music mixing, and their comments expressed a desire for simplicity

and an overt appreciation for a tool capable of doing the work for them. It is the expression of a currently prominent sentiment, I believe, where average users legitimize software and ascribe professional expertise to both built-in features of professional software applications as well as third-party software extensions. In this sense, features such as Neutron's 'Track assistant' as well as other instances of offloaded labor like preset libraries and software automation contain value—both symbolic and economic as we shall see—and exert what I would term 'rhetorical lure.' I opt for the term 'lure' instead of 'force' because I consider the concept of non-human agency in more moderate ways as opposed to scholars in the field of object-oriented ontology. I do not recognize a form of 'free will' to be present in digital algorithms—in my view a prerequisite for agency.[3] Still, and paraphrasing Walter Benjamin's concept of 'aura' to some extent, I believe that the kinds of features in professional software applications that relate back to established professional techniques and practices can lure users because they are shrouded in an aura of professional ethos. Presets, templates, and other instances of ready-made features, which are supplied either by audio technology companies and often endorsed by professional engineers, have the potential to be appealing and, thus, persuasive, to the extent that users—particularly those whose training follows non-traditional paths—may succumb to the temptation of foregoing the drudgery of practice, which established audio engineers like Michael White and others consider paramount for success.

Following this line of thought, my argument is that beyond the capturing of sound, the computer environment needs to be interrogated as a site of memory and for the way it facilitates and constrains the process of mixing. We may perceive memory in an era of

[3] In *Ambient Rhetoric*, Thomas Rickert argues to dissolve the conceptual lines between the subject and object in rhetorical scholarship. In a digitally-saturated information and knowledge economy, rhetoric can no longer retain the autonomy of human as the sole drivers of the discursive act. Rickert develops the concept of *ambience* as an umbrella term to explain the ecologies we inhabit. According to Rickert, humans are not the exclusive actors in the rhetorical situation; agency can be found in things, objects, as well as spaces. Rickert concludes that once we become aware of these influences, and only then can rhetoric make a first step toward sufficiency.

ubiquitous computing, thus, as a mediating principle where practice and technology use are reconciled i.e., where human agents may clarify and negotiate their decision to learn as well as to outsource tasks to various types of digital aids. By revisiting the fourth canon of rhetoric, we can make better sense of these techno-cultural developments. In recent years, researchers from other fields such as philosophy, cognitive psychology, and neuroscience have already explored related questions. Media theorist Wendy Chun, for instance, argues in *Programmed Visions: Software and Memory* (2011) that software interfaces create the illusion of a "seemingly sovereign individual" (8). Her assessment echoes the results of recent experiments in cognitive science which show that in the era of laptops, tablets, and smartphones our organic brains often tend to store not the information about a topic, but rather how to find the information using available technologies (Sparrow et al. 2011). In a similar vein, Alexander R. Galloway speaks in *The Interface Effect* (2012) of software interfaces not only as "effects, in that they bring about transformations in material states" (vii). He also discusses software as "the effects of other things, and thus [they] tell the story of the larger forces that engender them" (vii). The fourth canon's generative, creative, and reflective potential can, in my view, help researchers better understand the multi-faceted ways people respond to external and software-enabled stimuli.

To accomplish this, I review in "The 4th Canon of Rhetoric in Practice" the literature that deals with the history of the fourth canon, its relationship to *techne*, and its declining role for professional practice. Then, I tie my review to critical assessments of computer technologies. While memory has long been linked to *techne*, I find that a more active and involved utilization of the concept of *techne* allows us to investigate the epistemic conditions of a particular group or formation. The concept of *techne* helps to construct a more nuanced picture of the field of audio production. In "Audio Engineering as Techne," I explore the

history and work patterns of music mixing through the prism of *techne* and walk readers through the steps that an engineer takes in the course of a mixing session.

New Media researcher Matthew Kirschenbaum sees a problem with "the current state of new media studies in which the graphical user interface is often uncritically accepted as the ground zero of the user's experience" (34). By way of referencing particular arts of memory from classical and medieval rhetorical scholarship such as the *loci method* and segmentation I show in "Making Memories, Creating Order" the various memory systems that professionals have devised a means of dealing with content and design overload, and how professional productivity software such as digital audio workstations are customizable and malleable to reflect the user's professional memory. In this way, software becomes manageable to the point where the user can 'forget' the tool and, instead, focus on their creative practices.

Scholars in rhetoric often justify the deprivileging of the art of memory in view of the emergence of literacy. However, public speakers continued to use memorial composing strategies right up to the modern period. After all, unlike pen and paper or even the portable computer, a trained memory is always readily available as a source of invention. Memory becomes a tool, a device that can be used to perform higher cognitive operations. Writing itself evolved as a type of memory tool since the human brain places definite limits on the amount of information it can store; therefore, as literacy developed, technologies were created that allowed more words to be remembered. As a result, according to Merlin Donald, the most recent cognitive step in human evolution is the use of writing as an external storage medium (269). Although memory and writing are tools, ancient and medieval scholars did not see them as separate from knowledge making: they also functioned as ways of creating knowledge. In "Any Sound Imaginable," traditional concepts of memory's copiousness

illustrate the types of strategies that professionals develop and employ to retain agency over their creative process.

Offering access to the expertise of professionals via digital technologies has become a robust business and marketing strategy in recent years. In "Commodified Memory and the 4th Canon's Persuasive Dimension," I look at the various ways that the notion of memory has found its way into product development and marketing. Given the rise of digital technologies in the field of education, I believe we also need to place more significant attention on the rhetorical implications of memory in an era when software is capable of participating in what Martin Heidegger and Janet Atwill have called 'productive knowledge' (Atwill 1998, Heidegger 1977). In essence, the prospect of a 'productive knowledge' embedded and enabled by software creates the provisions for memory to function as a powerful, persuasive appeal.

1.1 A Note on Method

The methodological path I chart for this study is qualitative in nature and broadly informed by three principal research considerations. First, this study revisits both classical rhetorical treatises and modern interpretations about the canon of memory to spotlight the canon's prescriptive as well as symbolic functions, which I consider critical for understanding the technological conditions of today's creative work environments. Each of the subsequent content chapters uses a subset of functions pertaining to the practical use of memory to examine the working conditions of audio engineers. Prescriptive are those elements that speak to memory's capacity to serve as strategy for the organization and structuring of professional knowledge as well as the canon's potential to aid the tasks of critical thinking and invention; the symbolic quality of memory, then, relates to the canon's more intangible role in defining and maintaining communal aspirations as well as perceptions

of professional expertise. What we will find is that the vital role that memory plays in bridging the past, the present, and the future for a given professional community over time is now being disrupted by digital technologies and a tech industry that has found varied ways to leverage memory's commodification and incorporation into the feature lists of software products. Deconstructing the principal tenets of the fourth canon of rhetoric, thus, serves to lay a conceptual and theoretical foundation.

The bulk of the research for this study went into defining, building, and fleshing out the field of audio production as the contextual frame. Three principal research questions—grounded in an understanding of memory as practice—guided this process:

(1) How does the field of audio production define and perceive professional expertise and success?

(2) How has technological progress influenced the creative and technical dimensions of audio mixing?

(3) How is the relationship between remembering and forgetting leveraged by both professionals and software companies?

As these are very broad questions—each worthy of its own study—I opted for a process of elimination to stake out a limited and, therefore, manageable scope. First, this study is geographically restricted to the history of recording in the United States of America. Albeit audio production is a global profession and recording studios in Great Britain such as the famed Abbey Roads studios have exerted a great deal of influence on the history of mixing (the 'British Sound,' for example), the recording scene in the United States has been the home of most of the transformative changes in mixing and (still) remains unsurpassed in its creative and technological contributions to the profession. That is not to preclude, or even diminish, the historical importance of recording centers like London, Paris, and Berlin. Each would, in fact, warrant a separate study. For this study, however, I focus on the centers of

American popular music such as New York, Nashville, Memphis, and Los Angeles. Second, the majority of historical references that I include will be limited to the post WW2 era up to the present rather than extending the historical range all the way to the earliest technological inventions that made sound reproduction possible.

The third, and most consequential decision as far the scope of this study is concerned was to identify a starting point for information gathering. As this study explores the aspirations, conventions, and motivations of those working with audio professionally, I opted to build a comprehensive overview of the profession through the anecdotes, professional insights, and stories of audio engineering experts and veterans. Their stories offer diverse experiences about what McCarthy and Wright (2004) would call the 'felt-life' of a technology pertaining to a wide range of issues including expertise, mentorship, practice, product, and workflow. For this overview, I decided to focus on accomplished voices in the field and exclude textbooks and handbooks for mixing because these instructional materials often provide a rather prescriptive, formulaic approach to the craft.

In American popular music, engineering expertise can be measured in two ways: either by comparing overall record sales and setting a cut-off point or by looking at international recognition such as awards received. This study pursues the second option because rather than basing industry recognition solely on the appreciation of music consumers, awards are decided by a jury of professional peers. In particular, the Grammy Awards, first awarded in 1959, recognize achievements in the music industry each year and one award category is for the best-engineered record. The two awards in this category are for either classical or non-classical albums. Since the historical references in this study all fall within the province of American popular music, recipients of the award for classical music albums were excluded. In addition, while the Grammy Awards have a history of roughly sixty years, only those who received an award after the year 1981 were considered; the early

1980s saw the first significant milestones for digital music mixing, and thus, the list of Grammy Award recipients consisted of engineers with extensive first-hand experience of a pre-digital era in mixing, but who also experienced the digital revolution in music production.

This yielded a list that covered a wide-ranging list of influential voices in the industry who have either adopted digital mixing into their work or not. This first step in information gathering resulted in a list of 20 engineers. After conducting search queries on Google and YouTube about these engineers, three were subsequently excluded because they either had no public presence on the Internet to speak of or have only shared limited information about their view of the craft. For each of the remaining 17 engineers I created video playlist bins on YouTube to curate hours of professional reflections on the following topics:

- Differences between analog and digital mixing
- History of music mixing
- Workflow
- Sound editing and shaping

In the course of listening to their stories, additional names of engineers came up who hadn't won the Grammy Award for best-engineered non-classical album but who had won Grammy Awards for their work in other categories such as the awards for best song and album of the year. This additional step resulted in a final list of 25 influential voices in the American field of audio engineering. Below I list in no particular order their names[4] and the artists they are known to have worked with:

- Andrew Scheps (Red Hot Chili Peppers, Jay-Z)
- Ryan Hewitt (Red Hot Chili Peppers)

[4] Unfortunately, the field of audio engineering remains by and large and to this day a very male-centered profession. While there are a number of famous female audio engineers in the United States like Sylvia Massy, I only found a few public comments of them and mostly unrelated to the state of audio mixing with digital technologies.

- Dave Pensado (Beyonce, Christina Aguilera, Mary J. Blige)
- Jack Joseph Puig (The Goo Goo Dolls, No Doubt, Sheryl Crow)
- Tony Maserati (The Black Eyed Peas, Jason Mraz, Puff Daddy)
- Joe Barresi (Queens of the Stone Age, Avenged Sevenfold)
- Jacquire King (Kings of Leon, Tom Waits, James Bay)
- Chris Lord-Alge (James Brown, Joe Cocker, Bruce Springsteen)
- Tom Lord-Alge (Steve Winwood, U2, Peter Gabriel, Marylin Manson)
- Al Schmitt (Henry Mancini, Steely Dan, Toto, Natalie Cole, Quincy Jones)
- Bruce Swedien (Michael Jackson, Paul McCartney, Barbra Streisand)
- George Massenburg (Earth, Wind & Fire, Billy Joel)
- Ed Cherney (Bob Dylan, Lenny Kravitz, Eric Clapton, Sting)
- Jim Scott (Tom Petty, Red Hot Chili Peppers)
- Andy Wallace (Run-DMC, Aerosmith, Prince, Nirvana, Foo Fighters)
- Tchad Blake (Elvis Costello, Pearl Jam, Sheryl Crow, The Black Keys)
- Darrell Thorp (Foo Fighters, Ray Charles, Jay-Z)
- Mick Guzauski (Madonna, Cher, Boyz II Men, Michael Jackson, BB King)
- Joe Chiccarelli (U2, Alanis Morissette, Beck, The Killers, Frank Zappa)
- Vance Powell (Chris Stapleton, Jack White, The White Stripes)
- Michael Brauer (John Mayer, Coldplay)
- Manny Marroquin (Kanye West, John Mayer, Alicia Keys, John Legend)
- Neal Cappellino (Alison Krauss, Willie Nelson, Dolly Parton)
- Kevin Killen (Peter Gabriel, U2, David Bowie, Bon Jovi)
- Frank Filipetti (Foreigner, The Bangles, James Taylor)

Their reflections on the craft were subsequently aided by secondary literature consisting of autobiographies and video documentaries to gain additional insights about what life is like for the working engineer and how the recording studio as a place of "discipline, performance and *anarchy*" (Brown 361). Below is a representative quote from Phill Brown's autobiography, *Are We Still Rolling?*:

> Discipline—having only 4, 8, 16 or 24 tracks to work with and limited outboard equipment. Performance—getting a group of four to 60 musicians to deliver a live recording. Anarchy—general alcohol and drug base, coincidence, serendipity, madmen and the wonderful freedom of the 1970s. In today's 60-track, digitally clean, over-produced records—all this appears strangely appealing. (361)

The stories provided by these accomplished voices in the field provided a rich contextual tapestry filled with recurring patterns as well as unique working philosophies that help to explain, as Helen Schwartzman explains in *Ethnography in Organizations*, "the taken for granted, but very important, ideas and practices that influence the way lives are lived, and constructed, in organizational contexts" (4). In addition, the covered topics all relate to aspects of the mixing profession that are widely considered pivotal for professional recognition and success.

The final step in the process, the roofing so to speak, was to apply these research findings to the analysis of various software application designed for audio signal processing. This software analysis was conducted along the heuristic tenets of media studies in the style of media researchers including Lev Manovich, Wolfgang Ernst, and Alexander Galloway. Their work is based on thick descriptions, and historical references designed to both demystify the often-overwhelming depth of today's software environments as well as illustrating lines of progression in terms of technological developments. In addition, their

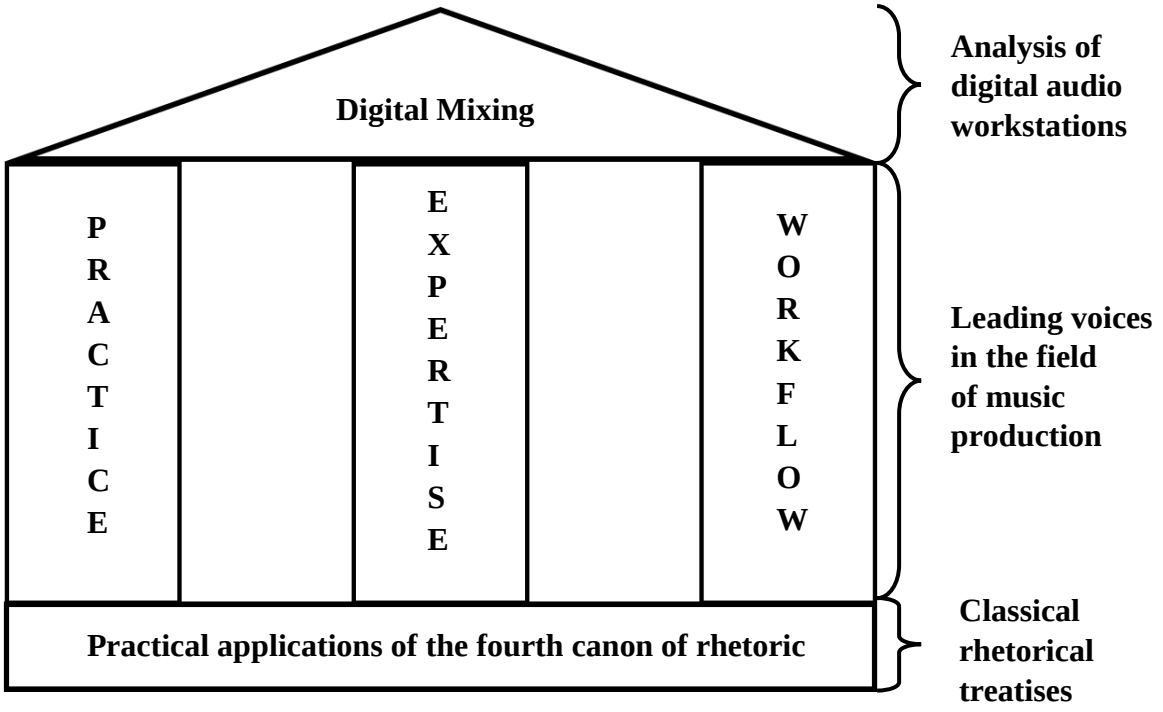

Figure 1 Visualization of this study's methodology.

work emphasizes how technologies enable as well as constrain forms of practice. That being said, this is not a study that can claim completeness. In line with Harry Walcott's assessment of the goals in qualitative research, this study aims to "discover essences and then to reveal those essences with sufficient context, yet not become mired trying to include everything that might possibly be described" (35). Therefore, only a fraction of my research made it into this study to illustrate how the commodification and digitalization of professional memory have influenced the audio engineering community, its established workflow patterns, its approach towards knowledge retention, and how professional software now limits and creates creative possibilities.

1.2 The 4th Canon of Rhetoric in Practice: A Brief History

The fourth canon of rhetoric has commonly been dismissed as mere memorization because of its supposed difference to imagination. Mary Carruthers, for example, prefaces *The Book of Memory* with the following observation:

> When we think of our highest creative power, we think invariably of the imagination. "Great imagination, profound intuition," we say: this is our highest accolade for intellectual achievement, even in the sciences. The memory, in contrast, is devoid of intellect: "just memorization," not "real thought" or "true learning." (1)

As simply a set of techniques for memorization, memory does not aspire, as the quote implies, to the appreciation given to the canons of invention, arrangement, and style, which would supposedly best reflect the province of imagination and the tenets of creative work as valued by present-day culture. As Carruthers notes, memory became regarded as an outdated technology, a tool of oral culture which had little connection to modern rhetoric or to literacy.

Yet, when we take the works of several classical thinkers of rhetoric into consideration, we will find that most scholars give memory a more prominent status, even when it is framed as memorization. Memory was considered not merely a skill, but an art. Influenced and shaped by both imagination and reasoning, classical rhetorical treatises featured memory as a quintessentially constructive element in the rhetorical process, aiding public speakers in generating the ideas and the forms which would become products for public performance and delivery. As Mary Carruthers emphasizes in her important research on memory, ancient scholars attributed the most significant creative powers to those with the most superior memories, to the extent that "in their understanding of the matter, it was memory that made knowledge into useful experience, and memory that combined these pieces of information-become-experience into what we call 'ideas,' what they were more likely to call judgments" (3). In *De Oratore*, Roman rhetorician Cicero discusses strategies for the individual to speak well in any given situation. To achieve this state, Cicero suggests that a full and organized memory is a useful tool in proportion to the weight of the other four canons (40-1). In order to prepare one's memory for oration, Cicero acknowledges that

practice and training is the most successful combination (43). As a result, a well-stocked storehouse of memory assisted the orator to draw on numerous examples and ideas at a moment's notice to reinforce content, for example, or to refute an opposing argument that has not been anticipated by the orator. Here, Cicero suggests memorizing a great number of others' writings as well as creating one's own syntheses between them.

When rhetoric became a discipline, scholars formalized memory as a deliberate effort, as an art, as a practice. Both Frances Yates and Sharon Crowley identify the oldest extant description of memory as practice within a passage from the so-called *Dissoi Logoi*, a sophistic document fragment dating back to around 400 BCE, in fact three centuries prior to the more well-known rhetorical handbook, *Ad Herennium* ("Modern Rhetoric" 37). The section on memory goes as follows:

> A great and beautiful invention is memory, always useful both for learning and for life. This is the first thing: if you pay attention (direct your mind), the judgment will better perceive the things going through it (the mind). Secondly, repeat again what you hear; for by often hearing and saying the same things, what you have learned comes complete into your memory. Thirdly, what you hear, place on what you know. (qtd. in Yates 29-30)

Oral cultures, as we can glean from this passage, praised an expansive and trained memory. It indicated that an individual had a great "storehouse of knowledge"; more importantly, a trained memory was desirable because readying the memory with practice and storage techniques aided the professional orator in the practice of invention, a consideration of learning that survived well into the Middle Ages. "The cognitive procedures of traditional rhetoric were practiced," as Carruthers explains in *The Craft of Thought*, "as a craft of composition, rather than as one of persuasion" (3). Such medieval practices were based on invoking mental images or cognitive "pictures" specifically via the use of tropes and figures

that aided public speakers in both thinking and composing (3). Carruthers, in fact, calls memory "a machine" that nurtured the creation and retention of intricate networks of knowledge. In other words, classical conceptions of memory had a lot in common with the concept of *techne*, functioning and appreciated as a type of productive knowledge that would lead its practitioners towards inspiration and invention. As a productive form of knowledge, memory bridges past, present, and future. Bruce Gronbeck finds this bridge in Aristotle's philosophy of memory that emphasizes the "power of the past" and how all human beings might "bring it into consciousness" (139). By referencing the capacity of the past to direct and shape present and future practice, Aristotle introduced a more dynamic conception of memory, Gronbeck maintains, which also implies—as my study will show—productive links between memory, agency, and subjectivity. In other words, memory's canonization within the discipline of rhetoric is grounded in the notion of being a teachable faculty that aids invention to varying degrees, a teachable *techne* concerned with the creation, synthesis, and storage of knowledge as well as its ordering.

To this end, classical scholars of rhetoric made a clear distinction between *natural* and *artificial* memory—the latter denoting various methods, strategies, and techniques for improving one's recollection and retention of knowledge. For example, orators were trained in artificial memory techniques such as the memory palace where speakers would assign and attach elements of their speech to imaginary items placed in an imagined space to turn the act of delivering a speech into a mental walkthrough of the imagined space. Therefore, it was the responsibility of public speakers to develop and to teach these valuable precepts for *artificial* memory. According to the author of the *Ad Herennium*, one develops and hones *artificial* memory pro-actively "by a method of discipline . . . so as to become exceptional" (III.vxi.29). Personal effort is key. We may think of Aristotle's *inartistic* proofs that are merely gathered together and declaimed by the speaker, whereas the *artistic* proofs demand

specific effort informed by the speaker's professional skill. It helps to bring in Bruno Latour here, who argued that "fabrication and artificiality are not the opposites of truth and objectivity" (124). For Greek and Roman scholars, *artificial* implied a deliberate human effort to train and expand i.e., to master one's working memory. Becoming an expert, thus, illustrates a capacity for agency that manifests as choice and control over the storage and retrieval process, and that comprehends memory as personal practice since speakers may decide what is worthy to be stored, and what can be forgotten. Moreover, *artificial* memory involves a decision-making process with regards to the specific ways that information is to be stored—ways that as I will show in subsequent chapters can help us gain a more nuanced understanding of memory's influence on current conditions of learning, professional practice, and human-technology interaction.

Greek, Roman, and medieval scholars perceived an active connection between the art of memory and skill acquisition. In fact, medieval writers "would not . . . have understood," Mary Carruthers explains, "our separation of 'memory' from 'learning'" because memory turned "knowledge into useful experience" (1). Medieval conceptions of memory recognized the formative power of memory as technology. Sherry Turkle states in *The Second Self*: "Technology catalyzes changes not only in what we do but in how we think. It changes people's awareness of themselves, of one another, of their relationship to the world" (13). The art of memory functioned not simply as a tool, but as a means and mode of understanding and engaging with the world, or as Sharon Crowley puts is in "Modern Rhetoric and Memory": "rhetorical consciousness is fully consonant with memory arts" (43). While it's been scholars of the 20th century like Sharon Crowley, Frances Yates, Deborah Hawhee, John Reynolds, and Kathleen Welch who began to advocate for the fourth canon's revival in rhetorical scholarship, the study of memory has seen a resurgence in the humanities at large as well. "Relationships between memory and rhetoric," Elizabethada Wright observes

in 2005, “have become increasingly studied in the late twentieth and early twenty-first centuries” (52). Since 1998, Stanford University Press has been publishing the book series *Cultural Memory in the Present* featuring interdisciplinary humanities scholarship that explores “any present production and organization of words and things, gestures and images, sounds and silences, that are steeped in a past that is anything but over” (De Vries and Cohen). The interdisciplinary journal publication, *Memory Studies*, has been providing a venue for critical memory scholarship in the humanities and social sciences to advocate for the necessity to remember and archive the condition of memory within emergent digitized culture. Deborah McCutchen’s review of scholarship that explores memory as a form of knowledge in the context of language and writing skills acquisition is a prime example of the many vital roles an active and internal memory practice can play in the production of complex texts. Multiple studies across various demographics have found that the larger the memory span the greater the skill of the writer to connect ideas coherently on the micro-level of the sentence, the meso-level of the section, and to the macro-level of the entire text (McCutchen 57). Moreover, studies have found that commonly agreed upon technical conventions such as genre and discourse, are much easier employed by writers with longer memory spans (58).

Current and future trends in the world of machine learning, in the field of algorithm programming, and in the digital technology market at large, however, have pointed towards the possibility to outsource professional practice and externalize memory in the context of technology use. Digital technology industries have begun acting as a kind of counterpoint to the art of memory, thereby bringing digital technologies much closer together with practices of memory than paper and pen could provide. This observation isn’t new. Scholars in the field of media studies have been writing about corresponding implications for a while. As early as 1969, in “McLuhan in the Light of Classical Rhetoric,” Patrick Mahony writes that

"McLuhan's rhetorical orientation reveals a vital alliance between memory and pronunciation. In terms of videotapes, phonograph records, and indexed books, to go no further, memory or information storage has been exteriorized into new media or forms of pronunciation" (14). While this observation remains peripheral in relation to his study's purpose, Mahony finds that there is a meaningful connection between McLuhan's reading of media and memory's relation to both print and digital technologies. Similarly, Jay David Bolter writes that "the ancient art of memory was, in fact, another way of addressing the gap between writing and memory. It was an attempt to turn human memory into a technology like external writing" (109).

As a teachable skill, the art of memory extends beyond its concern for the individual but needs to be understood as a communal and cultural process as well. Carruthers argues that "*Memoria* also signifies the process by which a work of literature becomes institutionalized—internalized within the language and pedagogy of a group" (9). It is this very relationship that my study builds upon to reconsider the fourth canon of rhetoric in the context of a digitally-enabled and structured information society. In so doing, I contribute to an area in rhetorical scholarship that kicks off a conversation about various types and degrees of digitally-enabled memory practices in the context of technology use, and as a discipline we can illustrate the extent to which digital memory technologies become 'active' and influence the work of the other canons. Further, we can interrogate the ways that digital technologies are used to distribute, organize, and sanction knowledge.

My research adds to existing investigations into the relationship between agency and technology by offering a rhetorical perspective. For Plato, memory connected the individual to the "divinity of the soul," and it marked proof of the soul's divinity for Cicero. It was a guide to invention and the "locus point" of the topoi for Aristotle, and Quintilian treats it as the (re)source of the speaker's eloquence and professionalism (Reynolds 5). In oral culture,

memory used to contribute more directly to acts of community, and to serve as a pathway towards social consensus and commemoration (Hobart and Schiffman 2). Through memory, a community continually redefines itself and its aspirations amid ever-changing circumstances. But my research shows that memory in digital technologies may act to disrupt, facilitate, afford, and constrain. It is in this capacity of digital memory that Winifred Horner worries about human memory's replacement "by powerful external memories in books, libraries, and finally in the huge computer databases that can store the memory of a culture. With the first technology, history—the cultural memory—began, and memory in the limited internal sense was permanently altered" (180).

The techne of memory still exerts that kind of epistemological influence in our post-literate, digital culture moment, but to a different degree and towards different ends. For one, the crucial issue with knowledge in the information age is not possession but access. Katherine Hayles argues in "The Condition of Virtuality" that education in the twenty-first century is about ways of teaching access to rather than retention of knowledge or information. In other words, the techne of memory is bound up by material concerns because we become receptive to the need for acquiring those kinds of devices that we utilize prosthetically to access knowledge. Various scholars and popular thinkers have written recently about the materiality of memory. In *Lingua Fracta*, Collin Brooke argues against an understanding of memory as merely "the retention or location of quantifiable amounts of information [because] [i]t is in this sense that we speak of a computer's memory—its capacity for storing a finite number of kilo-, mega-, and gigabytes worth of information" (144). Brooke argues for a practice of memory rather than an understanding of memory simply based on retention. In *Rhetorical Memory: A Study of Technical Communication and Information Management*, Stewart Whittemore uses a case study approach to analyze technical communication management practices and how these practices contribute to the

organizations' creative work; he argues that developing writing expertise involves a process of cultivating a social and embodied "habit," defined as a memory stocked with shared, collective knowledge that can be drawn upon when needed. The concept of memory extends beyond mere storage, functioning as an critical element within epistemic systems. When we reflect critically about the notion of access, we re-frame memory caught between internal and external epistemic conditions, and we start to see digital technologies as spaces where memory becomes negotiated.

Processes of exteriorization may hamper human expertise. In his *Institutes of Oratory*, Quintilian emphasizes that the human mind "is always looking ahead, it is continually in search of something which is more remote . . . whatever it discovers, it deposits by some mysterious process in the safe keeping of memory, which acts as a transmitting agent and hands on to the delivery what it has received from the imagination" (213-15). Certainly, we live in a time where the organizing principle and foundational appeal of digital media is memory. From its content to its purpose, from the language we use to talk about hard drives as archives and storage spaces, how we consider the Internet as the repository of humanity's collective and personal memories, its ontology and alleged providence is defined through the parlance of memory. The concept of memory conditions our understanding of digital technologies as an ever-increasing archive in which no piece of information, no piece of data, is lost. This belief is predicated on the assumption—in fact depends on it—that the digital machines that surround and infuse our daily lives are clad in a promise of permanence. And when we can take for granted that information can be safely stored in digital media, many of us will not take issue with the assessment that digital media trump humans as record keepers. After all, our capacity to remember degrades with age. We are prone to forget things. Digital technologies, however, remember because, quite frankly, they are better at it, so much so that in our current moment questions of forgetting and memory degradation have been turned into

problems that digital technologies are supposed to solve. It is important to problematize this assumption. Already in 1960, computer technology pioneer Andrew D. Booth worried how "computers of the future will communicate directly with each other and human beings will only be called on to make those judgements in which aesthetic considerations are involved" (360).

The issue of human forgetting, memory degradation, and the workings of the human mind in general, in fact, foregrounded early conceptions and discussions of digital technologies in the middle of the 20th century. The works of pioneers in the field of computer science such as Vannevar Bush, John von Neumann, Douglas Engelbart, and Ted Nelson, were animated by the notion to turn questions of human forgetting into a problem solvable with digital technologies. For example, in "As We May Think" (1945), which to this day remains the conceptual lighthouse in the field of computer science, Vannevar Bush premises his proposal of a 'memory extender' machine, the so-called 'memex,' on the circumstance that the sum of human experience has expanded to such a level that it exceeds the limited capacities of human memory. Therefore, if humanity desires to continue its progress, it is dependent upon the need to mechanize humanity's records so that we may not have to suffer becoming bogged down part way by overtaxing the limited capacities of our minds. Not only that, Bush imagines how much more enjoyable life would be if we were to experience the privilege of forgetting all the manifold things that we do not need to have immediately at hand, while feeling reassured by the presence of a machine capable of storing information and aiding us in finding information again whenever necessary.

Though the memex was never built, Bush's dream of a mechanical solution to overcome the natural limits of human memory, was supposed to be a desk-like machine with two projectors and various levers that—not unlike analog mixing consoles or digital mixing software—would enable a user to create permanent associative links between documents and

to retrieve them at will. Present and future documents were to be stored on microfilm and dropped into the machine as necessary. By depressing a lever, content placed at the top of the memex would be photographed into the next blank space in memex film. The concept of associative linking, which predates today's common practice of hyperlinking, illustrates Bush's desire not merely to 'extend' human memory, as the name of the machine implies, but to create machinery designed to reflect the workings of the human mind. Describing the propensity of humans to forget, Bush argues that "trails [memories] that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory" (Bush n.p.). The memex's associative trails, however, would not fade, thus enabling humans, in the most technophilic sense, to liberate themselves from the drudgery of remembering. According to Bush, the individual should not be burdened with repetitive thought processes when there are more powerful mechanical aids available. In other words, conceptual or declarative knowledge that an individual develops in the course of repetition, Bush contends, are "a fit matter to be relegated to the machine," so that humans may indulge in the procedural or, as Andrew D. Booth imagined, reserve their mental effort to "make those judgements in which aesthetic considerations are involved" (360).

From the very beginning, the development of computing technologies arose out of a frustration with the limits of human memory and the belief that these limits are an obstacle to continued human progress. As the mechanical solution to a natural problem, early pioneers regarded the computer as a technological upgrade to overcome human fallibility and, thus, necessary for humanity's future; but more importantly, the machine was branded as man's loyal servant, as the quintessential memory aid, capable of freeing the human mind to pursue other things. It is quite interesting to consider that technology company IBM first resisted to use the term 'computer' because the word originally denoted a particular human profession

before electronic computers became commercially available. To call a machine a computer was to imply job redundancy (Campbell-Kelly and Aspray 115).

Over the course of the last three decades, from the time when computers first became commercially available to our present era of ubiquitous computing, the job title 'computer' not only disappeared, but its electronic counterpart has become de rigeur in most people's lives. Yet, especially over the course of the last two decades, technophilic sentiments regarding digital media have been met more and more frequently with scholarship that problematizes the effects of technology on the human mind. The always-thereness of new media conditions a future that is predictable, that emphasizes the default. By saving the past, digital media are supposed to make knowing the future easier. While the impetus for the design and development of digital technologies in the course of the 20th century was grounded in the desire to extend human memory, to overcome its degradation, recent research indicates the extent to which digital media might actually be degrading the very thing that it was designed to save. We might, in fact, read against the grain of Bush's original argument to illustrate current concerns. Indeed, the title "As We May Think," and especially the use of the present conditional 'may' is highly ambiguous. On the one hand, it can refer to a future of humanity that is technologically enhanced: what wondrous things might we be able to ponder when we can offload our memories, our knowledge, into machines? On the other hand, however, 'may' can also indicate a form of sanctioning, an act of submission: what is given to us to think about? What kind of thinking may we be left with?

American cultural critic Nicholas Carr pointedly asked in 2008: "Is Google Making Us Stupid"? The use of search engines and online websites, Carr argues, harms a reader's "capacity for concentration and contemplation" ("Is Google Making Us Stupid?" n.p.). In his later book from 2010, *The Shallows: What the Internet Is Doing to Our Brains*, Carr presents several cognitive studies to support his overall argument that digital reading practices can, in

fact, degrade comprehension and knowledge retention rather than enrich them. In partial support of Carr's position, Katherine Hayles references studies conducted by cognitive scientist Stanislaus Dehaene who examined the neurological effects of traditional reading and showed that repetition of careful reading enhances synaptic connectivity within the brain ("How We Read" 69). So-called hyper-reading on the computer screen, in contrast, does not facilitate meditation on individual passages; instead, the hyper-reader responds to information overload by clicking too much, reading too little, and remembering even less.

The problem of hyper-reading, according to Carr, is ultimately a problem of and for memory; specifically, it results in a dismissal of the need to have a good memory. Hayles summarizes Carr's argument in the following way:

> For retention of more complex matters, the contents of working memory must be transferred to long term memory, preferably with repetitions to facilitate the integration of the new material with existing knowledge schemas. The small distractions involved with hypertext and Web reading—clicking on links, navigating a page, scrolling down or up, and so on—increase the cognitive load on working memory and thereby reduce the amount of new material it can hold. With linear reading, by contrast, the cognitive load is at a minimum, precisely because eye movements are more routine and fewer decisions need to be made about how to read the material and in what order. Hence the transfer to long-term memory happens more efficiently, especially when readers reread passages and pause to reflect on them as they go along. (68)

In an age where digital media technologies may condition what and how we remember as well as forget through the various software we use, the tenets and *technai* of the fourth canon may become critical counterpoints of reflection.

Productivity software is just one such area that demands more careful and critical attention. John R. McNair, for example, applies the fourth canon the design considerations that go into desktop icons and other elements of digital interfaces ("Computer Icons"), a question even more interesting today, given the increased sophistication of interface design and human-computer interaction. In their textbook, *Ancient Rhetorics for Contemporary Students*, Sharon Crowley and Deborah Hawhee consider memory's relevance in the computer age with regards to computer storage systems as forms of "electronic memory" that outperform human memory systems (328). While I find the notion of 'improvement' debatable, I agree that something like electronic memory needs to be set against human memory. As software companies have, over the years, consolidated more and more automated features into their offerings, productivity applications become the very sites where memory practices are negotiated.

When conceptualized as execution, software *does* something. It performs the encoded instructions, thereby making things happen. This apparent ability of software to generate a product or outcome has given cause to a number of studies around software within the humanities (Hayles 2005, Mackenzie 2005, Galloway 2006). Chun concludes that "[r]ather than getting caught up in speed then, what we must analyze, as we try to grasp a present that is always degenerating, are the ways in which ephemerality is made to endure" (173). As memory becomes enabled, embedded, and distributed in the user interfaces of software, memory practices become programmable—indeed, outsourceable. In this sense, digital technologies have increasingly played a role in establishing the conditions for seeing, for rendering phenomena visible while withdrawing others from view; in other words, for understanding the world.

Algorithms are the central building blocks of software. They are the coded instructions that software enlists to perform any given task. As plans of action or rules that

govern computational processes, algorithms in software in many ways prescribe and define the possible actions within these programmed spaces. Algorithms not only represent the operationality of software; as Mackenzie suggests, they also participate in defining the organization of professional practice (43). Algorithms reside at the nucleus of our information ecosystem, where they are used to sort, filter, suggest, recommend, summarize, map, and list information and content according to predefined parameters. Increasingly, we have come to rely on these programmable decision-makers to manage, curate, and organize the massive amount of information and data available to us, and to do so in a meaningful way. In this way, algorithms, and software, and digital media technologies do more than archive and mediate memory. The practices performed by algorithms in software reveal the possibility that digital media technologies and software become active in shaping the epistemic outlook of a community. Beer (2009) calls this capacity the "power of the algorithm," its ability "to shape social and cultural formations and impact directly on individual lives" (994). Algorithms are generative procedures that generate digital memory.

Therefore, we need to consider the consequences when digital memories—as epistemic representations—encounter memory as internal practice. Carruthers uses the term "educated memory" here to spotlight how the ancient and medieval notions of memory might be (re)examined today: "memory was much more than a matter of providing oneself with the means to compose and converse intelligently when books were not readily to hand, for it was in trained memory that one built character, judgment, citizenship, and piety" (9). There is a practical quality about the fourth canon that I explore further, and while much work remains to be done to turn memory into a mode of inquiry to examine the ability of humans to recall and mediate past experiences across a broad range of creative and professional activities we may think about memory as a set of techniques and strategies designed to meet applied and practical needs.

Finally, I want to acknowledge that my work is motivated by Brooke's *Lingua Fracta* in which he emphasizes that "memory is the one canon whose status as *practice* is in need of rehabilitation" (144). This idea of *memory-as-practice*, I argue, is a key element in lifting the fourth canon back into contemporary scholarship. By way of looking at digitally enabled mixing practice, I want to return the field's attention to the more traditional, practice-oriented conception of the fourth canon. At the same time, I will need to depart from earlier, more techno-enthusiastic conceptions of the fourth canon in the computer era. In particular, Crowley and Hawhee imagine

> Simonides seated before a speedy computer equipped with huge amounts of storage, plenty of memory and a fast graphics card, efficient word-processing software, a scanner, and quick access to the Web. We suspect that he would program his machine with one or several of the electronic memory systems that are now available, but he could program and install a version of the artificial memory system he created in the fifth century BCE, as well. Would he then quit using his mental memory system to remember things and their relations, relying instead only on his computer whenever he needed to remember something? We think not. We think he would continue to use both. In fact, interaction with his machine might stimulate Simonides to achieve even more dazzling feats of memory than those he displayed during the fifth century BCE. (328)

Crowley and Hawhee's seem to suggest a smooth and harmonious transition—in fact, symbiosis—between internal and external memory practices. In my view, that is debatable given the multi-layered digital literacy requirements that software poses to contemporary users.

2 AUDIO ENGINEERING AS TECHNE

> "Once we were finally done, the master tape was an endless puzzle of stitched-together fragments, made up of pieces from different mixes that were done days, weeks, or months apart….I came to understand just how much artifice was required to make something sound 'real.'"
>
> -- Glenn Berger, *Never Say No To a Rock Star*, 61

> "Sound pressure is what you feel from the music when it is piped through a PA at 120 decibels. One hundred and twenty decibels starts to rattle the organs in your body. As your body responds to resonant frequencies, everything becomes exciting. The place is hot, the crowd is optimistic, and the moment is theatrical, but we record makers, we have to shut our eyes, because in the end we cannot depend on decibels, resonant frequencies of nightclubs, or charisma. We have to create the illusions of sound pressure. We have to make things sound loud even though they are being played back quietly on a little iPod."
>
> -- Daniel Lanois, *Soul Mining*, 48

> "The mind is always looking ahead, it is continually in search of something which is more remote . . . whatever it discovers, it deposits by some mysterious process in the safe keeping of memory, which acts as a transmitting agent and hands on to the delivery what it has received from the imagination."
>
> -- Quintilian, *Institutes of Oratory*, 213-5

Mixing is both art and craft. It includes straightforward, technical procedures as well as creative activities. It involves both linear, and non-linear workflows. During the mixing of a song, engineers blend various sounds into a cohesive combination that satisfies various musical, sonic, technical, commercial and personal concerns. Similar to cinematography, professional music production and mixing is (still) a relatively young profession in the creative industries. Major developments such as the invention of multi-track recording, micro-level audio manipulation, and the digital audio workstation happened during the second half of the 20th century. Similarly, the roles and responsibilities of mixing engineers have also changed dramatically during that time period due to technological advancements that made it much easier to manipulate audio after it had been recorded. Prior to WWII and

before the invention of the condenser microphone at the beginning of the 20th century, early recordists approached their work empirically with experience and knowledge of the art being their only teachers. Working as technical staff for music labels at the time, sound engineers positioned performers inches from a sound-collecting recording horn so that the recording was better than the 'best seats in the house' for a live performance. They manipulated the relative physical positions of the singer and the accompanying instrumentalists to control overall sonic balance and volume and to allow prominent sounds such as the voice to come through clearly on the recording. Expertise in recording was to get the most fidelity in the moment of the actual recording. "From the time that commercial recording began," writes Schmidt Horning, "inventors and recordists sought to achieve more brilliant and lifelike sound, the successful attainment of which relied on the recordist's expertise with the tools of his trade" (22). During the first half of the 20th-century engineering was a matter of optimizing the technical performance of the recording medium. Mixing was, however, extremely limited to positioning the musicians, instructing them with respect to presence and tone control, and guiding vocalists on how close they should be in relation to the sound collecting horn. Any mistake in the recording from any of the involved musicians necessitated a retake.

After World War II, the field of audio production changed dramatically due to several developments both inside and outside the recording studio such as technological innovation, economic prosperity, and a growing demand for entertainment and consumer goods. With regards to early developments within the field, two inventions stand out: tape recording, which emerged in the 1940s, and multi-track recording, which was invented in the 1950s. Unlike disc recording, tape recording allowed for the editing and the unprecedented manipulation of recorded musical performances. In addition, its fidelity far exceeded that of the earlier disc recording medium so that tape soon became the default medium of recording

across the entertainment industry i.e., in music recording, film, and radio. Multitrack recording added a new dimension of creative and aesthetic freedom to the profession. It allowed for the recording of multiple sound sources onto the same tape, but as separate and discrete audio 'tracks,' which could then be further manipulated—what we now commonly understand as post-production in creative industries. Prior to that development, the production of recordings was limited to really only 'documenting' the actual live performances; and the whole performance was recorded to a single track. With multitracking available, engineers in the studio were suddenly able to adjust relative levels, manipulate the sonic characteristics of each individual track, even to create entirely new sounds that could not be reproduced in a live performance. Commenting on one of the early examples of a multitracked production, Les Pauls' "How High the Moon?," iconic mixing engineer Bruce Swedien exclaimed: "it had changed pop music forever . . . . [t]here wasn't a shred of reality in it—and it was wonderful" (Zak 11). Through the ingenuity of engineers like Les Paul and George Massenburg, music mixing became a matter of going beyond merely capturing live performances of music, but augmenting recordings with effects to create larger-than-life representations. Engineers began to use effects such as delay and reverb more selectively to augment the recordings. Errors in individual recordings could be solved without having to re-record the entire song with all of the musicians. Essentially, multi-track recording transformed a technical discipline into a creative profession, and the recording equipment became an instrument for creative expression.

These developments were met with a music industry that flourished in the post-WWII era, in large part by appealing to younger audiences, a younger cohort of independent recording engineers and producers emerged who embraced the music of their generation i.e., rock 'n' roll. Whereas established experts in the field had developed their expertise through years of experience, rock 'n' roll was about experimentation and creative expression. The late

forties and early fifties were a heyday for the development of independent studios all over the United States, often occupying underrepresented niche music markets. For example, Ahmet Ertegun founded Atlantic Records with Herb and Mariam Abramson in 1947. The label built its reputation primarily on its work within the emerging recording genre of rhythm and blues and artists such as Ray Charles, Joe Turner, and Ruth Brown. In addition, elements of what would eventually become rock 'n' roll had been emerging in various recordings in the wake of World War II. In 1953, a young Elvis Presley began recording demos at the Memphis Recording Service, home of Sun Records. In mid-1954, Sun Records released Presley's first big hit, "That's All Right," which not only catapulted Presley to stardom, but it also exemplified how recording and mixing engineers began to experiment with new sonic palettes and developed distinctive styles of sonic sculpting. Listeners began to embrace

Figure 2 Musicians arranged in front of a sound-recording horn in the 1920s.

records that had a more edgy, and low-fi sound. According to Schmidt Horning, "[i]n the burgeoning popular music field of post-war America, having a unique sound that differentiated one from another artist was becoming almost as important as the choice of material" (36).

The early fifties were really a heyday for independent studios all over the United States and Universal Recording in Chicago was part of that movement. The multi-talented entrepreneur behind Universal was Bill Putnam, described by famed engineer Bruce Swedien as "the father of modern recording as we know it today" (Cogan). Swedien further explains that "the processes and designs that we take for granted—the design of modern recording desks, the way components are laid out and the way they function, cue sends, echo returns, multi-track switching—they all originated in Bill's imagination" (Cogan). Magnetic tape and other recording technology developments allowed unprecedented levels to fine tune a

Figure 3 Bruce Swedien recording Michael Jackson's Thriller album on a Harrison console.

recorded performance. This empowered engineers to apply a compositional approach to the act of recording because songs could be build in separate stages. This brought new levels of control over the process and transformed established techniques and required skills.

Multitrack recording resulted in a significant expansion of creative agency, its widespread adoption resulted in the creation of multiple recording facilities nationwide, and technology aided the recordist's creative process. In 1970, *Billboard* proclaimed the recording studio "The Crucible of Creativity," No longer a facility for merely transferring an artist's performance to disc, the recording studio became "the chief tool of the producer…the final catalyst, the crucible wherein the talents of producer, artist, songwriter and musician may be brought together and into the market place and exposed to the ultimate consumer" (*Billboard 1970 International Directory of Recording Studios*, May 9, 1970, 6). It was in the recording studio where the transformation of music from a craft-based endeavor to one reliant on technology for its form and content further developed. As recording engineers sought to improve the sound of records and experimented with the technical affordances in the studio, their improvements gradually changed notions of authentic performances, "good" sound, or what constituted music. Glenn Berger describes these creative changes in the following way in his autobiography:

> Paul [Simon] was not satisfied with the whole performance of that tune ["Santa Monica"] from any of the [live] shows. So, painstakingly, Phil [Ramone] created a complete song by editing together fragments of multitrack from different performances across America, from California to the New Jersey Turnpike. We took a few measures from the concert in San Francisco, then a chorus from a theatre in Uniondale, finally a verse from Notre Dame in Indiana . . . . Paul [Simon] couldn't find one whole live, vocal performance [of "America"] that he liked, so he decided to replace much of his singing by

> overdubbing it in the studio . . . . As I watched [Paul] Simon replace each organic musical part with their bionic replacements, I began to wonder what "live" really meant. (Berger 45-6)

The studio was no longer the place to document the live playing of musicians, but rather became a workshop within which musicians, producers, and engineers collaborated on sound recordings that could either emulate live performances or exist as their own works of sonic art.

By the early 70s, 16 and then 24-track recording machines were the norm in recording studios. These were expensive machines, sometimes costing upwards of $100,000 (over half a million dollars if adjusted to inflation). And, of course, they were paired with large format mixing consoles that took up much of the control room and were similarly priced. The cost of the technology central to the task of multitrack recording, not to mention that of the professional microphones, and increasingly sophisticated peripheral equipment such as reverberation, delay, and compression devices, along with the studio space to house it, meant that access to such studios was strictly limited to those musicians fortunate enough to win a recording contract or foot the bill for studio time themselves. Those whose primary interest was in engineering or production roles most often found work at studios through a loosely evolving system of apprenticeships, working their way up from menial jobs to eventually sitting in the chair in front of the mixing desk.

As a result, many engineers developed unique mixing styles and approaches, and they became very secretive about their techniques because these techniques attracted clients. In his autobiography, Glenn Berger talks about observing his mentor, famed American engineer Phil Ramone:

> The mix was Ramone's chance to perform. As the song unfolded, with the instruments entering and falling out, with parts rising up to prominence and then

> blending back into the background, Phil continuously massaged the sliding volume controls called faders. He finessed these subtle relationships to create an emotional arc, in search of the combination that would have that spark where it all came together, sounded right, and most important, felt right. (47)

Here, it was the responsibility of the assistant—in this case Berger's—to call out fader moves: "'Track 13! Fade it out! Cross-fade to 12! Push the *charango*, now!'" (49). Total recall and automation first emerged in the late 1970s and completely revolutionized this crucial, yet tedious part of the mixing process. As Berger explains, "[w]e rehearsed all the changes in volume and proportion throughout the song, learning what Phil [Ramone] called the 'choreography.' I memorized all the moves as he perfected them. With each run through, as I learned the parts, I called out the alterations to him" (Berger 47-8). Total recall and automation reduced the necessity of finishing a mix in a single continuous outpouring of effort. A complex manual mix required several pairs of hands and practice runs for everyone to learn and remember their moves. Automation allowed interim storage of balances, moves, and rough mixes that could speed the final mix. Total recall, though laborious to reset, was a time-saver as well. Mixing began to be an iterative process rather than a performance. Inevitably, some producers and engineers considered reducing spontaneity detrimental to creative expertise. Then again, very few mix moves are done manually today. The next technological leap was the introduction of resettable consoles in the early 1980s, which paved the way for the DAWs and digital consoles of today.

The digital audio workstation revolutionized the art of music production. According to Théberge, the contemporary DAW is a "visually oriented, random-access form of technology that allows engineers to record not only 'tracks', in the traditional sense, but to operate at the sub-track level, freely editing, processing and moving bits of digital audio data around in ways that would be impossible in a linear, analog system" (82). One such DAW,

Pro Tools, debuted in 1991. It priced around $6000 (today, professional DAWs are sold in the range between $300 to $600). DAWs bestow upon engineers and increasingly songwriters and artists more than ever before in the history of recorded music the power to manipulate sound, as easily as changing words with a word processor. Some blame the DAW's manipulative power for declining standards of musicianship, bad music on the radio, excessive mediation by producers, and so forth. While DAWs do not oblige producers or musicians to fix anything, the relatively inexpensive price tag of DAWs and the subsequent myriad of software solutions that can now be instantiated as so-called plugins transformed the makeup of the audio engineering community: from a 'restricted access' and tightly-knit community of professionals to one that includes every level of skill. The audio technology industry understood these changes, and nowadays it is common practice for these companies to include extensive libraries of preset settings to help aspiring engineers mix music. This is, as the next chapters will show, both a blessing and a curse for mixing expertise.

In her analysis of the tacit skills developed by audio engineers in the first half of the twentieth century, Schmidt Horning (2004) identifies 'aural thinking' as a key way in which engineers attuned their sensibilities towards the particular needs of their role to produce records. In practice, aural thinking concerns an aptitude of the professional mixing engineer to identify and appraise the raw sounds that make up a song to be mixed and the ability to put them to use—both technically and aesthetically—towards a finished record. Mixing expertise means to have the ability to evaluate what sounds or sonic frequencies to keep or curtail and screen out, how the individual sounds will work within the overall sonic, architectural matrix of a recording and anticipate how they will be received by an imagined listening audience. It involves the intense development of listening skills so that the ear is tuned towards imagining the creative possibilities of a given sound source. To the attuned ear, open to creative possibility, distinct moments of sound come alive in terms of their creative potential just like

the finished sculpture that hides within the clay. As Grammy Award-winning engineer, Ed Cherney, explains: "Learning how to listen objectively[5] is an acquired skill. It takes a long time to learn how to sit in front of music and listen to it and be able to pick out the balances and the timbre and the interplay between the instruments, to make sense of it" (*Behind I* 14).

From a social science and cultural studies perspective, we may treat mixing as a form of professional *habitus*. From the unique vantage point of rhetorical scholarship, mixing is a form of *techne*. A familiar concept in rhetorical theory, the concept of *techne* has its roots in two epistemological traditions: the "humanist" liberal arts tradition, as illustrated by Quintilian and founded in normative conceptions of knowledge and subjectivity, but also what Atwill refers to as "an older model" of *techne* that is understood as art, notably in the writings of Protagoras, Isocrates, and Aristotle (5). Early sophists used *techne* to describe the knowledge they taught; Protagoras described his instruction as political techne; Isocrates referred to his instruction as logon techne, or the art of discourse. Martha Nussbaum explains in *The Fragility of Goodness*, the term *techne* was used in a number of ways in ancient Greek culture, with 'craft,' 'art,' and 'science' mentioned most commonly (94). Nussbaum argues that the ancient Greek word for techne was more inclusive than any equivalent term in our language, claiming that early in Greek culture techne was associated with episteme, which is usually translated as knowledge: "In fact, to judge from my own work and in the consensus of philologists, there is, at least through Plato's time, no systematic or general distinction

[5] We should treat Cherney's use of the attribute 'objective' with a grain of salt. Listening—be it professional or recreational—is an inherently subjective activity. The same 'mix in progress' will elicit different reactions from different listeners (even from the same listener when heard at different moments during the day). In addition, different engineers will all suggest different processing tweaks. The reason for this is that the human auditory system does not just transmit sonic vibrations straight from the air to our consciousness; it not only colors the raw sensory input through its own nonlinear response, but it also constantly adapts itself in response to incoming sounds—partly in order to extract the maximum information from them, and partly just to shield its sensitive physical components from damage. Although the fact that our hearing works like this is helpful in everyday life, it actually works against engineers in the context of mixing, casting a long shadow of doubt over every balancing and processing decision they make because it only takes a few seconds for our hearing system to compensate for imbalances, thereby hiding rather than revealing problems. It is, therefore, very common for engineers to take frequent breaks to (re)attune their ears.

between episteme and techne" (94). Nussbaum further argues that "[e]ven in some of Aristotle's more important writings on this topic the two terms are used interchangeably" (94). Although Aristotle ultimately splits techne from episteme in creating his triad of knowledge in *Nicomachean Ethics* (*episteme*, *techne*, and *phronesis*), Aristotle saw techne as "productive knowledge" and included within its domain a wide range of arts: medicine, military strategy, architecture, poetics, and rhetoric (Atwill 6). For Aristotle, techne is productive in that it brings forth art as "a state of capacity to make, involving a true course of reasoning" (1140a 10-12). "The aim of *techne*," John Wild writes, "is the *complete* permeation of action by plan . . . . The whole complex sequence in all its relations must first be grasped as a whole. Then, in light of this, a course of technical action must be charted which will really bring us to the end" (263). While methods, techniques, principles, and skills are important elements of *techne,* Aristotle's definition also includes reasoning which means that skills need to be accompanied by a deep, and comprehensive understanding of an art so that successful practice is not the result of mere chance, but a combination of a technical and creative expertise that takes into account the varied constraints within a given *techne.*

Music mixing does not happen in a vacuum. The decisions that engineers make for a mix are influenced by a number of conditions and constraints that are both natural and technical. First and foremost, the processing of audio is influenced by the limited range of human hearing which is between 20 Hz and 20,000 kHz. By comparison, dogs and cats can process sonic information up to 45,000 and 65,000 kHz respectively. Some mammals, like whales, can hear frequencies of up to 120,000 kHz. To make this natural constraint a bit more comprehensive for the layman, Glenn Berger explains in his autobiography that "the human ear can hear sounds from the low boom of thunder and the thumping bass from your sub-woofer to the sheen of cymbals and the sweet transparency that comes from the high frequencies where the air vibrates about 18,000 times a second" (201). Part of mixing

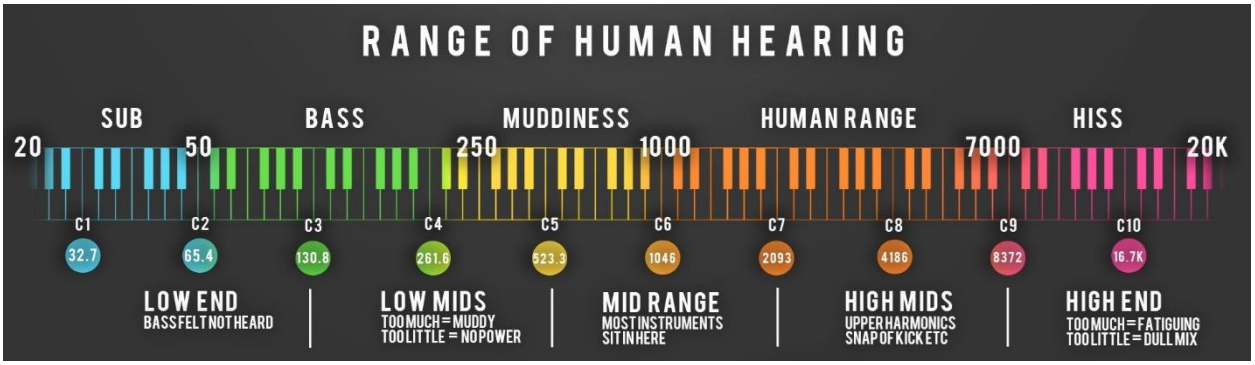

Figure 4 The range of human hearing - Infographic. Source: ProductionMusicLive.com

expertise is an inert understanding of this natural constraint and how to best deal with it technically and aesthetically to serve and satisfy both the client's artistic vision as well as commercial requirements.

Other constraints are more technical in nature. For one, engineers have to take into account a loudness ceiling imposed by the technical limitations of currently available sound-reproducing technologies. While some forms of distortion are quite pleasing to the human ear—and we will look at those in a bit more detail later in the chapter—this is not the type of clipping distortion that occurs when audio crosses the loudness ceiling. To make matters worse, engineers also have to take into account that different audio formats such as vinyl, CD, as well as formats used for online audio streaming such as MP3 or AAC, all set their loudness ceiling at different loudness levels. The engineer, therefore, has to anticipate the listening medium and adjust processing accordingly. This is part of the professional mixing *techne*, and it illustrates the role that memory and recollection plays.

Classical rhetorical theory understands *techne* and memory to be closely related. In the *Institutes of Oratory*, Quintilian remarks:

> For while we are saying one thing, we must be considering something else that we are going to say: consequently the mind is always looking ahead, it is continually in search of something which is more remote: on the other hand, whatever it discovers, it deposits by some mysterious process in the safe keeping

> of memory, which acts as a transmitting agent and hands on to the delivery what it has received from the imagination. (213-5)

Furthermore, we may deploy the concept of *kairos* i.e., the opportune moment for action, to function as a link between *techne* and memory. Both require a kind of 'attunement' between mixing knowledge and the work-at-hand. In the context of classical oratory, memory requires an attunement during the moment of performance. Trained public speakers leveraged *kairos* when they recognized the right time for recalling an illustrative example, an argument, and so on. Therefore, they needed a trained memory, especially when they were asked to speak without preparation (see Crowley and Hahee 317). In a similar fashion, mixing engineers develop finished mixes in their minds first. They carefully and critically listen to the raw audio facts, develop a clear opinion about what types of processing that is required to align both raw and imagined mix while remaining open to spontaneous moments of creative inspiration. In this context, choosing the equipment that allows engineers to hear (or 'monitor') their mixing work professionally is not a task to be taken lightly, because it is the window through which they view everything they do. Ultimately, the creation of a mix is a laborious and time-intensive process, and all of the decisions that go into a finished mix are geared towards appealing to a listening audience. But what makes a mix appealing? While there are many different opinions, generally engineers consider a mix successful if it satisfies four principal conditions or characteristics: clarity, separation, balance, and space.

- ***Clarity***. Every sound in a mix should be pristine and clear; there should be blurring of sounds, no unwanted noise, or other types of technical anomalies.
- ***Separation***. Instruments, especially those that serve important functions in the arrangement should be easily discernible. A great mix, even ones that are dense, will allow listeners to differentiate between individual sounds in the mix.

- ***Balance***. A commercially successful mix will have a good balance of sounds across the entire frequency spectrum. A mix that skews either too much towards low or high-frequency information will quickly become difficult to listen to. In addition, the individual recordings that contribute to the mixed song should also be balanced between the left and right speakers.
- ***Space***. In addition to the left/right balance, a successful mix will offer listeners a sense of perceived depths. Here, conventions typically vary based on the genre of music. Front to back balance is typically accomplished with artificial reverberation and other time-based effects such as delay.

These four conditions guide and structure the work of the engineer and they align with the vision of the client as well as commercial considerations pertaining to genre, arrangement, and instrumentation. The following section will illustrate the work that goes into a mixing session in a bit more detail.

2.1 A Primer on Music Mixing Principles and Workflows

Observing seasoned mix engineers at work can be a very deceptive thing because they often seem to jump at random between different mixing tasks. In reality, however, they have developed such an intuitive grasp of mixing that they can deal with individual mix issues as they arise without the risk of neglecting the bigger, sonic picture. Watching mixing experts illustrates the nonlinearity of mixing, a fluidity that is the result of many years of training and a consequence of knowing one's equipment inside and out. For the layman, it seems that mixing does not follow a strict process, and to some degree this is true. There are as many approaches to mixing as there are mixing engineers at work. However, the mixing process can, in fact, be segmented into several main elements. What follows is an overview and brief discussion for each part in the context of mixing a pop song.

***Prepping the Mix*.** Assuming that we are talking about a 'pure' mixing session i.e., a session not recorded by the same engineer, then the first thing that engineers would do is to create a new session in their digital audio workstation of choice.[6] The next step is to import the individual tracks of the song into the session and to edit the tempo setting, or BPM (beats per minute) setting so that the DAW is able to align a tempo grid onto the imported tracks. Moreover, a saved BPM setting also allows engineers to program delay and echo effects via musical values rather than having to set delays in milliseconds. Once the tracks are imported and aligned with on the tempo grid, the engineer starts listening through each of the tracks individually to take inventory and assess the recording quality of each individual track. While not an exhaustive list, a few of the most common issues that recorded tracks may have are:

- Audio cancellation and phasing effects due to misaligned microphones during the preceding recording session
- Tuning and pitch correction issues
- Musical groove problems
- Unwanted noise and popping sounds

Aside from dealing with any type of track quality control issues and solving them with the help of various, specialized processors, engineers also use this step to begin building a mental (or aural) picture for the subsequent mixing session of the song. Part of this is to identify important and prominent elements in the recordings.

Keeping current genre conventions and commercial listening expectations in mind, the engineer identifies what we might call 'sonic' anchors around which the mix will eventually be built. Genres, here, function as commonly agreed upon retrieval cues necessary to recall and use/expect particular listening conventions and mixing strategies. Most of the

[6] Most often this would be Avid's *Pro Tools* which is still the most widespread software solution in today's mixing studios.

time, especially in popular music, the most important elements include the vocal, drums, and also the bass guitar. These have to be loud and present in the finished mix. In addition, engineers look for possible ‘gems’ in the recordings such as an interesting lick that a guitar plays in the middle section or a creative, arpeggiated synth melody that only happens in the choruses. While these little parts might still be masked by other instruments when playing back the unprocessed sounds, the engineer takes a written or mental note to ensure that these parts will come out in the final mix.

Creating a Balance. Finding a suitable balance is the next step in the process. This task involves setting the relative volume levels of the tracks and panning sounds off center to the left speaker or to the right speaker. This task is again usually guided by established genre conventions. Often, an initial balance is achieved by approaching the balancing task hierarchically i.e., building up the mix in stages. The most prominent instruments such as drums, bass, and vocals are tackled first. Then, the remaining instrumentation is brought in progressively until a complete, basic mix is playing. Some genres of music have stricter rules than others. For example, in rock, pop, and big band music it has become common practice to place instruments in a sonic space just as they would be set up on a live stage. Panning is a powerful tool for mixing engineers to create the illusion for listeners that they are experiencing a live performance on stage. In order to obtain the most ‘natural’ panning of a drum set, for example, mixing engineers commonly begin by spreading a stereo representation of the drum kit left and right. Then they listen for the placement of each piece of the drum set and place the recorded signals accordingly. The kick and snare drums are usually kept in the center of the stereo spectrum, while hi-hat and tom-toms are usually placed in relation to their stereo representation. However, true stereo realism is not the goal. The attribute ‘natural’ can be misleading. The reality of mainstream record production is that panning is usually carried out for solid technical reasons, whereas the rest is done purely on

the grounds of personal taste with scant regard for any notion of stereo realism. For example, most drum-kit recordings usually spread the instruments widely across the stereo picture although such listening experience would occur only if the listener was actually seated on the drum stool.

Cues for creating a volume and panning balance do not just come from genre conventions. The song's arrangement also provides vital information for the engineer to create a starting balance of the instrumentation. The arrangement structures the entire listening experience. If we think of the basic musical material in a production consisting of lyrics, melodies, and chords, then the arrangement of that material establishes all the other elements that make up that piece of music. For a pop song that uses verses, choruses, and maybe an interluding bridge, for example, these elements include the specific instrumentation at different points in the arrangement, the exact distribution of harmonies and notes across the pitch range of instruments, the particular playing techniques and styles used by each performer in the verses and choruses, and the precise rhythmic configurations of the song's groove for each section. The job of the engineer is to understand the arrangement, to know when and where to support it with sound processing, and to know which tracks carry each section of the song. In order to ensure clarity and separation, one approach is to feature a limited selection of instruments at any one section in the song (usually three to four) in order to maintain the listener's interest and support the buildup of the production as a whole.

Shaping Sounds & Sculpting the Mix. Many of the developments in audio technology equipment are designed to allow the 'shaping' of sounds. These include various types of frequency and dynamic signal processors, reverberation as well as echo, modulation, and distortion effects. This is where the creative, non-linear characteristic of the mixing practice is most evident. Here, a compressor is one of the most widely used tools. Compression reduces the level differences between the quiet and load parts of a vocalist's performance, for

example. As an automatic volume control, a compressor makes it easier for the engineer to find a static volume fader setting that works for a track over the course of the song. What happens is that the compressor evens out discrepancies in volume within a given audio recording. All the compressor needs to know is which signals the engineer considers to be too loud. This is where the engineer sets the so-called loudness threshold. What can be a little confusing, though, is that this control is implemented on different compressors in quite different ways.

From a mix perspective, the primary purpose of compression is to achieve a stable balance. However, while the technical rationale to use compression is to control volume imbalances, in practice mix engineers utilize compressors usually for more reasons than just to reduce volume gain. They may also change the tone of processed signals quite a lot, or they are used to blend two or more tracks together. Asked about sharing one of his many little mixing secrets, American producer Jim Scott, known for his work with American country band *Dixie Chicks*, reveals:

> One of the tricks Lee DeCarlo taught me which I still use to this very day is to put the bass and drums through the same compressor. It's something The Beatles engineers used to do, too, way back when. Even if the bass and the drums aren't really playing together all that well, when you put them through the same compressor, they usually will, amazingly, actually glue together: you can feel it and hear it. That's an old, old trick, but I still use it and it still really works. (Behind *II* 93)

A crucial element of the mixing process is to find ways of dealing with audio signal information in the low, middle, and upper parts of the frequency range of human hearing. Drums, especially the kick drum, and the bass often occupy the lower parts of the frequency spectrum. This is the area that is more felt than heard while listening. A compressor that

receives audio information from both the drums and the bass adds a combinatory, sonic nuance to a mix that gives the illusion that these audio elements are in lockstep. Dynamics processing provides the tools to balance all the audio events in an individual track's timeline in order to find a single, stable, and suitable fader setting for that mixer channel.

When the mix as a whole is concerned a special type of compressor, a so-called limiter, is used to achieve perceived loudness maximization without unacceptably compromising other qualities of the production. Usually genre-dependent, the use of a limiter and how it is set reflects the instrumentation of the song, the expectations of the targeted listening medium, and potential wishes of the client. For example, a jazz record will not be mixed as loud as a pop record, and a blues record will not sound louder than a heavy metal record, and so forth. Over time, engineers learn to understand common loudness processing options and how they relate to the specific loudness requirements of various commercial release formats such as vinyl, CD, or MP3. However, dealing with loudness issues is only half the story in a mix because there will normally be frequency-domain balance problems as well that need to be addressed. Solving these kinds of problems is the job of the equalizer.

An equalizer adjusts the levels of different frequency regions relative to each other. It typically consists of a variety of different filter curve types such as so-called shelving and peaking filters. Each of these filters can change the frequency balance of a sound in a different way. Equalizers are used to tackle frequency-domain imbalances. To understand why equalization is so vital in creating a good mix balance, we need to understand a phenomenon called "frequency masking." Whenever several instruments play together and one of them exerts a lot of sonic energy in a particular region of the frequency spectrum, then our aural perception will be desensitized to that frequency region as far as the other instruments are concerned. If the drum cymbals fill up the frequency spectrum above 5,000 Hz, for instance, we will perceive this frequency range a lot less well in the lead vocal. In

other words, the cymbals will be “masking” the vocal in that particular frequency region. While the vocal might sound great and bright on its own, the moment the cymbals are added it will appear dull. To retain apparently the same vocal sound against the cymbals, an engineer would either reduce the volume of the cymbal frequencies above that frequency range or exaggerate this range in the vocal sound. Equalization helps to create separation between instruments. This type of equalization processing may make individual sounds a lot less subjectively appealing when played on their own, either because certain frequency regions have been exaggerated to overcome masking from less important instruments or because some frequencies have been cut to avoid masking more important ones. Yet, a good equalization setting is not necessarily the one that makes an instrument sound best when played back in isolation.

Aside from compression and equalization, engineers utilize a variety of sweetening effects. The most common effect in this category is artificial reverberation. Originally designed to simulate the sonic reflections that bounce off boundaries in a real acoustic space, engineers use reverberation units to simulate realism to unnatural-sounding, closely recorded instruments. Back in the 1950s and 1960s, not every studio possessed naturally good acoustics, so engineers devised means of compensating for this, borrowing techniques from radio and motion pictures. Artificial echo had been used in broadcasting and film sound since the 1930s to create specific dramatic effects (Schmidt-Horning 37). Two early types, called plate and spring reverbs, found common usage in the 1960s and 1970s. The audio signal is used to set off vibrations in a bit of metal, and then the reflections of these vibrations are captured using sound-capturing pickups. While neither design is good at simulating realistic spaces, both are (still) highly regarded in the industry today, being well-suited to creative tonal and sustain enhancements as well.

Part of the popularity of reverb is that it can enhance several aspects of a song simultaneously; it has the power to enhance the following significant elements:

- *Sonic Blend and Perceived Depth*. Reverb is used to create a more cohesive sound by making separately recorded instruments sound as if they belong together in the same space. An instrument that isn't at all blended sounds upfront and close to the listener, whereas an instrument that blends well is pushed more into the background, away from the listener.
- *Size*. Artificial reverb can increase the apparent dimensions of the acoustic environment, making it sound as if the tracks were recorded in a larger (and maybe better-sounding) room. In addition, if any given instrument excites the simulated reverberation noticeably, then it will appear larger and more powerful to the listener even if it is relatively low in volume level and well-blended with the rest of the instrumentation. Reverb can increase the size of both the whole mix and individual instruments.
- *Sustain*. Because echoes are essentially delayed versions of the effect’s input, any reverberation effectively increases the sustain of a sound it's added to.
- *Spread*. The simulated echoes in most artificial reverberators are distributed across much of the stereo image. This spreads sonic information more evenly across the picture and may also increase the apparent stereo width of individual processed tracks, or indeed the whole mix.

In a typical mixing session, a reverb effect unit is inserted onto a dedicated send-and-return channel. Such a channel can receive audio signals from any other channel in the mixer. The signal from the to-be-processed instrument is, then, partially routed to the reverb channel. This means that for the final mix the reverb effect is excluded from affecting any of the processing decisions that already happens on the dry recording channel. In addition, the

volume levels of dry recording and reverb effect can be set independently. And last but not least importantly, multiple audio tracks can be sent to the same reverb to achieve the aforementioned blend of instruments as well as overall sonic depth. Reverb effects are not the only types of time-based and modulation effects that one commonly finds on a send-and-return channel. In fact, the majority of effects of this kind are used in such fashion. Delay is one of them. A delay effect creates patterns of echoes that are typically much simpler than those of a reverb. Delays introduce complexity and a sense of fullness to any element in a mix. The amplitude, frequency response, timing and length of delayed acoustic signals provide powerful cues for localization and determining the perceived size of the sonic environment in which the song lives. When delays are artificially added to sounds in a mix they can add a sense of recognizable depth and space that adds intelligibility and presence. Additionally, delays are often exchanged for reverbs in a mixing session because of the way delays can deliver reverb-style enhancements in more precise and targeted ways. For many upfront modern productions, in fact, delays may be more suitable than reverbs, simply because they take up less sonic space in a mix.

Although people take great pains to minimize distortion a lot of the time in record production, distortion is, yet, another sound-shaping effect often used during mixing sessions because it offers creative sound processing possibilities as well. Distortion devices add new musical harmonics to the source signal, and because the device automatically processes sound frequencies that are usually related in some way to the frequencies of the source, they retain a musical connection. In other words, distortion gives engineers the opportunity to change the timbre of an instrument without substantially altering its musical function in the arrangement. There are many electrical devices that can create musically useful distortion, and many of these have now been digitally modeled to be used in digital audio workstations. Among those are tape machines, guitar amplifiers, effects pedals, vacuum tubes, transistors,

and transformers. Some of these devices such as sub-harmonic synthesizers serve special purposes by only affecting a certain subset of an instrument's or a song's overall frequency range. In the case of the sub-harmonic synthesizer, this would be the lowest parts of the frequency spectrum.

Another way to affect and change a signal's timbre is to align the source with a pre-recorded and pre-processed sample. This technique is most commonly used for the elements of a drum kit such as the kick drum, the snare, or the tom-toms. If one of these fails to satisfy the genre or the client's vision as well as in cases where the recording just did not hold up sonically to the desired sonic result, samples add a much wider scope for tailoring the timbre of the audio source to suit the production. Whereas equalization can only adjust frequencies that are already there, samples add something new to a sound instead. All of these effects act as 'sweeteners' that augment the listening experience beyond the basic balance in order to (re)present the original material in a more flattering, commercially appealing light.

Automating the Mix. This is commonly the last principal step in the mixing process and in today's digital mixing software practically any mix or effect parameter can be automated. While balancing and shaping the mix goes a long way towards the finished record, engineers understand that the listener's ear is constantly "refocusing" on different parts over the course of the song. To make a visual analogy, it's a bit like watching a game of soccer on television. The camera focuses the attention on the player in possession of the ball while the other players are only in peripheral vision or off-camera and hence are seen in less detail. When the ball is passed to a different player, the camera shifts our focus to the receiver of the pass, and so on. Listening to music works in similar ways as we usually focus our attention on one thing at a time. The job of the mix engineer is to direct the listener's attention toward what is most important in the track at any given moment.

Automation is the last crucial step towards accomplishing that goal. Automation allows engineers to store or 'record' mixing decisions directly into the memory banks of the computer and have the computer 'play back' these decisions. The most common application in the course of a mixing session concerns volume automation. In order to create volume consistencies or adjust volume for creative effects, engineers put a mixing console in 'record' mode, hit play and then 'ride' the volume fader of an individual track such as the main vocal. The volume adjustments are then stored into the memory banks of the computer, so that the next time the song plays the fader movements will be controlled by the computer chip. Automation is, of course, inextricably tied to the development and implementation of computer chips into audio mixing console equipment in the course of the 1980s. "Back in the 1970s," Glenn Berger reminisces,

> there was no automation of mixes. Since the advent of digital technology in the following decades, every move in a mix can be remembered – you make a [manual] modification [such as a fader ride] once and the computer will replicate that change eternally. But in ye olde days, we crafted mixes by hand, starting fresh each time. It was artisanal. Though this method could be nerve-wracking, it had its advantages; it allowed for the serendipitous moment. Sometimes an imperceptible nudge of a fader would allow magic to occur. (47)

Automation of virtually any control and parameter used during mixing is, thus, a rather recent development, and to some degree, it prefigured the development of subsequent devices that are built around 'smart' mixing algorithms, which I will discuss in more depth in subsequent chapters. One area where automation augments a song is to change the level of reverberation and delay effect between arrangement sections. The most common configuration is for verses to feel more intimate, drier, and closer whereas the choruses are bigger and more live sounding. A reverb level that makes sense for verses does not necessarily make sense for

choruses. Therefore, engineers frequently ride the level of reverbs to better distinguish one section from another. Other moments when engineers rely on automation is to intensify musical factors such as instrument timbre and stereo width. To do that, engineers listen to the moment-by-moment variations in a track, build a mental picture from this information and record a pass of automation information on top of the to-be-processed track(s).

As emphasized at the beginning of this section, a good mix is one that satisfies technical and aesthetic requirements with regards to clarity, separation, balance, and space. Engineers go to great length ensuring that every aspect and element of a mix, that every pitch and every noise, every note and its sustain, every moment in time, and every region of the frequency spectrum is properly addressed. All of these decisions are influenced and shaped by technology. This has always been the case regarding the mixing profession. However, to speak of the impact of technology on practices of music production seems to some extent a strange proposition for our conventional experience of music has always been a technologized one anyway. A perusal of the literature on the history of recording technology reveals the extent to which technology has not only shaped our experience of music but has provided much of its form and culture. As documented by Millard (1995), Negus (1992), Frith (1986, 1992), Middleton (1990), Katz (1999, 2004), and others, the history of sound recording demonstrates the extent to which technological developments have influenced the ways we experience music; and by the same token, how music is produced.

In that regard, the *techne* of mixing has developed in lockstep with technological change. Aristotle's understanding of *techne* as productive knowledge, Janet Atwill argues, is "always situated in some form of social exchange, art can never be concerned with determinate knowledge or value . . . productive knowledge has no external arbiter, no final judge, but only 'makers' and 'users' who change with every exercise of an art" (176). Atwill claims that art, or productive knowledge, lies at the heart of Aristotle's teleological

perspective, and her book, *Rhetoric Reclaimed*, represents a desire to revise "the scholarly neglect of Aristotle's domain of productive knowledge [as it] bears witness to the power of the philosophical paradigm to obscure alternative, situated standards of knowledge and value" (173, 11). As professional communities such as the audio engineering community incorporate more and more digital technologies into their field of practice, it becomes crucial to seek an understanding of the relations between our conceptions of *techne* and current technology use. Although Atwill oversimplifies the etymological connection between *techne* and technology, merely stating that technology is an "obvious cognate of *techne*," she notes that the distinctions between art, craft, and instrumental knowledge that we are accustomed to nowadays were largely "ignored" in ancient conceptions of *techne* (53). Practicing an art involved learning the ability to navigate shifting and multiple strategies; this ability to navigate these strategies begins with memory. And thus, the prospect of digital aids to compensate for lack of expertise and skill i.e., the availability to use machine-learning to simulate mixing proficiency has several implications for professional expertise. The subsequent chapters will look at these implications in turn.

3 MAKING MEMORIES, CREATING ORDER

> "Memory is one of the five divisions of ancient and medieval rhetoric; it was regarded, moreover, by more than one writer on the subject as the 'noblest' of all these, the basis for the rest." (9)
>
> -- Mary Carruthers, *The Book of Memory*, 9

> "Note-keeping is a big part of what I do. There is nothing like being fully informed: knowledge equals ease of operation."
>
> -- Daniel Lanois, *Soul Mining*, 13

"Wow," I hear my friend exclaim as he walks past me behind the sofa in the living room. "What do you mean?" I ask facing him. "Looks like that guy is flying a spaceship!" I turn back, taking another look at the images flickering on the television, and respond with a chuckle: "Yeah, looks like it, does not it?" This brief exchange happened while I was watching an interview posted on YouTube that features American audio engineer and producer, Jack Joseph Puig, or 'JJP' as he's commonly known in the industry. JJP is a recording and mixing veteran who has worked with several Grammy Award-winning artists like The Goo Goo Dolls, Sheryl Crow, John Mayer, and No Doubt. The interview, in which JJP describes his early years at the famed Ocean Way Studios in Los Angeles, California, was taped at JJP's workplace which boasts a staggering amount of audio recording and mixing equipment with pieces of hardware stacked from floor to ceiling against each wall in the room. With the bright-lid control indicators lid on all the hardware unit in his studio, one does have the impression as if JJP's workplace is out of this world. Technology seems to engulf Puig in his studio, or we can go with my friend's assessment: Puig is flying a spaceship.

Figure 5 Jack Joseph Puig in his mix room at Ocean Way Studios in Los Angeles, CA.

It was this brief encounter with my friend that sparked the idea for this chapter. It was the moment when I began to more fully and more critically reflect about the actual workplaces of mixing engineers, and how the arrangement of all the tools they use in this space correspond to notions of workflow and efficiency.

Jack Joseph Puig's mix room i.e., his collection of sound-shaping tools and the way they are set up, is arranged purposefully to facilitate his professional (creative) practice. From the large format mixing console on the left to which all the tracks of a song are routed to the various outboard compressors, equalizers, limiters, effects units, and so forth around the room, each piece contributes in one way or another to his mixing process. Therefore, it is safe to assume that the arrangement i.e., the placement of each individual piece of hardware follows a carefully thought-out plan, a tried-and-true strategy developed and adjusted by JJP over the years that suits and facilitates his creative workflow. For example, if a vocal requires more punch, and he wouldn't receive that from the built-in channel processors on his console, we might very well see him sending the signal to a dedicated and pre-routed outboard compressor behind his chair, then wheeling over to the unit to adjust certain parameters as he

listens to the track until he is satisfied with the result. Moreover, it is safe to assume that whenever JJP hears a problem with a processed track he would know intuitively not only which processor needed to be dialed in but also where the processing unit was located in his mix room.

Not unlike many other engineers who came up in the analog era of mixing and have accumulated a similarly large number of analog processing tools in their studios like Michael Brauer, Vance Powell, and Chris Lord-Alge, Jack Joseph Puig's workflow involves a constant back and forth movement among strategically placed units inside the mapped-out space of the mix room, and after many years of experience, we may assume that JJP and his peers do not even have to think about moving their bodies from one sound shaping device to another anymore. In other words, engineers like Jack Joseph Puig have developed expertise in making the technology 'disappear'; they don't have to think about the physical arrangement of knobs on a console or the front panel of a mixing device anymore. Any type of physical movement within the creative space becomes second nature to the point where the engineer may begin to disregard the actual movement and, instead, focus exclusively on

Figure 6 Michael Brauer's mix room at Electric Lady Studios in New York City.

creative ideas and their technical execution. This is not to suggest, of course, that these arrangements aren't prone to change. Mixing professionals frequently make adjustments to their mixing setups, either because of economic considerations or matters of personal taste.[7] Engineers have developed conventions for setting up the tools in the physical mixing space so that the arrangement works for them, that it facilitates creativity and also encourages an efficient workflow. As such, the physical space of music mixing may be regarded as a manifestation of an imaginary space in which the engineer arranges artifacts capable of manipulating sound in a purposeful way to foster their professional practice and creative output.

The same principles, as we will see in this chapter, also apply to the digital space of music mixing. In fact, they might be even more prevalent due to the constraints of the computer screen coupled with the windowed/layered use experience of current productivity software solutions. Here, the classical tenets of the fourth canon of rhetoric—as concrete strategies of arrangement and placement—can help make sense of those features in current professional software that structure and clarify the digital work environment. Greek and Roman public speakers developed strategies for the purpose of arranging content in the inner recesses of memory. This purely practical activity developed into a powerful set of skills for recollection, the so-called *ars memoriae* (see Yates 1966). And looking at classical texts, this was the kind of art worth having.

3.1 Memoria as an Affair of Space and Segmentation

In fact, a trained memory was a sign of professional expertise and even fame. From its classical conception, the art of memory was considered a powerful tool to be used not only to

[7] We may re-think the history of recorded music as the emergence and evolution of tools to manipulate the realm of the 'possible,' and the current transitional moment from analog to digital appears as a moment of rupture for the workflow principles of an entire generation of engineers.

memorize speeches by rote but, in fact, to retain and recall knowledge of all sorts, and do so even *ex tempore*. A good, well-stocked memory was a valuable asset that required maintenance and dedication. Just like external memories, it had to be updated, added to, and indexed at set intervals: an invisible, but painstaking process of management. Erasmus taught that "the best memory is based on three most important things, namely study, order, and care" (qtd. in Yates 127). "For Ramus," Rossi argues, "memoria had a very specific task: it was an instrument for introducing order into both understanding and discourse. As such it can neither be omitted nor neglected by the orator" (100).

Bringing order into chaos is, for the art of memory, an affair of space. Both the *Dissoi Logoi* and early Platonic dialogues that date back to 400 – 390 BCE, ground the art of memory in considerations of architecture. The *Rhetorica Ad Herennium* describes that "memory consists of backgrounds and images" (III. xvi. 29). While Aristotle and Augustine focus on the temporal nature of memories, as Mary Carruthers argues, most authors, who describe to province of memory, connect the temporal to the spatial, such as Albert Magnus in "On the Good": "place is required for the mental task of recollection" (qtd. in Carruthers *Craft* 13). Memories are distinguished from one another through their imagined, spatial relationships.[8] As Mary Carruthers observes, memory places "are entirely pragmatic: they are cognitive schemas rather than objects" (13).

This architectural art is, according to legend, attributed to the poet Simonides, who lived circa 556 – 468 BCE. The story of the moment Simonides invented the art of memory is attested primarily by Roman sources—Cicero, Quintilian, Pliny, and others. As the story goes, Simonides from the island of Ceos attends a banquet given by a Thessalonian nobleman. After reciting some ill-received poetry, Simonides is summoned outside the banquet hall by

[8] The ties between memory and space have also been important in the twentieth century as historians have realized the importance of materiality on memory. For example, many theorists have observed the impact of physical statues and memorials on public memory (see Cohen, Driggs et al.; Levinson;; Savage; Schwartz).

two visitors. During Simonides' absence, the roof of the banquet hall collapses, killing everyone inside. When relatives come to collect the victims, they discover the corpses so badly maimed that identification seems impossible. Simonides, however, is able to recall the exact spatial arrangement of the banquet and the location of each guest at the table and thereby identifies the bodies.

The strategy used by Simonides is commonly referred to as the *loci* method. According to Cicero in *De Oratore*, Simonides concludes from his banquet experience that

> persons desiring to train this faculty (of memory) must select places and form mental images of the things they wish to remember and store those images in the places, so that the order of the places will preserve the order of the things, and the images of the things will denote the things themselves, and we shall employ the places and images respectively as a wax writing tablet and the letters written on it. (II.lxxxvii)

Loci were similar to real spaces, such as the rooms in a house. Professional speakers would use the method to build out entire speeches, whereby the room acted as a symbolic reference to corresponding parts of a speech. The *loci* method, then, aided the orator in the act of delivery as he would merely have to move mentally from one room to another.

Public speakers turned memory into a clearly organized and easily accessible imaginary space that they could subsequently fill with content. In their minds, practitioners would picture houses, temples, palaces, or parks, and each content subject to be remembered was to be positioned in strategic places along an imaginary walkthrough. Particularly vivid images were placed after every fifth locus, possibly so that the organization of a speech could be traced on the fingers (Sadoski and Paivio 13). As Frances A. Yates explains, the rhetorician treated architecture as a writing substrate, on which images that connect to the objects to be remembered, were inscribed. She states: "The art of memory is like an inner

writing. Those who know the letters of the alphabet can write down what is dictated to them and read out what they have written. Likewise those who have learned mnemonics can set in places what they have heard and deliver it from memory" (6-7). In order not to burden the memory unnecessarily, most classical treatises recommend choosing buildings that actually existed and with which one was familiar; that way the imagined space would remain highly adaptable and flexible for remembering both content and know-how.

Recollection strategies remained important well into the Renaissance. Dante's *Divine Comedy*, for example, emphasized the faculty of imagination through an elaborate system of *loci*, with the poem based on locations in hell, purgatory, and heaven (Yates 22). However, during the Renaissance more imaginative memory systems emerged. Symbolic imagery became the means by which to develop and retain knowledge. As Sadoski and Paivio observe in *Imagery and Text*: "Some renaissance scholars believed that through the faculty of imagination and elaborate imaginal memory systems, the entire universe could be understood" (21). One of the most complicated memory systems ever designed was created by Giordano Bruno. In this abstract system, Bruno combined mystical numbers, stars and planets, and letters from several different alphabets. While his highly complicated system relied on esoteric occult references, it reflects the importance that many Renaissance scholars put not only on imagery but on forms of symbolic arrangement through artificial memory systems as well.

In the fifteenth century, Giulio Camillo worked to develop a highly complex theater of memory which would employ the "performance of memory" as a means of locating and dramatizing knowledge of the whole universe. While no trace is left of his theater of memory, Yates explains that Camillo's theater was a wooden building in the form of an amphitheater. The theater was divided into seven sections, so that when attendees stood on the stage and gazed out into the auditorium, they would see seven arches, spanning seven rising tiers. As

Peter Matussek explains in "The Renaissance of the Theater of Memory," these seven sections represented the seven planets known at the time—the divine macrocosm of alchemical astrology. The seven tiers that rose up from them, coded by motifs from classical mythology, represented the seven spheres of the sublunary down to the elementary microcosm. On each of these stood emblematic images and signs, next to compartments for scrolls. The exact operation of the theater, however, remains a mystery. Still, Camillo's theater of memory indicates that spatial organizations and movements are crucial to coalescing abstract ideas. While Camillo's theater of memory is strongly influenced by ancient theories of memory such as the *loci* method, it also prefigures more recent methods and processes of memory. Yates connects Camillo's theater, for instance, with the mechanism of the digital calculator, leading other scholars to connect his theater to computer programming and virtual reality (see the work of Lina Bolzoni, Hartmut Winkler, and Stephen Boyd Davis, for example).

Aside from using imaginary architectures, professional speakers also relied on strategies of segmentation. Quintilian, who is skeptical of architectural methods, advocates for the segmentation of texts into small, easily digestible chunks, and he seems to imply that dividing passages literally on the page, in writing, is a good way to go about it. His main advice for memorizing an oration is to divide the whole into smaller parts where the subdivisions should neither be too lengthy nor too short as "otherwise they will be too many in number" (11.2). Fifth-century rhetorician Martianus Capella references the *loci* method as well but explains that it would "require much practice and labour," which is why "it is customarily advised that we should write down the things which we wish easily to retain, so that if the material is lengthy, being divided into parts it may more easily stick in memory" (qtd. in Yates 51).

For the clearest example of a system of numbered segmentations, Mary Carruthers points to a text by Hugh of St. Victor (d. 1141) called "De Tribus Maximis Circumstantiis Gestorum," which she translates as "The Three Best Memory Aids for Learning History." In this text, St. Victor applies segmentation principles to the memorization of religious psalms. According to Frances Yates:

> Surely they were the things belonging to salvation or damnation, the articles of the faith, the roads to heaven through virtue and to hell through vices. These were the things which it sculptured in places on its churches and cathedrals, painted in its windows and frescoes. And these were the things which it wished chiefly to remember by the art of memory, which was to be used to fix in memory the complex material of medieval didactic thought. (55)

While St. Victor's method is inspired by the display of artifacts of divinity, it involved that students would form mental grids in their minds numbered from 1 to 150, each numbered space corresponding to one of the psalms. Then they would attach the incipit of each psalm to its proper number, the incipit being the right amount of text that can be seen in a mental glance. Finally, mental grids were to be imposed onto each psalm as well to subdivide each into segments. Once judiciously secured in these nested mental grids, students would be able to successfully "retain . . . the whole series one verse at a time; first by dividing and marking off the book by [whole] psalms and then each psalm by verses" (Yates 55). What the mind cannot recall in a single expanse it can recall in brief, segmented, numbered units. This scheme utilizing numbered segments, Carruthers argues, extends back to the late Roman Empire, for both St. Augustine (d. 430) and St. Jerome (d. 420) refer to the numbered orderings of the Psalms in such a way that suggests it was a teachable strategy for recollection (Carruthers 96-7).

While memories exert an enormous influence on human life, they are typically constructed and reconstructed in one's mind without conscious effort. With artificial memory systems, however, it became possible to exert a certain amount of control over memory construction, to decide what is to be stored and what may be forgotten. But it is not the idea of what is to be remembered that is crucial with regards to artificial memory; it is not just about *memory-as-storage*, for with its systems, one decides not only *that* memories are to be stored but also *how* or *in what form* they are to be stored. Therefore, most methods of recollection involve a double construction—the construction of the memory itself but also the more deliberate placement of artifacts of memory within the imaginary space. The cardinal sin in ancient conceptions of the art of memory was, as Carruthers argues, not so much the notion of forgetting but of disorder (82). It is this latter activity that may function, in my view, as a critical lens with regards to software use.

3.2 Using Memoria to Manage the Windowed Mixing Experience

Let us recall Jack Joseph Puig photographed inside his mix room (see figure 3). Surrounded by all of his analog equipment, we find a single computer monitor set on a small desk at the far end of the large mixing console. And if we look even more closely, we can see an opened session in his Pro Tools DAW. This tells us that Jack Joseph Puig uses his DAW merely as a playback machine for the tracks that make up a session; the mixing happens in the 'real world.' This setup strategy is quite common these days. Albeit out of sight in the image, Michael Brauer's mix room also includes a computer that runs the session. This has to do basically with convenience and economics. In the past, tape-machines were used to record and play the tracks back for a mixing session. The mix was then printed onto a new piece of tape, a so-called master tape. Tape-machines require constant maintenance in order to keep them properly aligned. Digital storage has made tape recording all but obsolete, and many

recording studios don't even keep tape machines anymore. But, going back to the image, take note of the difference in total size between the computer screen and the equipment spread out in Jack Joseph Puig's mix room. It is, of course, misleading to judge the 'size' of a computer by the size of its screen. Yet, given the spatial premise in my argument, it is remarkable to ponder that within a mere two decades a tech industry has taken root with software companies that offer more or less all of JJP's various types of mixing equipment in digital form, so much so that audio production can be done exclusively with software instead of hardware.

Albeit the plethora of currently available software is remarkable, one of the (many) challenges that audio software companies, and in turn mixing engineers, have been faced with concern the physical constraints imposed by the relative real estate determined by the size of the computer screen. In other words, aside from included features, it is often the arrangement, navigation, and layout of features in software that is central in facilitating professional workflows. Although current DAW manufacturers have opted for different types of layout decisions,[9] they remain bound by the physical limitations of the computer screen. In other words, unlike the arrangement of analog equipment in Jack Joseph Puig's room, where each hardware unit (including knobs, faders, and metering displays) remains always visible, digital mixing is a windowed experience; more importantly, albeit some units in his room seem to sit behind other pieces of equipment, JJP's mixing tools are constantly accessible throughout any given mixing session. DAWs, however, cannot offer that level of access; digital mixing workflows always involve navigational tasks such as scrolling through menus and switching between windows. These activities remain inevitable components of the digital

[9] For example, the widely used Pro Tools DAW uses a multiple-windows configuration system i.e., that separate software windows are used for track editing and the mixing console. A user can choose whether to show or hide a window, decide where to place multiple windows inside the computer screen, and also save custom window configuration. Presonus' Studio One software differs in that regard. The default window is an attempt to consolidate all of the features into a single, modular window. A set of buttons allows the user to toggle certain window views on and off, and the software automatically expands or compresses adjacent windows.

Figure 7 The main window of Harrison's analog console-inspired Mixbus software.

mixing experience simply because there are too many features available for all of them to be displayed simultaneously on a single screen. One exception to this more default digital mixing experience, however, comes from a more recent entry into the world of DAWs called 'Mixbus.' This digital audio workstation has been developed and is sold by Harrison Consoles, a company known for its large-format mixing consoles. In contrast to other DAW manufacturers, Harrison utilizes a "[s]traightforward 'knob per function' mixer layout based on Harrison's renowned music consoles" ("Mixbus: Overview of Features"). In practice this involves a window design-strategy that is reminiscent of the analog mixing experience whereby most editable parameters always remain visible and accessible in the graphical user interface; in turn, Mixbus' visual representation significantly reduces the frequency of window-switching and scrolling. Unfortunately, Harrison's Mixbus software mixing solution remains an isolated, yet interesting take on the digitally enabled mixing experience. Most industry-standard solutions such as Avid's *Pro Tools*, PreSonus' *Studio One*, and Apple's *Logic Pro X* implement a more established interface design strategy similar to productivity software solutions in other (creative) professional disciplines such as Microsoft *Word*, Adobe

Photoshop, or Apple's *Final Cut Pro*. In these software cases, showing, hiding, and switching between sets of windows is an inevitable part of the workflow experience.

For a professional practice such as music mixing, where creative ideas should ideally flow seemingly into idea execution, the limitations of the screen and the multiple-window interface design naturally cause a temporal delay in the process. Any time a piece of audio needs to be edited and manipulated, an engineer has to deal with lag time because of all the manual steps involved in navigating the DAW software application. This issue of having to deal with lag is even more prevalent in the world of mixing today because of a technological reality that goes far beyond the confines of digital audio workstation software: digital storage. As we have learned in the previous chapter, companies began to develop larger and larger mixing consoles to accommodate the increased number of tracks in a song that the earlier invention of multi-track recording made possible. At the height of the analog mixing era, it wasn't uncommon to find mixing consoles in studios that boasted up to 72 and 96 individual channels. These consoles would accommodate even the highest track counts for a client song at the time. Interestingly, because of the sheer number of available channels, the still present physical limitations in large-format consoles were not considered a constraint. This only changed when digital mixing began to make its appearance in the early 1990s and when it eventually came to pervade the field of audio production. Today, it is not uncommon for professional mixers to receive a song to mix from clients that contains more than a hundred tracks. The current reality of computers capable of handling the potentially infinite track count–only constrained, of course, by both available hard drive space and the computer's processing power—might at first seem liberating, at least for producers and songwriters who can indulge in building complex compositions; for mixing engineers, however, this poses a content management challenge not merely because of the increased number of elements that become part of the engineer's work, but also because it introduces additional lag time due to

having to scroll through all of the tracks inside the DAW. Professional audio engineers, as well as other professionals in different fields, are very cognizant about dealing with what we may refer to as their unique variety of information 'overload' brought about by the digital revolution. Even the largest analog mixing consoles cannot accommodate what engineers receive today from the clients on a regular basis.

In the analog days, professional engineers would set up their equipment spatially in such a way that their work environments would (1) enhance and facilitate the mixing process, (2) keep processing tools close to the their fingertips, and (3) remain flexible to tackle the mixing of different types and/or genres of music. In a way, engineers would map out their mix room just like classically trained orators who would rely on techniques such as the memory palace to aid their practice and workflow. Certainly, there is only so much equipment that one can cram inside a room, and engineers like Jack Joseph Puig and Michael Brauer seem to use up every available inch. Yet, we also need to consider again the purposefulness in the arrangement i.e., the comprehensive order that is brought into the seemingly chaotic assortment of knobs and faders. Fortunately, current mixing software solutions offer a high level of customization, and by-and-large professional engineers take advantage of available options to develop and map out preferred setup arrangements inside their DAW. Again, the main goals here are to create and implement arrangement and layout strategies inside the DAW that minimize lag time and to map out a familiar, yet flexible workspace that's suitable across various types of genre and instrumentation.

For many engineers, the solution is what is called a mixing-template. Most current DAWs already come with a selection of pre-made templates tailored to various types of audio production situations. In the starting screen of Pro Tools, for example, users have the option to create a new session from several ready-made, built-in mix templates, all neatly organized by genre and/or production category. Yet, despite the availability of these templates, most

famous engineers in my study, especially the ones who have transitioned from analog to digital mixing or are in the process of doing so, utilize templates that they have built personally. As a means of getting the technology essentially 'out of the way,' mixing templates involve as Grammy-Award winning engineer and producer Andrew Scheps explains: "everything else that has anything to do with mixing" (Puremix-1 n.p.). Building a personalized template revolves around making decisions that broadly fall within three distinct areas of consideration and inspired by the tenets of the fourth canon of rhetoric, we may label them as *architectural*, *procedural*, and *navigational*.

How do *architectural* considerations come into play when building a personalized mixing template? Let us approach this question metaphorically. If we were to design a house, we would begin by staking out the dimensions for the foundation. Once that is done—and for the purposes of the argument let us agree to disregard the importance of structural balance—we would determine the number of floors and the number of rooms and their relative sizes. We also have to determine how the rooms should connect to one another, and therefore will need to define the placement of doors, the necessity for hallways, and the number and

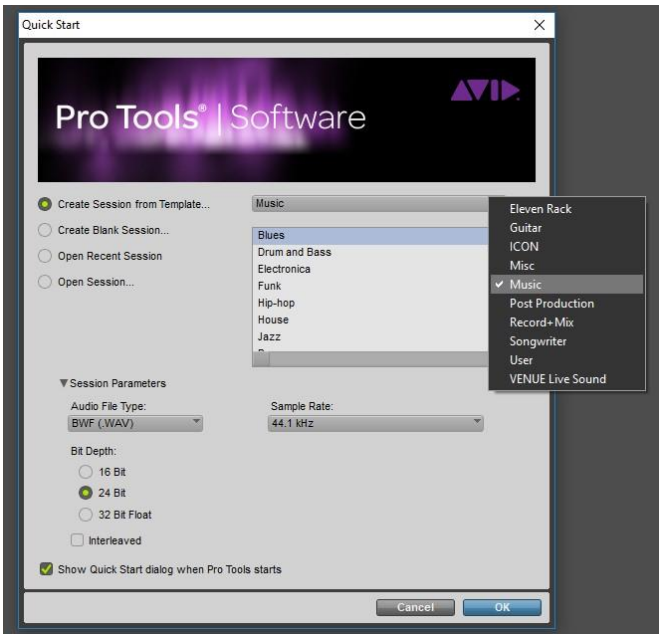

Figure 8 A view of the session creation window in Pro Tools 11.

placements of staircases (provided that we will not be building a bungalow, of course). Finally, we want to give each room a purpose. First, we would need to define a living room, a kitchen, maybe a dining area and a games room, and we must not forget to include bedrooms and bathrooms. Then, we can move forward and create a unique charm for each room. That would include choosing furniture, lighting, as well as decorative items. Finally, we might want to paint the walls for each room differently to make each stand out a bit more. All of these activities are generally guided by *architectural* considerations. The creation of a mixing template inside a digital audio workstation is not much different. For the process of building and designing our imaginary house, we would acquire the appropriate tools to get the job done. For the purpose of building a template, we would use the available features inside the DAW software.

The architecture of our mixing template begins by making determinations about signal routing. In the world of mixing, this means setting up audio so-called 'bus channels.' By default, each individual track that is imported into a DAW as a new mixing project is directly sent to the so-called 'main outputs' i.e., routed straight to the computer sound card and the connected speakers for playback. We may treat the main output as a room where the tracks move through. Now, imagine a house with just a single, giant room. Things would get cramped relatively quickly, and it would be difficult to enjoy some privacy. This is where 'bus channels' come in, and we may think of them conceptionally as a way for engineers to condense, compress, and consolidate sonic information akin to how public speakers would utilize the memory palace technique. Adding these into an empty session and then routing imported tracks to each channel instead of the 'main output' is essentially the same as creating separate rooms within our imaginary house so that tracks can be situated inside each room. These rooms are often labeled according to instrument type such as 'drums,' 'guitars,' and 'vocals.' While 'bus channels' do not differ in size per se, they take up various levels of

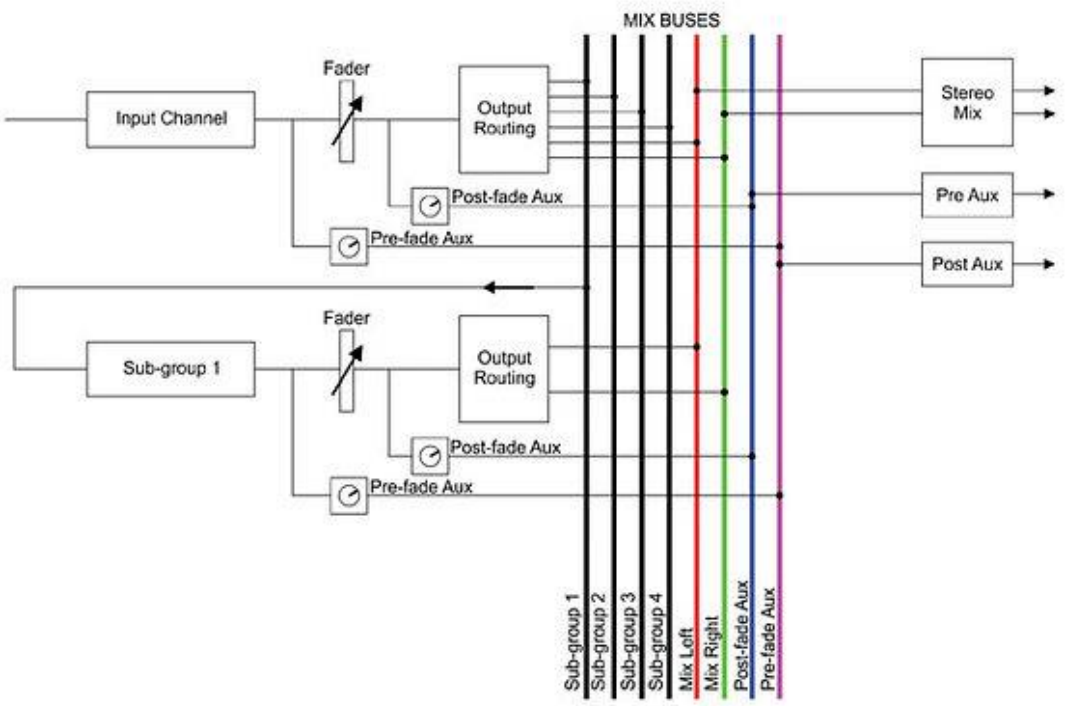

Figure 9 Visual representation of channel routing options in mixing technologies.

importance and prominence in the template nonetheless. Some ‘bus channels’ may only capture a small number of tracks, which are then routed further to yet another ‘bus,’ others might handle a larger number of tracks. Each ‘bus channel’ would then be routed to the ‘main outputs’—by definition a ‘bus channel’ as well—so that the latter then comes to resemble the main entrance hall in the house that each room connects to via doors, hallways, and staircases. The tracks still ‘leave’ the house via the hall and travel out to the speakers via the ‘main outputs.’ However, they each first gather in their assigned room—or rooms. There are no fast rules in the world of mixing and routing a single track to multiple ‘busses’ isn’t uncommon.

The number of ‘bus channels’ added to the template is totally up for the engineer to decide. Often, less is more as professional engineers point out, but ultimately the main goal is to set up a comprehensive and manageable number of routing channels. As Fab Dupont, Grammy-winning engineer and co-founder of the online mixing tutorial platform

Puremix.net, jokingly explains: “use your own routing because your routing is *your* routing, and you own it, and you share it with yourself” (Puremix-2 n.p.). Pep talk aside, professional engineers tend to utilize between five to twenty dedicated ‘bus channels’ on average for audio signal routing purposes. Aside from ‘bus channels,’ DAWs also commonly provide so-called ‘auxiliary channels’ or ‘FX-channels,’ as they are often labeled. While these channels are similar to ‘bus channels,’ they differ in one crucial aspect: rather than *sitting*, for lack of a better term, directly at the output of each track channel, ‘fx channels’ receive audio signals from so-called ‘sends.’ The figure provides a comprehensive rendition of the main difference between these two types of ‘bus channels’ based on where they each sit in a routing matrix. The ‘bus channels,’ which are labeled ‘sub-group’ in the image and colored in black receive the audio from the track or ‘input channels’ directly from the channel’s output, whereas ‘aux channels’ receive the audio from dedicated ‘pre-fade Aux’ or ‘post-fade Aux’ sends, and engineers can determine the volume level that’s being sent to each ‘aux channel’ via dedicated volume knobs. In terms of our used metaphor, we could say that while an individual track mostly shares a distinct room with other tracks, it may also reside partially in another. Setting up ‘busses’ and ‘auxes’ is often the first step in creating the mix template. These channels provide the foundation for a productive and successful mixing session. The next step in creating a mixing template revolves around defining a purpose for each room and populating it with objects that are in line with the engineer’s aural and stylistic preferences.

Why do many people enjoy a bit of singing while taking a shower? The answer is reverberation. Bathrooms are commonly floored with tiles, and sometimes the walls in a bathroom are tiled as well. Flat, tiled surfaces have reverberating properties, and therefore any sound produced in the bathroom bounces off from the tiles, which we then experience as echo or reverb. Artificial reverberation is one of the many sound-shaping effects that

professional engineers rely on during mixing. As explained by Paul White in a *SoundOnSound* article from 2006 called "Choosing The Right Reverb,"

> [a]rtificial reverb is an integral part of music production, as it puts back the sense of space and place that's removed by close-miking voices and instruments in an acoustically dead studio. In the real world, reverb is created by sounds reflecting and re-reflecting from surfaces in an enclosed or partially enclosed space, and the resulting pattern of sound is infinitely complex. The geometry of the space and the materials from which it is made affect both the pattern and intensity of the reflections, and the rate at which different frequencies decay. Our brains derive information from these audio characteristics, enabling us to learn something about the nature of the space without necessarily seeing it. In music production, this means that the reverb type and its settings need to be chosen carefully if the human hearing system is to accept it as natural — or at least believable. (White n.p.)

Reverberation comes in many different flavors, both in the analog world as well as in the context of software-enabled mixing practice. The most common types of reverb are room simulations, plates, chambers, halls, and ambiences, and without going into much further detail, each type exhibits particular reverberation characteristics. Reverb and echo processors are commonly used during a mixing session as 'send' effects i.e., that the effect applies only partially to the audio source because it gives engineers both more control over the level of the reverb as well as the opportunity to send multiple tracks to the same reverb unit. For tracks that are usually mixed with a bit of artificial reverb like vocals, snare drums, keyboards, strings, and guitars, the engineer can dial in an amount of volume level that is sent to the reverb 'aux' channel. In other words, reverb effects are commonly blended in with the source material. Since reverb processors reside as inserts on an 'aux channel,' the 'aux' in effects

gains a specific purpose for the engineer, which poses the following question: how many and which types of reverbs do we need for the template? In other words, how many and what types of bathrooms should be part of our house?

Similar to classical public speakers who furnish the rooms inside their memory palaces with objects that represent various types of rhetorical strategies and techniques (the commonplaces and the topoi, for example), mixing engineers often utilize a variety of reverb processors for any given mix. These are then inserted on correspondingly labeled ‘auxes’ in the mixing template. And as there are no fast rules in mixing, the choice of processors is highly subjective and based on personal workflow preferences as well as musical taste. That being said, most engineers tend to choose a set of processors that provide the most common types of reverberation. That way, engineers are ready to deal with whatever sound material they are working on. In addition, incorporating reverbs into the template significantly speeds up the mixing process because the technical tasks of setting up the effect i.e., browsing through all the reverb processors in the DAW, inserting the effect, routing audio signals, opening the processor interface, and setting the parameters for the effect, are not part of the mixing process anymore. In turn, once the idea comes to mind to drench a piece of audio in a little bit of reverb, the engineer can go straight to toggling through the sets of processors already routed in the template, compare various reverberation flavors quickly, and choose the most pleasing type. This is a common strategy for template building, and it does not apply solely to reverberation effects. Engineers commonly (*pre-)furnish* their ‘aux’ and ‘bus channel’ *rooms* not only with various types of effects such as compressors & limiters, equalizers, modulation and pitch-shifting effects, they often create more than one ‘bus’ for processors of the same type. For example, an engineer might rely on two hall-type reverbs, one with a short, the other with a longer decay characteristic in order to have different flavors for each type ready to go. Over time and by utilizing the same types of effects on a variety of

audio material, engineers naturally start to memorize the unique sonic characteristics of each effect type. Ultimately, audio engineers reach a level of familiarity with the effects and processors included in their mixing template; a familiarity that contributes significantly to the development of critical listening skills. What remains is a level of professional confidence, expertise, and yes, memory, whereby the experienced engineer knows just from listening to the unprocessed audio which effects would best capture the creative ideas formed in the imagination.

The last but certainly not less important aspect of *architectural* considerations in mix template building pertains to the matter of session organization i.e., the visual segmentation of channels and the order of tracks in a session. With few exceptions (such as dedicated songwriting templates), mixing templates contain only 'bus' and 'aux' channels instead of audio and/or instrument channels because the practical goal is to have a number of chosen processors and track routing channels already set up and ready to be imported into a session containing previously recorded audio. An important element at the end of an engineer's mix template creation journey is, therefore, to determine preferable ways to distinguish not only between the various types of preset channels in the template but also to be able to differentiate between the template processors and the recorded audio channels; and to find a way that can go beyond the mere labeling of channels. The challenge here is not so much that font sizes often tend to be on the smaller side of the spectrum in software applications, which would make a more overt way of distinguishing between the different types of channels appealing, but simply the constraints of the computer screen. While a Jack Joseph Puig or a Michael Brauer can easily move between the channels on a console and the effects processors set up all around the work area in physical space, the DAW user will always have to contend with the fact that a computer screen can only visualize a limited section of an opened session

at any one time. Defining a visual scheme can help make sense especially for sessions that have a high track count.

Various methods exist here to confront this challenge. One method, and as it turns out one that many audio professionals rely on, is to utilize the color palette feature, which has become a standard feature in today's software solutions for audio production. Engineers often develop and apply a consistent and specific color-coding scheme to distinguish between different channel and instrument types. A 'bus' channel might be colored in red, an 'aux' channel in light blue, and audio channels—usually grouped by instrument type—would receive their own unique color as well. Such a method significantly speeds up the task of finding the channel(s) that will require the work of the engineer. Taking the grouping principle a bit further, another example is to move all of the audio tracks as well as the template-related channels as a whole and place the template channels either before or after all the audio channels. For the vertically designed arrange window in a DAW that would mean placing the template channels either above the first audio channel or below that last, similar to a waterfall where we imagine sound to flow from top to bottom. In the laterally-designed mixer window in a DAW, this means to place them to the left of the first or to the right of the last audio channel. Another method would be to place all of the audio routing 'bus' channels to one side and each auxiliary channel next to the instruments to which the send effect is being applied.

However, the method that I have come across the most for this research is to place a 'bus' channel next to its type of instrument and the instrument type related 'aux' channels next to the 'bus.' For example, a 'bus' channel to which all the guitars in a session are routed and a corresponding set of 'aux' channels for guitar send effects might be placed between the last guitar channel and a channel featuring a different instrument type. This method yields an

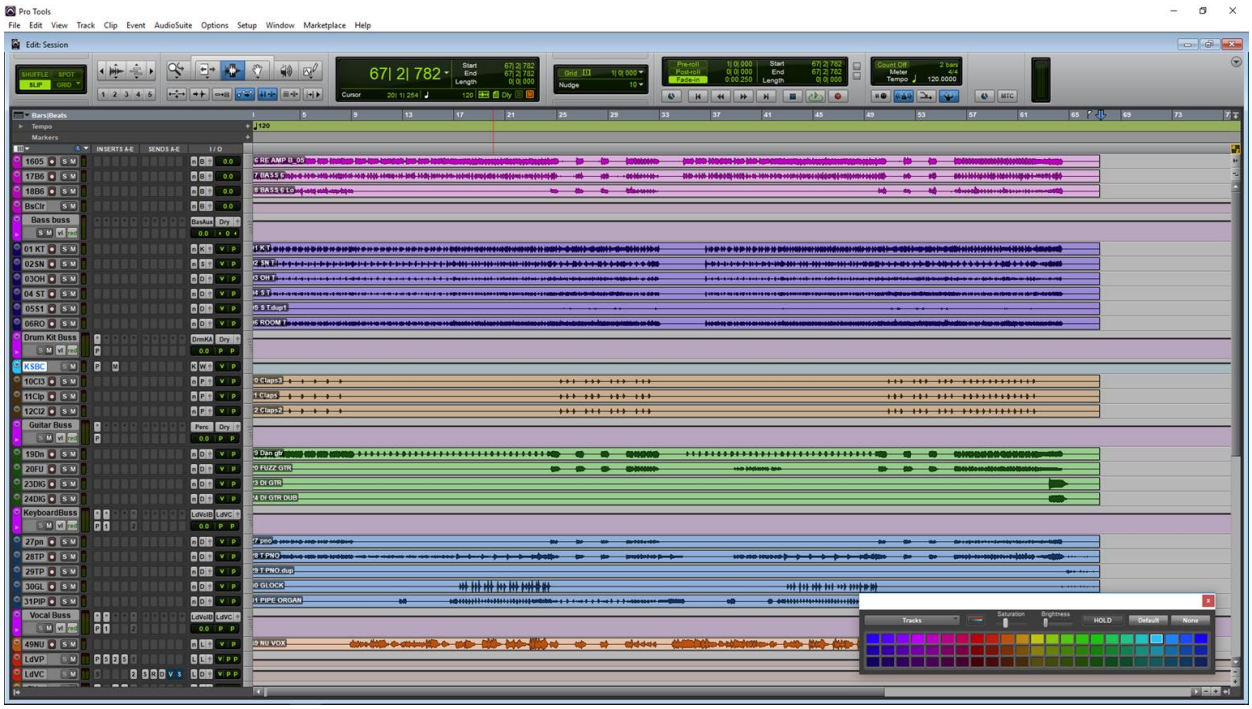

Figure 10 Color-coding tracks in Pro Tools.

added, organizational benefit. The user interface design of DAWs, as we have learned in the previous chapter, is largely inspired by the design of large-format mixing consoles which offer channel routing options for both audio as well as ‘bus’ and ‘aux channel’ processing. Since DAWs generally don’t make a visual distinction between different types of channels (unless the user engages in window zooming, of course), engineers can use their template-related channels as visual separators. Here, engineers would often choose a brighter color for template-channels (bright pink in the screenshot) so that these channels become visually pronounced demarcation lines between groups and types of instruments as well (colored in purple, beige, green, blue, and red). Though the screenshot depicts the arrange window, the same visual principles apply to the console view window, of course. All these examples of segmentation and ordering methods illustrate how *architectural* considerations in mix-template creation go hand in hand with the crucial tasks of prepping and cleaning up a piece of music for a subsequent mixing session.

Mixing, in many ways, is an art. The artistic element of this professional practice comes into play when the engineer chooses between different types of processing how to apply each one of them. But mixing is also craft, which is concerned with *procedural* considerations. While the previous examples of track ordering also blend into these kinds of considerations, developing a process through the creation of a mix template goes beyond mere channel arrangement and track segmentation. As alluded to earlier, DAWs offer users a wide variety of features to personalize the operational side of the mixing process. For one, the same feature can be found in multiple windows. An engineer does not necessarily need to utilize the mixing console window if the arrange window—as is the case in Pro Tools—also give access to adding processors and effects to a channel and adjusting its volume, and so forth. Therefore, many engineers choose to hide the mixing console window altogether and instead use the arrange window exclusively for their process. Andrew Scheps, for example, explains in many interviews that his mixing template relies exclusively on a maxed out arrange window to facilitate his process. Such a decision is also made easier in software because today's DAWs offer dedicated settings windows for mix view options so that the engineer can decide the number of features displayed for each window.

In a similar way, many engineers also customize the main ribbons at the top of the software interface in order to improve ease of operation when working with software. As shown in the screenshot, the ribbon includes both informational elements as well as tool selection features. Based on the engineer's preference, these content boxes can be shown or hidden. Moreover, most if not all of these content elements can be customized further. For example, while the DAW software offers users a wide selection of different editing tools to work with audio such as cutting, selecting, and merging, most tasks only depend on a limited set of editing tools. DAWs allow users to foreground these most-used tools in the ribbon so that choosing a tool does not involve having to browse through the entire list of available

features. That, of course, implies that the engineer relies almost exclusively on the computer mouse as an input device for music mixing. However, DAWs—similar to other productivity software like word and video editing application--also include extensive libraries of keyboard shortcuts to speed up the engineer's workflow. Rather than using the mouse exclusively, engineers either learn the available shortcuts or create and store more personalized sets of task-related shortcuts.

Last but not least, the mixing process also relies heavily on *navigational* considerations. As we all know, popular songs usually consist of various sections such as verses, choruses, intros, interludes, as well as outros, and a big part of mixing, as we have learned in the previous chapter, is about enhancing certain sections of the music by bringing in effects that are exclusive to the section. A vocal performance might need different effects for the chorus compared to the verse to help it compete with the other instruments in these climactic moments in the song. In order to facilitate this element of practice, DAWs give users the option of segmenting a song via the placing markers, thereby splitting the whole

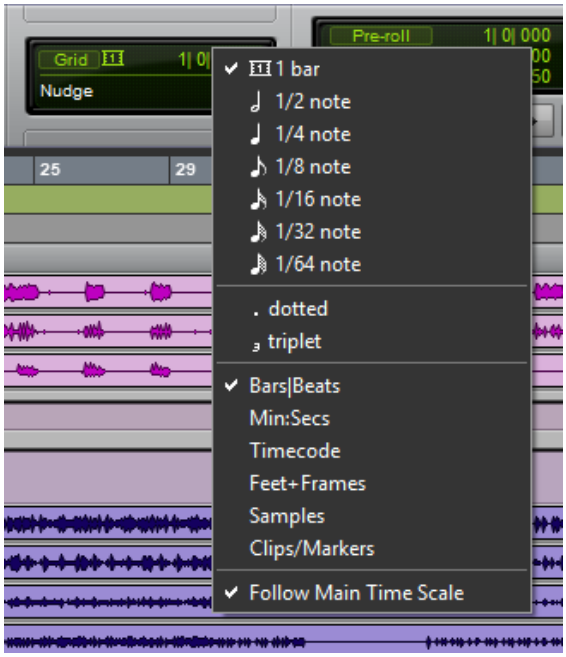

Figure 11 The timing grid option menu in Pro Tools 11.

song into its smaller arrangement components. These markers can be also be labeled so that the engineer can quickly and easily toggle between listening to the second chorus or the first verse rather than having to scroll through the song's timeline to find a section each time. These markers are often linked to a keyboard's numeric keypad so that the numbers 1-9 synch the playback head from one marker to the next.

An additional method of better navigating the interface during the session involves customizing the so-called timing grid. This helps to preserve the timing for notes, clips, events, and selections in the DAW, which is very useful as engineers—in agreement with the client—often move around sections of audio to adjust, change, and/or enhance the arrangement of a song. The grid can be set in various ways using note values (½ note, ¼ note, etc.), minutes & seconds, and even down to single samples (to make very fine adjustments). Of course, the settings one chooses for the grid affect any editing operations that are made while the grid mode is active. Another prominent method for making sessions easier to navigate is through what engineers refer to as 'stripping the silence' from audio tracks. Oftentimes, the same instrument does not play throughout the entire song. The recording of these instruments, however, often does not stop in between sections played. This is especially true for those recordings where the song is recorded live with the whole band rather than recording instruments one after the other. Albeit this step in the session prepping process also frees up crucial processing power of the computer, the benefits of stripping the silence from audio are mostly visual. Rather than having to search for the moments when a supporting instrument plays, stripping silence has the effect of de-cluttering the editing window and thereby carving out the actual arrangement of the composition on the time grid. As these various examples show, music mixing is not just about applying various techniques to the editing, manipulation, and shaping of a piece of audio, it is also about creating a convenient,

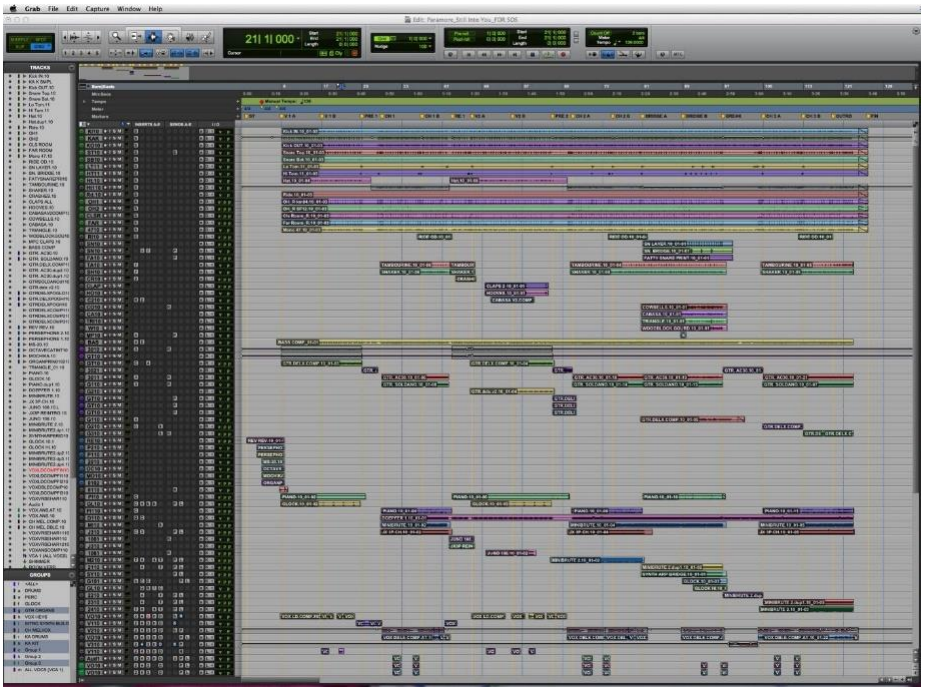

Figure 12 A cleaned-up session with stripped silence in Pro Tools 11.

efficient, and familiar work environment that enables, facilitates, and nurtures the engineer's creative decision-making process.

Similarly, DAWs are not merely designed for features and functions; they also offer a way of personalizing the use experience. Mixing templates, session order strategies, as well as color coding, ribbon customization, and keyboard shortcuts are just a few of the most prominent means that engineers have at their disposal for mapping out a structured, virtual mixing experience that remains consistent, but can anticipate whatever mixing situation the engineer is faced with from song to song, and session to session. As Andrew Scheps explains quite humorously: "So, I get a session from an artist. It's got a bunch of audio, might have a million aux tracks, 65,000 plugins. Whatever it happens to be, I will . . . import session data from . . . [my template] session into that [artist] session" (Puremix-1). A software experience based on personal preference, thus, fuels and motivates the engineer's creative juices.

3.3 The Importance of Getting Technology 'Out of the Way'

This chapter has shown that software customization can greatly enhance workflow efficiency by reducing the kinds of workflow delays that are an inevitable part of the software use experience. By and large, prep work and setting up continue to be steps that mixing engineers take very seriously. They deem these steps as important—if not more—as the actual mixing session. In other words, pro-active organizational considerations in mixing aid the engineer in forming a strong foundation on which to build a successful mix. Similar to the relationship between the fourth canon and its siblings, strategies of spatial ordering provide the basis for all of the subsequent, mixing-related activities. This kind of spatial mindset to practice is not limited to the field of audio production, of course. Any type of currently available productivity software allows the user to personalize and customize the use experience, and I believe that one does not need to be a professional writer or content editor to take advantage of these principles. A pro-active embrace of customization options has positive implications for any type of current software use. For example, adjusting some of the default settings in Microsoft Word has helped me tremendously in writing this book. Rather than having to adjust font style, font size, and line spacing each time I open a document, for example, I simply adjusted the software's default settings to suit both personal preferences as well as professional requirements. That way I was able to focus more on the important things of developing and flashing out my ideas. Of course, this is just one of the many features in Word that can be customized, a worthwhile journey through the settings windows and available document templates that, I believe, can yield a great number of learning moments for a user. Given the mind-boggling number of features programmed into currently available productivity software solutions, I see great benefits in setting aside the time, in learning the ins and outs of the software, and in creating a software environment that facilitates and nurtures a more intuitive practice.

For classical rhetoricians, the tenets of architecture and segmentation provided powerful means for memorization (Carruthers 13). However, memory strategies also had another important purpose. Classically trained speakers not only relied on memory strategies to enhance their skills at recollection and content delivery, but they also used mnemonic architectures for the purpose of combining information in new ways. Therefore, memory was regarded as a crucial path towards invention, the first and often seen as the most important canon of rhetoric. The *ars memoria* was, according to Lina Bolzoni, a system of "ordering" content so that it might "help create content" (6). Such contextual tenets are not unfamiliar to professional mixing engineers; in fact, many consider the tasks of curating and ordering content crucial elements in their practice. Their motivations and the many ways they go about dealing with these tasks is instructive, so much so that we can deduce techniques and strategies, that are transferable to other types of professional practice, and which may inform our own personal use of software applications. Therefore, questions surrounding the utilization of digital technologies for composition and invention will be the focus of the next chapter.

4 ANY SOUND IMAGINABLE: LEVERAGING MEMORY FOR INVENTION

> "As soon as I hear a sound, it always suggests a mood to me."
>
> -- Brian Eno

> "One must acquire knowledge of a very great number of things, for without this a ready flow of words is empty and ridiculous."
>
> -- Cicero, *De Oratore*

> "There's an old myth that says whenever you buy an acoustic guitar, set it in front of your speakers and play the best music you know and let the guitar absorb it, and the wood will retain that sound. Mixers need that same sort of thing. Get your own taste and then study."
>
> -- Dave Pensado to Pro Audio Files

In the control room of a recording studio a record producer stands slightly behind the right shoulder of an audio engineer who sits in front of an impressive large-format mixing console. Through a glass door in the back of the control room we see a tape machine, aligned and ready to capture a top-grossing performance. The song begins to play. We do not know how many takes have already been recorded, but there clearly is anticipation in the room. As the song moves through its introductory measure, the producer directs a double-handed calming motion to an off-screen performer while the audio engineer turns up the volume faders for the microphone. The performer is given a cue for when to come in, and from the look of it we seem to be witnessing just another regular vocal recording session in the studio. The song, as it turns out, is a ballad in the tradition of so-called 1980s 'power ballads,' a style made famous by American bands such as Heart, Cheap Trick, Journey, REO Speedwagon, and Cinderella; it is a genre in popular music where the singer really must carry the song. In other words, the commercial success or failure of this record rests squarely on the shoulders of the singer and her ability to connect with the listener on an emotional level.

The first few lines of the lyrics find their way smoothly onto the tape. Indeed, the vocalist's performance suits the genre and the song well, and so we are not surprised to see that the producer's eyes widen with joy; he seems relieved. This record is going to be a hit! The audio engineer, however, does not seem to share the producer's feelings of relief at all. He appears visibly stressed, his actions becoming hectic as he captures the singer's performance onto the tape. He moves all over his console and stretches himself at times to fiddle around with knobs and faders, all the while the producer appears to have the time of his life, singing along to the tune. When the first chorus arrives, the audio engineer's countenance turns to one of pain, his facial expressions presenting a mix of agony and torture. He pushes away the producer. He does not acknowledge his client's thumbs-up motion. And as the camera pans left, through the wall of the control room and into the live room, we finally learn the cause of the engineer's overt distress: the singer's performance is dreadful!

Her voice is piercingly shrill, more screaming than singing, and even the pianist in the background cringes because of her abysmal performance. Back in the control room, the producer continues his sing-along, captivated and enamored by the sound of the vocal coming out of the speakers; the audio engineer, by contrast, now engages in a heavy breathing technique to brace himself for the final climactic chorus and the outro of the song. When the playback stops the reactions of the people involved couldn't be further apart: while the producer throws kisses and the singer gives a thumbs-up, the engineer falls back into his chair, breathing heavily and holding up his twisted hands in pain.

Of course, this video is not to be taken seriously. One important piece of information I omitted in this description is that once the camera shifts into the live room, the rest of the video is underlaid by audience laughter. It is a comedy sketch called "Sound Engineer's Hard Work" uploaded onto YouTube in 2013 by Canadian comedy show called "lol :-)"; but

Figure 13 A still from the video skit, "Sound Engineer's Hard Work."

despite its humorous premise, the video speaks to a number of aspects that will be pertinent to this chapter, and my broader study of software technology use in general.

In classical rhetorical theory, the canon of memory was often thought together with the first: invention. In his main rhetorical work, *De Oratore*, Cicero emphasized the crucial and constructive bond between the two for his consideration of the 'perfect orator':

> To begin with, one must acquire knowledge of a very great number of things, for without this a ready flow of words is empty and ridiculous; the language itself has to be shaped, not only by the choice of words but by their arrangement as well; also required is a thorough acquaintance with all the emotions with which nature has endowed the human race, because in soothing or in exciting the feelings of the audience the full force of oratory and all its available means must be brought into play . . . . one must know the whole past with its storehouse of examples and precedents, nor should one fail to master statutes and the civil law. (I.16-18)

Cicero's call for an expansive memory culminates in a conclusion that very much echoes the description of memory as a treasure-house for invention in the *Rhetorica Ad Herennium*:

"What can I say of that repository for all things, the memory, which, unless it be made the keeper of the matter and words that are the fruits of thought and invention, all the talents of the orator, we see, though they be of the highest degree of excellence, will be of no avail?" (I.18). For French philosopher, Henri Bergson, memory is a "synthesis of past and present with an eye to the future, in that it contracts the moments of this matter in order to use them and to manifest itself by actions" (220). The art of memory bridges past and present for future action, and often does so through acts of writing designed to archive and curate experience. Throughout the history of Western civilization, the arts of memory and writing have had a special bond: indeed, the Latin root memoria means both memory and memoir.

For our mixing engineer, memory and invention play a crucial role for success. Let us recall from an earlier chapter: the work of audio engineers is stressful and often driven by tight deadlines. At the same time, audio engineering professionals consider their work predicated on the idea that it is their principal responsibility to present their clients' work in the best possible light. In other words, audio production involves a constant balancing act that is not merely about ensuring that the creative ideas and talents of musicians are captured onto a recording medium, but that their creative output is presented in the most appealing for both the client as well as their audience of listeners. This is true for any type of service industry, of course, where the job of the professional is to craft larger-than-life representations of their clients' creative work. In fact, today's listening audiences expect no less. And to satisfy expectations both effectively and efficiently, many engineers understand and promote the importance of being prepared for *kairos*, the opportune moment. The video sketch takes this aspect to its extreme, of course, by pitting stress, hectic work, and obvious physical exhaustion against the purported ignorance of the ideal listener—represented by the producer—whose principal concern is to be satisfied. Stress and hectic actions can make for some good comedy, but the stress caused by deadlines is, at least in the day-to-day mixing

work, simply part of the professional experience. Instead, we will use the stress shown in this video merely as a point of departure to discuss the ramifications of past and current technological developments in the field of audio production on notions of expertise and practice.

For one, the sketch pokes fun at a now long-standing craze and widespread use—and sometimes miss- and over-use—of so-called pitch-processing software such as Autotune and Melodyne i.e., the kinds of software-exclusive automation tools that are capable of discreetly correcting intonation discrepancies in real-time. Though we will revisit the implications of real-time processing software on technology use and practice to some degree again later in this chapter and the next, it is important to emphasize that the video sketch communicates this aspect of mixing in a more original, and less technology-centered way. Not once does digital software actually make an appearance in this video. Instead, the capability of turning a measly performance into a stellar one in real-time, of being able to cut a record without the necessity of any sort of professional musical talent, seems to fall squarely within the expertise of the audio engineer; and based on his involved use of the equipment, we can assume that he had to deploy every available technique in his magical toolbox to please his client. Just like the main character in the 1994 movie *Speed* played by Keanu Reeves, who has to keep a bomb-equipped bus moving at a fixed speed to prevent a devastating explosion while overcoming one (physical) obstacle after the other, the audio engineer in this video does his utmost to steer a dreadful vocal performance through the compositional arrangement of the song. All of this unfolds moment to moment; there is no time for, let us say, a quick Google search to read about required recording skills and techniques. The engineer needs to be on top of his game; he must adapt, react, and anticipate to shifting circumstances as they unfold to please his client.

More importantly, however, the video offers an interesting take on how accustomed popular music audiences have become with regards to expecting finished records that sound larger-than-life. The producer's, and to some extent the singer's non-verbal reactions to what has been recorded very much illustrate how our listening expectations are based on a desire for performances that are 'more-real-than-real.' Given that the stellar performance that comes out of the speakers in the video needs to be attributed solely to the engineer's and not the vocalist's performance, we may infer that by-and-large, the capacity for music in today's popular music scene to appeal and find an audience (read: to sell) necessitates the use of advanced technologies. Those who make records today without the aid of currently available digital technologies like famous American engineer and producer Steve Albini, have chosen to do so consciously—either because they feel it suits their own or their clients' musical style and taste, or they are targeting certain audiences of audiophiles that prefer a more old-school type of recorded sound anyway. Most practitioners who work in the field of audio production subscribe to current listening standards and expectations, however.

Whichever approach is used, the finished mix is the result of a series of decisions (made by the artist, the engineer, and the producer) about the tone and sonic imprint of the song. A mix has a 'sound', a sound that is shaped and informed by the additional processing done to the recorded tracks; a sound that can be identified and described by way of language. To a listener, the drums might feel 'punchy,' the guitars 'harsh,' the vocal 'airy.' As far as the sound of the vocal in the song from the video is concerned—we are focusing on the vocal here also because my research has shown that vocal processing is one of the most frequently requested pieces of professional information that aspiring engineers are eager to learn from professionals—we might use descriptive terms such as 'warm,' 'airy,' 'present,' and so forth. We can do so because of the emergence of multi-track recording because this allowed engineers to record, and in turn process performances in isolation. But we need to talk about

another crucial invention in the early 20th century as well that brought unparalleled fidelity to the recording process: the condenser microphone.

Developments in digital software have largely benefited and are predicated on the fidelity of today's microphones, capable of recording sound sources at a wide frequency spectrum onto the recording medium. The wider the frequency spectrum, the more sonic information is available to the engineer for further sound manipulation and other types of post-processing. Multi-track recording allows signals to be recorded to individual tracks, and this has given audio engineers tremendous control with regards to applying distinct effects onto individual tracks that make up a song. The 'sound' of the final product i.e., the record released for public consumption, is therefore influenced by both the performance as well as the creative processing work done by the engineer. Otherwise, the larger-than-life standard in popular music production and the corresponding listening expectations of audiences would not have been a thing in the first place. The sketch, given its premise and goal, of course, takes this aspect to a ridiculous extreme: it ascribes the professional sound of the vocal exclusively to the work of a seemingly tortured audio engineer, and not to the (lacking) talent of the singer. Still, and guided by a quote of Mark Twain's who defined humor as the "good-natured side of a truth," we find an implied truth in record producing that acknowledges the finished record as a collaborative effort of creative individuals in both the 'live' as well as the 'control' room.

To discuss the peculiarities of a sound a bit more, we can bring up a few more popular examples while staying within the realm of the vocal performance. To begin, let us throw the names of some of America's most famous singers onto an imaginary whiteboard. Frank Sinatra, Tina Turner, Michael Jackson—all of them considered iconic vocalists in the American popular music scene with multiple high-grossing records; all of them performers who are (still) admired for their timbre, and all of them (to this day) deemed inspirational for

anyone in the craft of singing. Moreover, and most importantly, their careers have been pivotal for the global success of American popular music. But how might we describe their singing chops to someone else? How would we begin to describe the sonic characteristics of their recorded performances? For Frank Sinatra, we could use a combination of descriptive terms and semantic attributes such as ‘intimate’ or ‘soothing,’ for example, or ‘relaxed’ but ‘big,’ and so forth. Frank Sinatra is known for his so-called ‘crooning’ voice. A development in early 20th century vocal performance that wouldn’t have been possible without the invention of the condenser microphone, “[c]rooning was remarkable,” McCracken explains, “for its homogenizing synthesis of American music, as it combined the intense romanticism of the Victorian ballad with the amorality of the urban novelty song and the emotionalism and sensuality of jazz music” (365). In *Modern Style Singing* (1934), Al Bowlly defined “crooning” or ‘microphone singing’ as it was often called in the following, albeit ridiculing way:

> Let us pause for a moment to examine this word “crooning.” It is a horrible expression . . . associated with all the unpleasant, smeary, wobbling vocalisms that one ever heard. . . . Different dictionaries give varying definitions, although none of them is up-to-date enough to define it as “quiet singing into a microphone, in the modern dance-band style.” Their efforts vary between “a low moaning sound, as of animals in pain” to “the soft singing of a mother to her child.” (qtd. in McCracken 367)

Such description shouldn’t take away from the astounding commercial success of crooners such as Bing Crosby, Nat King Cole and Frank Sinatra, and even today’s success of ‘crooning’ performers like Josh Groban, Michael Bublé, and Diana Krall. But what it shows is that the technologies like the condenser microphone helped to define particular vocal sounds that became distinguishable and describable and, thus, to some extent reproducible

and interpretable. “Just a few years before Sinatra,” Glenn Berger shares, “there had been no mics, amplifiers, sound systems, or recordings” (160). The invention of the microphone offered the opportunity for a recording environment that “made it possible for people to sing in a more natural style because they didn’t have to project in the same way” (Berger 161). The microphone became the singer’s instrument, and just like other musicians would express preferences for certain instruments and sounds, the same became true for vocalists. Throughout his illustrious career, Frank Sinatra, for instance, relied almost exclusively on the same microphone model for his work in the recording studio: the famed U47, which German manufacturer Neumann began producing in 1949.

“Sinatra was the ultimate modern vocalist,” Berger concludes (161). “He changed our sense of what vocals were meant to sound like” (161). We might even extend Berger’s statement to the degree that Sinatra—as well as other crooners like Bing Crosby and Nat King Cole—changed the ways a vocalist should perform in front of the microphone: from projection to intimate singing. For many music critics and sound enthusiasts, the sonic characteristics of the Neumann U47 were indispensable for the sound of Sinatra’s recorded

Figure 14 Frank Sinatra recording with the famed Neumann U47.

vocal. However, these are relative and subjective statements, but nonetheless, the example of Sinatra, his contemporaries, and his successors shows how the microphone opened up a myriad of ways for engineers to shape the sound of a recorded vocal performance in the course of mixing. Tina Turner's voice, for example, has a harsher, more saturated, and more powerful quality, a hoarseness captured onto tape that is strangely pleasing. This required a different recording microphone strategy. Asked about his use of two microphones during the recording of Turner's voice for "What's Love Got To Do With It?", engineer John Hudson explains:

> [W]hen you sing softly, close on the mic, and you hit a note that's going towards the bottom of your register, it's going to get boomy, a bit chesty. However, if you put up a second mic slightly further away, you can crank that up when the person sings low notes softly. That brings the presence back to the low note. . . . That's what I did with Tina, close-miking her with a valve Neumann U67 while the distant mic, an AKG C12A, was there to pick up the loud parts. However, the C12 was overloading. She was so loud, it was unreal — we had the doors closed and they could hear her in the reception area! I had never experienced anything like it. I was absolutely staggered, and I could tell that Terry [the producer] was in a bit of a panic. He said, "It's distorting! It's distorting! Quick, quick! Fix it! Fix it!" Any valve mic that didn't have an attenuator on it couldn't cope. (Buskin n.p.)

Different singers require different microphones. Michael Jackson's vocal style, then, was markedly rhythmic, up-front, and cutting. He is known to have used a Shure SM1B microphone extensively for the recording of the *Thriller* album. It's not surprising that the SM1B is advertised to customers by referring to this historical fact. While this list of terms to describe the sonic qualities of these famous singers is far from exhaustive, it helps to explain

the profound contributing factor of recording technologies on professional, creative practices of invention. “As soon as I hear a sound,” explains famed record producer Brian Eno, “it always suggests a mood to me.” Such mood, or rather the particular sonic characteristic can be identified, classified, categorized, curated, and collected; and most importantly, studying the sounds from previous records helps to define one’s own creative voice. It is an agency-building activity that recognizes and references the past to define the present.

‘Sonic’ characteristics transcend actual performances and thus offer new, critical modes of listening. Such modes of listening are not predicated on the idea of merely being entertained or emotionally satisfied anymore; for engineers (and to some degree audiophiles) they appeal to a professional desire for continuing one’s own education and expand one’s sonic horizon. In this sense, the result of a recording i.e., the final record, gains an added, exclusively technical dimension of appreciation. It becomes an artifact of professional skills training. Throughout my research I frequently came across audio engineers who—in the course of discussing their productions in interviews—would reference past records or sounds that influenced their current creative work, their sonic explorations constantly guided by the question: “How did they do that?” This question turns the record, then, into a historical artifact, a way of studying the techniques of famous engineers such as Al Schmitt, Phil Ramone, and Bruce Swedien, and then finding personal techniques to achieve similar results. This chapter illustrates the various ways in which audio professionals collect and curate the past as a means of training their professional memories to foster their creative work. And this is, again, an opportunity for the fourth canon to shine a light on digitally-enabled practice and to make sense of current operating principles within audio production software solutions.

4.1 Building a Repertoire of Mixing Techniques with Software

There are diverging views on whether artificial memory is cause or product of practice. Drawing on the work of Jack Goody, Joyce Irene Middleton argues that artificial memory is a product of a distinctly literate culture. Focusing on investigating Plato's so-called wax tablet metaphor, Middleton contends a one-to-one correspondence between the art of memory and alphabetic writing. "The very notion of memory as 'inner writing,'" she argues, "shows the early influence of literacy on the rhetorical tradition of memory" (120). The 'wax tablet' has been a classic metaphor to describe the act of remembering. The passage appears in Plato's *Theaetetus*. In a dialogue on knowledge and truth, Socrates asks the youth Theaetetus to imagine "that our minds contain a wax block, which may vary in size, cleanliness and consistency in different individuals, but in some people is just right" (99). Considered a divine gift of the goddess Mnemosyne, the mother of the Muses, Socrates explains that

> whenever we want to remember something we have seen or heard or conceived on our own, we subject the block to the perception or the idea and stamp the impression into it, as if we were making marks with signet-rings. We remember and know anything imprinted, as long as the impression remains in the block; but we forget and do not know anything which is erased or cannot be imprinted. (99-100)

While the metaphor is apt and very useful for my study, at the time of Plato, wax tablets had already been in use for a number of centuries. As Mary Carruthers explains in *The Book of Memory*, they consisted of two or more narrow boards tied together, and when coated with wax, they functioned similarly to note and sketchbooks (22). Contrary to Middleton's assessment, literacy never completely usurped orality in Greece and, later, Rome. Instead, a

culture of writing developed alongside traditional modes of oral discourse, “which maintained their centrality long after the introduction of writing” (Yunis 2).

In Plato’s academy pupils probably carried wax tablets around and it must have been a very natural figure of speech to represent memory as a composition surface, whose quality varied with the condition of the wax. When someone has a good memory, when their mental wax “is deep, plentiful, smooth and worked to the right consistency,” they will find it easy to absorb memories and retain them for a long time (Plato 104). Both Aristotle in *De Sensu* and *De Memoria,* as well as Cicero in De Oratore, also refer to memory as a wax tablet, as does the author of the *Rhetorica Ad Herennium*: “For the places are very much like wax tablets or papyrus, the images like the letters, the arrangement and disposition of the images like the script and the delivery is like the reading" (III xii). And despite the subsequent emergence of parchment, the metaphor of the wax tablet remained consistent in classical conceptions of memory. In *De Memoria et Reminiscentia,* Aristotle writes that experience, absorbed by the senses, leaves an “image,” an eikon in our memory, “just as persons do who make an impression with a seal” (Barnes 450a 25).

After Plato and Aristotle, the metaphor of a wax coated surface on which one could write or make impressions developed into a *topos* in the literature on memory. Cicero explains in his *De Oratore* that just as writing consists of signs and of the material on which those signs are written, so memory, like a wax tablet, comprises both a space, a surface, and the symbols written on it. The practiced speaker can place images in the ‘background’ and retrieve them at will, according to the *Rhetorica Ad Herennium*; this background is like a wax tablet or a sheet of papyrus, retention is like writing, remembering is like rereading what has been written (*Book of Memory* 28). Therefore, the art of memory is best understood in the context of a lingering orality rather than a lingering literacy, an orality that nurtures cultural memory and community. “Cultural memory, to be sure, was partly why the ancients

memorized Homeric epics and other poetry," Crowley and Hawhee explain. "Young Athenians and Romans were still memorizing lines from the Iliad and the Odyssey up to ten centuries after their appearance, well after they had been written down." (322-3). Moreover, even in literate times, it wasn't common practice—as it is still preferred today—to recite a poem or deliver an argument while looking at a written text. Even literate rhetors committed their orations to memory to be prepared for whatever may arise in the context of delivery. Ancient texts weren't really structured enough to be easily organized and sorted through. In a treatise of memory during the Renaissance, for example, we can find that literacy could not stand in for the art of memory:

> [A]lthough men invented writing, they could not remember everything that they had written. Some time after this, they realized that they could not carry everything they had written around with them, and the things they needed to remember were not always available in written form, and so they invented a subtler art so that they were able to remember many things without any kind of writing, and this they called artificial memory. (qtd. in Rossi 24)

In this sense, we may perceive writing as a primordial aid to memory and a pathway towards invention. As Carruthers argues, our words invention and inventory both come from the Latin word *inventio*, connecting memory not only to invention but also emphasizing "that one's memory store is effectively 'inventoried' . . . its matters are in readily-recovered locations" (*Craft of Thought* 12).

Inventoried information eventually brings us to the gradual emergence of the scholastic tradition. In the twelfth and thirteenth centuries, a communal need arose for so-called *compendia* taking the form of reference works and collections of commentaries that followed agreed upon, formal conventions. In about 1250 the concordance to the *Bible* appeared, followed by indexes, which were not intended for reading, but for referencing. This

new function—as an aid to accessing the external memory—required a new kind of presentation and classification. After the concordance, the first books appeared with a list of contents and an alphabetical subject index. Finding specific passages was made easier by section headings, keywords in the margins, red and blue initials, cross-referencing, references to quotations, proper names in red ink to catch the eye, and so forth. Textbook publishers began to implement new ordering systems, increasingly with alphabetical arrangements for entries to facilitate recollection. It would, thus, be false to assume that the book was originally considered a convenient substitute to the personal art of memory and a means of unburdening the mind by recording in writing what would otherwise have to be remembered. Carruthers argues that this way of treating the written word differs from the present relationship between writing and memory. Whereas nowadays we often feel the need to remember something until we can write it down, our ancestors regarded the act of writing as a powerful mode to remember things better.

The art of memory relied upon the idea of copiousness, encouraging rhetors to develop, organize, and draw upon an abundance of memory. In classical rhetorical practice developing an abundant memory was known as cultivating *copia*, or copiousness. Crowley explains: "Because ancient rhetoricians believed that language was a powerful force for persuasion, they urged their students to develop copia in all parts of their art. Copia can be loosely translated from Latin to mean an abundant and ready supply of language—something appropriate to say or write whenever the occasion arises" (16). To develop copia, students of rhetoric were encouraged to collect and copy *florilegia* (flowers of reading) or *commonplaces* into notebooks so that they could practice and imitate those commonplaces while committing them to memory. This rhetorical practice enlisted the technology of writing as a utility to give students a ready supply of figures and arguments for any topic and occasion. As such, the collection and stockpiling of commonplaces, of topoi of memory, was only the initial part of

the process. Crowley also notes that *copia* allowed students to declaim with inventiveness and style as the need arose: "[Public speakers] simply retrieved any relevant topics or commentary from their ordered places within memory, reorganized and expanded upon them, and added their own interpretations of the traditional material" (222). Copia trains rhetors to declaim on different topics at different times by preparing them to recall by re-inventing, re-arranging, re-styling, and re-delivering their memories of reading to make them compelling for a variety of audiences.

Furthermore, copia highlights that students do not select memories according to some predisposed representation or meaning, but rather according to what works, what exerts persuasive force at a given place and time, thereby generating productive strategies for recollection. Because memory arts concerned the storage, retrieval, and re-composition of information and knowledge, the memory arts can be understood as a deliberate and purposeful activity, as an aid to invention, and a pathway towards developing agency. Mary Carruthers notes in *The Book of Memory* that

> early writers agreed that writing on the memory is the only writing that is truly valuable for one's education, literary style, reasoning ability, moral judgment and (later) salvation, for in memorizing one writes upon a surface one always has with one. And the corollary assumption is that what one writes on the memory can be at least as orderly and accessible to thought as what is written upon a surface such as wax or parchment. (30)

While the metaphor of writing has found its way into the description of computer memories—Bolter, for example, considers them "fully automated writing pads upon which a processor can engrave electronic messages and later read them back" (*Turing's Man* 157)—the success story of the software enabled writing environment upsets established notions of performance and agency. "Topology and navigation, in addition to retrievability, make," as

van Dijck suggests, “the memory process a more intriguing effort than ever before; the networked computer is a performative agent in the act of remembering” (167). Current digital technologies, capable of increasing the abundance, pervasiveness, and accessibility of professional memories have become part of the field of practice to the point where the lines between personal activity and automated content contribution through software have become blurred. While digital technologies have introduced new considerations of efficiency into the media-memory landscape and professional practice, they’ve also increased a user desire that favors the immediate and the instantaneous over the distant and delayed, leading to an “intensification of our experience of the present;” this may, in turn, diminish the time and space we are willing to reserve for developing our memory (Hoskins 39). The field of audio production has been dealing with the ramifications of these technological developments, and professionals have found particular ways to retain a level of agency over their creative process in the era of digitally enabled, professional practice.

In *Recording the Beatles: The Studio Equipment and Techniques Used to Create Their Classic Albums,* Kevin Ryan and Brian Kehew show that modern mixing engineers have at their disposal a “nearly infinite array of effects. From traditional standbys such as reverbs and delays to more modern techniques such as convolution and emulation, the selection is endless and – for better or worse – instantaneous. Effects are now a ubiquitous commodity” (266). It should come as no surprise, then, that mixing engineers have become quite extroverted in their use of signal processing. Whereas mixing processors were once used to preserve the realism of a recorded performance, a majority of pop records do not sound as though they were, or even like they could have been, performed live. The larger-than-life sonic characteristic of music became a sign of professional quality in popular music. While audio professionals have and continue to make fundamental distinctions between what they do sonically in the studio and how music is performed live on stage, they deploy a

variety of signal processing techniques to craft larger-than-life performances. According to Alexander Case in *Sound FX: Unlocking the Creative Potential of Recording Studio Effects*,

> [t]he most important music of our time is recorded music. The recording studio is its principle musical instrument. The recording [and mixing] engineers and music producers who create the music we love know how to use signal processing equipment to capture the work of artists, preserving realism or *altering things wildly*, as appropriate . . . Equalization is likely the most frequently used effect of all, reverb the most apparent, delay the most diverse, distortion the most seductive, volume the most under-appreciated, expansion the most under-utilized, pitch shifting the most abused, and compression the most misunderstood. All effects, in the hands of a talented, informed and experienced engineer, are rich with production possibilities. (xix - xx, emphasis added)

As music production became a more creative craft—even more so since the invention of multitrack recording—the roles and responsibilities of engineers and producers expanded significantly. Specialized techniques and formulas for sound processing developed via extensive experimentation or through the magic of the eventual 'Eureka'-moments to augment a recording and turn a given song into a larger-than-life representation of an artist's creative output. In turn, recording studios in the United States, as well as producers, became much more known in the industry for being able to achieve unique tonalities, and famous artists would seek out specific engineers, producers, and recording studios just to get 'that' sound (whatever it may be).

Some of these techniques were more straightforward than others. Take for example American producer Phil Spector and his infamous 'Wall of Sound' formula, which was basically a production technique that called for large musical ensembles where multiple

musicians would play the same instrument to create a fuller and richer tonality (Zak 77). It wasn't uncommon for Spector to record two drum kits playing the same rhythm for the same song when one drum kit would have sufficed. Likewise, Spector's records often feature between four to six guitars playing the exact same part when other producers would rely on a maximum of two. At the time listeners marveled at the unprecedented power of songs produced by Spector such as "Be My Baby" by The Ronettes (1964), "You've Lost That Lovin' Feeling" by The Righteous Brothers (1966), or "River Deep - Mountain High" by Ike & Tina Turner (1966), and fellow engineers would puzzle over what Spector did to achieve his signature sound.

Yet, Spector's approach was quite overt. Many other techniques and processing formulas, however, were not. As audio production became more creative, engineers became a lot more secretive about their techniques, so much so that American engineer John Merchant, whose mixing credits include the Bee Gees, Michael Jackson, Barbra Streisand, and Celine

Figure 15 List of Pro Tools *equalizer factory presets arranged alphabetically by instrument and labeled according to sonic characteristics.*

Dion, would reminisce: "When I was working as an assistant, some of the engineers that I worked with used to put black cloth over the outboard gear to hide their settings" ("Multi-Platinum Mixing"). In essence, secret mixing techniques enabled by multitrack recording became valuable assets for the engineer, only to be bequeathed to an assistant after extensive vetting. Today, the idea of 'mix secrets' has become a bit more of an ambivalent concept, and aspiring engineers don't really have to wait for their mentors to reveal their secrets anymore. Digital mixing software solutions now commonly include extensive libraries of processing presets that promise to place a plethora of techniques at the engineer's fingertips.[10] These preset libraries are often neatly organized either by instrument type or musical genre, and each preset is labeled according to the results an engineer should expect from the settings—a readymade commonplace book. However, many professional engineers frequently express concerns with regards to making all of these presets available in software applications. On the one hand, they fear that software users would disregard the importance of studying sound and rely too much on software presets that, so they rightfully claim, can hardly be deemed final settings because mixing is not just a 'set-and-done' type of activity, but a continuous effort in manipulating and fleshing out sonic tonalities. Instead of promoting the use of readymade presets, many engineers urge aspiring engineers to embrace a different, and yes, more challenging method to build mixing skills: the creation and copious curation of a library of reference songs.

Building a comprehensive library of references is a very involved activity that accompanies all the stages in the career of a professional engineer. American engineer and producer, George Massenburg, neatly summarizes what reference mixes can do for

[10] Paul Théberge has noted in relation to synthesizer technology that during the 1980 there was a gradual change in emphasis in the marketing of synthesizers from (to simplify) 'lots of control' to 'lots of presets,' as the industry reconfigured itself from being a supplier to mainly professional musicians to being a supplier to a mainly hobbyist market (*Any Sound* 75-83). This same trend extended to the larger market of digital mixing, particularly with plug-in interfaces and their design.

professional skills development: “One mistake really stands out [in the work of up and coming engineers], and that is thinking their first efforts are great. I wish you guys pick up several of the top 100 CDs—the ones they are trying to emulate—and listen to them, compared with their work. And then tell themselves that their ears are not deceiving them!” (*Behind I* 174). As Massenburg implies here, the principal benefit of reference mixes is that they give engineers a professional, an often necessary, reality-check. Engineers depend on their critical listening skills for making technical and aesthetic judgments, but these skills translate into subjective, relative judgments about sound. Reference mixes provide a more, shall we say, objective dimension for judging the quality of a mix. We want to be careful regarding our understanding of the label ‘objective,’ though. Clearly, there is no single, correct way for mixing a song. Two mixes of the same song can sound vastly different based on the professional background of each engineer. Therefore, reference mixes provide engineers with a professional baseline because of their commercial success and/or artistic appeal. Furthermore, reference mixes have gone successfully through the final approval stage i.e., artist, producer, and label have all signed off on the work of the engineer and willing to release the mix to the listening public.

A broad and copiously curated library of references can anchor an engineer’s technical and creative decision-making process against commercial-level releases i.e., those that have been deemed ready to vie against other releases for listening audiences. Keep in mind that mixing engineers always operate within natural and technical constraints. In other words, engineers always work within the confines of what’s technically possible. On the one hand, the human ear can only pick up sound information between 20 Hz and 20,000 Hz. On the other hand, audio conversion is capped for loudness, and a mix that is too loud will naturally distort, and in not very pleasing ways. Finally, and despite the significant developments that have happened in surround sound, music engineers still have to contend

with the limitations of placing sound signals within a sound field (be it stereo, multi-channel, or in the most recent Dolby Atmos configuration) that is ultimately determined by the listening system used for playback in each case. Therefore, reference mixes can aid engineers in their own work because they provide a critical perspective on how other engineers have dealt with these constraints both technically and creatively. In addition, good references are those that translate well onto a variety of listening conditions (speakers, headphones, nightclubs, and so forth). As skewed listening perspectives after long hours of mixing work are an unavoidable part of the professional mixing practice, reference mixes may aid the engineer both for assessing various elements of a work-in-progress mix such as overall equalization and the relationships in volume level between individual elements in the mix, but also for '(re)calibrating' one's ears. In other words, reference mixes help to answer questions such as: "Is my vocal mixed loud enough so that the song will be able to compete on the radio? Do I have too much low-frequency information compared to my reference? Or, is there an element in my mix that's sticking out too much sonically that I need to correct?" Dave Pensado explains the importance of referencing this way:

> [Referencing] should be for inspiration . . . to make sure that you're able to compete with what your contemporaries are doing. For example, if you wanted to be a track star, and you decided, "okay, I'm going to run the 100-meter dash," [and] you go out and practice, and you get your time down to . . . 14 seconds. You're like, 'damn, that's great!' You go to your first track meet, Usain Bolt comes in at 9 seconds or less, and you're like, 'oh, maybe I should have been checking to see what the competition is doing. (Pensado's Place).

Interestingly, Pensado makes clear that reference libraries can serve as imagined tutors so that referencing other people's work can help engineers to increase their chances that the mixes they work on will ultimately be approved by the client. After all, the clients of engineers,

especially producers, are constantly aware of what's happening in the popular music scene, and therefore can judge the quality of an engineer's work based on similar records they are already familiar with.

Building the actual library used to be a tedious process, at least before the Internet revolution. Albeit some engineers still prefer going to boutique record stores in order to explore and find new music—the temples of music for the nostalgic and sentimental audiophile—the vast majority of engineers rely on currently available music platforms on the Internet such as Spotify, Pandora, and Apple Music, to get a feel for what's current in popular music scenes. These platforms have made it much easier in recent years to browse and discover new music. In 2015, Spotify, for example, introduced a sophisticated set of algorithms into its streaming service allowing users to start a playlist from a single song, and have the software populate a playlist automatically with songs that are similar in genre and/or musical style. Musical journeys and sonic discoveries have become a breeze with current music streaming solutions.

For most engineers, the process of building a reference palette and selecting the 'right' tracks for their libraries is informed by three related categories: musical genre, historical period, and musical element. The first two categories are rather practical considerations. Engineers consider it crucial to broaden their musical consciousness by way of listening to a wide range of musical genres; and while technical and aesthetic judgments in mixing often remain genre-specific, genre-mixing approaches have become common mixing as well. A drum kit for a jazz song sounds vastly different from, let us say, a drum kit in the genre of rock'n'roll, and thus the work of the engineer significantly contributes to the way we hear the elements of a song in a finished mix. The level of involvement of engineers with regards to the way music sounds nowadays is so profound that certain genres of music actually emerged from recording facilities rather than from shared cultural traditions and

musical conventions. British businessman and record producer Chris Blackwell, founder and long-time owner of the famed Island Records studios (known for discovering Bob Marley and producing his music), is widely credited as the inventor of the reggae genre. As Daniel Lanois notes in his memoir: Blackwell "had been a big part of the export of Jamaican rock 'n' roll . . . . When I spoke to Chris about it all, he explained to me that the reggae music everybody loved around the world had had its birth in the studio—in fact it had not been a documentation of what was happening on the street" (159). The creative input provided by mixing engineers shapes and solidifies the sonic characteristics for different musical genres.

Aside from studying aesthetical considerations that go into the recording and mixing of different genres, the process of building a reference library also helps engineers discern how technological developments in signal processing affect music productions within genres. For example, despite the overall genre similarities between a rock band such as Led Zeppelin and the contemporary band, Greta van Fleet—the latter widely seen as a contemporary successor to Zeppelin—the records of the latter rock group display increased audio fidelity and quality due to the technological advancements that have happened in audio production over the decades. This does not mean, of course, that older mixes should be barred from finding their way into an engineer's reference library because of outdated, mediocre technical equipment. In fact, the broad exposure to music across genres and historical periods yields an appreciation and, more importantly, an understanding of different tonal colors and flavors that, in turn, can help especially aspiring engineers define and develop their own individual styles and professional tastes. Interestingly, commercial success is, for many engineers, often only a secondary consideration when vetting reference tracks for inclusion into the archive; conventional wisdom in the professional community is that commercial success in no way guarantees good sound. Likewise, active referencing in the course of a mixing session is, many engineers find, more constructive for the mixing process and the final sound of a record

than spending vast amounts of money on expensive equipment; a carefully curated list of references can help guide the aesthetic decisions of the engineer.

The third category, musical element, is a bit more of an involved process than merely picking mixes from a variety of genres and historical periods. Engineers rarely rely on a single reference track in the course of mixing a song. Instead, they focus their attention on particular musical elements within a given reference track. For example, an engineer might want to mimic the sonic characteristic of a particular snare drum or the sound of a mixed acoustic guitar as it is mixed in a reference track. Not only that, rather than adding an entire reference track to the library, engineers often edit out and, thus, save the highlights from each reference track i.e., those sections they deem important based on a variety of technical and aesthetic aspects. One reference might help an engineer in creating a suitable, overall bass and treble tonality for the mix. Another reference might offer valuable insights for processing the lead vocal. Recall the example from the beginning of the chapter. When mixing ballads, for instance, the vocal is commonly much more foregrounded than, let us say, in rock music where the instruments appear to engulf the singer a bit more. Another element that engineers pay close attention to is the use of effects. That, however, becomes a bit more difficult and requires years of experience and training in critical listening since most effects such as delay or reverb are often hardly noticeable because they are being added only subtly to certain musical elements in the song.

Another reason why engineers prefer short reference snippets to entire songs is because of our ears' natural propensity to compensate for the sonic differences between two pieces of music relatively quickly. In other words, once switched back to the working mix, we tend to forget about the sonic characteristics of the reference after only a mere matter of seconds. Therefore, engineers switch between a reference mix and their work-in-progress as quickly as possible so that sonic contrasts become more revealing. For many years this

Figure 16 SampleMagic's 'Magic A/B' *and* 'Reference' *by Mastering the Mix.*

required complex routing strategies so that the switching can be done by pressing a single button on the keyboard. Technical innovations in the field of mixing software have made this process much easier. Third-party mix quality control software such as SampleMagic's 'Magic A/B' and the more recent 'Reference' software by Mastering the Mix have radically simplified the act of mix referencing. Rather than having to import various snippets into a work-in-progress session and then having to deal with complex routing issues, both of these tools offer comprehensive controls to load multiple references, match their volumes with the current mix, and then to make instant comparisons.

Referencing can play an influential role in the course of an engineer's professional journey, and many professional engineers swear by this method. Active referencing helps develop an engineer's critical listening skills so that identifying, describing, and distinguishing between various types of musical genres as well as learning more or less about the major sonic ingredients that are characteristic of different musical genres becomes easier over time. More importantly, active listening helps develop the engineer's professional taste and creative style. Most importantly, however, active referencing emphasizes an engineer's development of professional memory not merely when it comes to describing sounds, but also with regards to developing personal approaches to replicate, imitate, or interpret particular sonic characteristics via available processing and tone-shaping tools. An engineer

may, for example, identify that the sound of the bass guitar in a particular genre requires a certain amount of weight. While weight can be achieved via various mixing techniques including compression, equalization, and/or saturation, the approach is ultimately up to the engineer. The crucial requirement though, as we have seen in the previous chapter, is that the engineer instinctively knows how to reach the goal of adding weight to the source material. Professional engineers are making a point of that when they explain in interviews that it does not matter which tool is used as long as the engineer knows how to achieve the desired result, which is really an argument for the importance of spending time and familiarizing oneself with processors such as compressors and equalizers, how they work, what they do, and how to peruse them for manipulating the source material. According to Bruce Swedien, known for having mixed Michael Jackson's *Thriller* album, "you can get much more out of gear if you first know how to push the parameters as far as you can . . . but not too far, not to the point where it can degrade the music" (*Behind II*, 45). This takes experience and practice; in other words, it takes time. "[Y]ou've got to want to know how to manipulate the audio and make it do what you want it to do," Swedien explains. "You have to be very detail-oriented, and you have to be willing to spend the time it takes to learn your craft and develop the ability to shape sounds skillfully" (*Behind II* 46).

Audio mixing, as this chapter has uncovered, is very much an experience-driven activity. It involves both a honed creative imagination as well as technical know-how. Concepts, techniques, creative ideas, traditional and unconventional mixing decisions are part of the repertoire of famous mixing engineers, and they rely on various ways to build, expand, and maintain their professional repertoires to facilitate processes of invention. In that sense, music records, as we have seen, take on an additional meaning; they aren't solely for the listening enjoyment, but can also be used professionally for inspiration and study. The copious engineer swears by this method of critical and analytical listening to develop their

own professional expertise, mixing style, and inventive chops. Other engineers peruse included storage features in DAWs to build their own preset libraries based on settings that may function as suitable starting points to process various types of sounds and instruments; still others build and save entire mixing chains in their digital audio workstation that suit various creative mixing situations such as dealing with drums and vocals, etc. These settings are the result of both experimentation and successful earlier mixing sessions. And rather than memorizing these starting points and re-creating related settings each time, whereby technical considerations would delay the creative process, mixing engineers take advantage of the remarkable storage features of digital software. Settings files can be named and grouped by category, be it instrument or effect type. Ultimately, the computer and the software become commonplace books for the professional user.

5 THE END OF EXPERTISE AS WE KNOW IT? MEMORIA AS COMMODITY

> "The greatest and fairest discovery has been found to be memory; it is useful for everything, for wisdom as well as for the conduct of life."
>
> -- *Dissoi Logoi*, IX.1

> "So, how many engineers does it take to change a light bulb? None—the assistant did it the night before."
>
> -- Ed Cherney, *Behind I* 16

I used to play chess when I was a kid. I was never good at it, mind you, and that is probably the reason why I have not played in quite a while. However, just recently a video teaser ad on one of my social media feeds caught my attention, and it made me think about picking up the game again. But why, and why now? In retrospect, I stopped playing because I never saw my game improving in any significant way. While I do remember the odd win here and there—just with friends and never competitively—I will have to attribute these moments to pure chance and not the result of a well-planned and well-executed strategy. Nonetheless, I always liked the game of chess. I just wished I was better at it. To be honest, I am quite in awe when I read about the memory feats that master chess players accomplish: recall the exact moves of entire games—both personal as well as games played by others—long after they had been played or manage to play against multiple opponents simultaneously. But getting back to learning the game now would, at least for me, require such a level of discipline, determination, and time that I would need a truly compelling and persuasive incentive to make me want to put in the actual effort. That video teaser made some compelling arguments to give the game another go.

The teaser in reference is for an online video class taught by none other than former World-Champion and grandmaster Garry Kasparov. “Chess,” as I learn from my prospective instructor, “is a game of unlimited beauty, but it’s not just checks and attacks; you have to be creative.” Kasparov promises to share his “knowledge of the game of chess.” During the teaser, Kasparov poses a chess problem and asks his students how to solve it: “Let’s pause, stop the video, and think!” This is great! As a student, I am in control it seems. I can ‘work’ with a Grand Master to become a better player and do so at my own pace, and even become a better ‘decision-maker’; Kasparov promises as much. Now, this is a learning prospect I find appealing. After not having played the game for so many years, what better way to get back into playing than by learning from a world-renowned master?

Kasparov’s class is part of *Masterclass.com*, a website made up several video series of online classes taught by a variety of subject experts and famous individuals. At the time of this writing, interested learners can purchase access to 35 videos that cover a variety of creative and professional skills, from acting to cooking, film-making, sports, and writing, and more videos series are in the pipeline. *Masterclass.com* is a San Francisco-based online education platform. It was founded in 2015 by entrepreneur Aaron Rasmussen and film editor and director David Rogier. According to the creators, the platform is

> an immersive online experience that offers access to genius by allowing anyone to take online classes with the world’s best. Our instructors include Christina Aguilera, Serena Williams, James Patterson, and more…The videos are viewable at any time, and they can be paused, fast-forwarded, and re-watched as many times as you’d like. (*FAQ*, *Masterclass.com*)

Masterclass.com and other purchase- and/or subscription-based online learning platforms have been a more recent phenomenon in online education; yet, one that has been gaining a lot of traction. We can certainly attribute the emergence of this new industry to the successful

history and widespread creation and positive reception of tutorials and how-to videos on video platforms such as YouTube. The big difference between YouTube content and these subscription-based platforms is, however, the economic and symbolic capital that students have access to when they learn from renowned practitioners, from "the world's best." But not only that, contrary to the more traditional setup of an in-person master class, which has a beginning and an end date, on *Masterclass.com* learners can watch the uploaded content as often as they want, or rather for as long as they have an active subscription. Moreover, students can download dedicated exercise files and practice the skills and techniques taught with the same material used by the instructor. So, do we still need traditional, face-to-face instruction when we can simply purchase video tutorials?

This question reminds me of French philosopher Francois Lyotard 's epistemological and pedagogical outlook in *The Postmodern Condition*. While the collapse of 'grand narratives' and the parallel (re)emergence of localized knowledges jumps out as arguably his most memorable predictions for postmodernism, it is important to emphasize his view on how the roles of memory and information in postmodern culture have changed. On the one hand, Lyotard describes the increasing importance of the external storage of memory. "The traditional teacher," according to Lyotard, "is replaceable by memory banks, didactics can be entrusted to machines linking traditional memory banks (libraries, etc.) and computer data banks" (50). On the other, technology—as both memory's arbiter and vehicle—has become more pivotal for learning and the conduct of life. Lyotard perceives this as a seismic shift in what counts as professional skill. While the concept of the modern genius would describe someone who has recourse to personal and specialized knowledge, Lyotard's "postmodern" genius—or professional, for that matter—is the individual adept at exploiting innovative connections between vast and widely accessible, "stored" knowledges (51-2). A similar argument can be found in Kirschenbaum's *Mechanisms* where he argues—contrary to

Bernard Stiegler's assessment of memory as a technological tool—that memory "storage today is both an accessory, something you hold in your hand or slip into your pocket . . . but is also increasingly disembodied and dematerialized" (4). While the traditional teacher could still find work in such an epistemological environment by "teaching students to use the terminals," Lyotard is adamant about claiming that a "professor is *no more competent* than memory bank networks in transmitting established knowledge, no more competent than interdisciplinary teams in imaging new moves or new games" (53, emphasis mine). In other words, Lyotard sees two systems of knowledge transfer at odds here, and for him it is externally archived and archivable memories that cause the deprivileging of the traditional teacher in postmodern culture.

When a system of educational practice pushes towards the spotlight and promises increased convenience for the learner, it begins to challenge and often pushes out an established one. Given the recent emergence of the online education industry in general and the research I conducted particularly for this study, it becomes important to discuss the economic and epistemological implications of this development brought about by technological change. Here, the field of audio production can illuminate the implications and ramifications of this 21st-century technological trend. One of the most talked about economic consequences of affordable digital recording technology has been its impact upon larger commercial studios. Until the development of ADAT digital tape technology in the 1990s, the only option for musical artists to record was to purchase recording time at a professional recording studio, and even smaller, less expensive facilities were costly. A ten- to twelve-song album that took about two weeks to record on average could easily set artists back a few thousand dollars in the 1990s. Today, investing in a computer (and it does not even have to be a dedicated one for music production), a DAW, and a few microphones are all an artist needs to create professional records in a multitrack format.

The development of sophisticated software reverberation programs capable of simulating in breathtaking detail the sonic characteristics of various real-life recording rooms has had a devastating effect on the recording studio sector. With the exception of studios who are still in use to record orchestral music, many successful commercial studios have closed in recent years; Sound City, the Hit Factory, Unique Recorders, and Sony Music Studios in New York, Cello Studios and Rumbo Recorders in Los Angeles, and Smart Studios in Madison, Wisconsin, have all either shut their business since 2005 or have announced imminent closure. In most of these cases, the main reason was simple economics, the fact that more money was going out than coming in. Asked whether the rise of the home studio sector had a significant impact on his career, Grammy-winning engineer Kevin Killen replies: "The way the industry has been going the past couple of years, I've been forced to be creative in stretching a budget and finding ways to make a $100,000 record sound like a $500,000 record" (*Behind II* 107). Studios with large rooms that can accommodate many musicians are not really necessary anymore, and the development of low-cost digital recording technology has been playing an important role as well. As digital technologies for audio production have largely obviated the need for commercial studios, the conditions of knowledge transfer in the field of audio production have changed as well.

Thomas Porcello and Paul Greene's edited collection *Wired for Sound* has shown that educational change has affected working methods, accessibility, and stylistic development across a whole range of musical cultures. And the educational void is now being filled, I argue, by an industry that caters to an emerging community of self-taught engineers. And as it is true in every industry, various brands vie for customer attention, and they do so by employing various rhetorical communication strategies. In such a market environment, the concept of memory takes on a new meaning: as a powerful, persuasive consideration for product development and placement as well as brand management. Keep in mind, the teaser

for Garry Kasparov's class on chess caught my attention because it promised me access to the memories and professional experiences of a grandmaster.

Hence, there is an argument to be made here about the role that memory can play in the context of persuasive messaging. A professional culture defines itself through the way it reproduces knowledge. As R.L. Rutsky argues in *High-techne: Art and Technology from the Machine Aesthetic to the Posthuman*, the "matrix" of knowledge in the twenty-first century is "the sum of all data that surrounds us in a techno-cultural world. Indeed, the space of this memory is techno-culture itself" (153). In fact, memory seems to have become a currency for and a commodity of knowledge transfer, and therefore it becomes interesting to look at the various ways memory is employed as a persuasive device. Bradford Vivian supports this critical motivation: "The flurry of studies in rhetoric and public memory over the past scholarly generation," he writes in a review essay on recent work on memory, "has revived rhetoric's close association with memory in distinctively modern fashion: not as a performative technique but as a critical or historical mode of inquiry" (90). The following chapter presents a number of ways that memory becomes enmeshed within brand activation and product development as well as marketing.

5.1 The Disappearing Recording Studio Sector and Its Effects on Instruction

For most of its history, the apprenticeship model—in various levels of formality—served as the principal gateway for aspiring engineers to study the craft and the art of music production. Disc cutters, tape operators, and assistant engineers were trained on the job by existing professionals, sometimes in very formalized settings such as the large studios owned by record labels. Phill Brown gives an account of his time as an apprentice that is very representative of the learning experience:

> When I began work at the bottom of the studio hierarchy as a tape operator, I discovered that there was an informal system of apprenticeship in the recording industry. I was expected to learn by watching and listening while I made tea and performed other mundane jobs about the studio . . . . To work in a studio and to train under such engineers as Keith Grant [The Beatles, David Bowie, Queen], Glyn Johns [The Rolling Stones, The Who], and Eddie Kramer [Jimi Hendrix, Led Zeppelin] was a privilege, and I gained a unique approach and attitude towards recording that I carried with me through the next 30 years. (Brown iii)

Learning the craft was a rigorous experience, but as this quote also shows, it was pivotal in giving professional mixing engineers a multi-faceted training for future success in their jobs. According to Phill Brown, "[e]ach session seemed to differ in every way from the previous one, partly due to the diversity of the songs, but also because of the different working methods of each engineer" (Brown 14). In addition and in reference to what we have learned in the previous chapter, apprentices would pick up secrets, tips, and tricks of their mentors once they've applied themselves enough in their assisting role. Daniel Lanois is cognizant of the value and economic capital of mixing secrets. In his description of his recording studio in New Orleans he writes: "There were other pieces of equipment, like the Sony C-37A microphone that I had used on Bob [Dylan's] voice back in '88, some LA-2A compressors and Sennheiser 409 mics that are great on guitar amps, and many other pieces of processing gear that I will not go into—*I don't want to give away all my secrets*" (154, emphasis mine). As shown in previous chapters, music mixing does not follow many prescribed formulas. Aside from the obvious constraints of upper volume limits and the range of human hearing, the techne of mixing is governed by conventions and rules, and it developed through trial and error as well as the engineer's desire to experiment. In the *Rhetorica Ad Herennium,* we learned that natural memory is defined as "memory which is imbedded in our minds, born

simultaneously with thought" while artificial memory is characterized as "memory which is strengthened by a kind of training and system of discipline" (207). A trained and readied memory was crucial for an orator to appear polished and prepared for any situation. The same can be said about the art of music mixing. Established and successful mixing engineers would pass on their respective working methods as well as their particular musical tastes to their apprentices as a form of productive knowledge. By learning the techne of mixing at a dedicated facility, the next generation of mixing engineers received not only the skills necessary to handle various types of music mixing situations, but the collaborative work environment also fostered the development of professional taste.

Moreover, the traditional studio environment nurtured the apprentice's desire to acquire more knowledge. In my research, I frequently came across mixing engineers reminiscing about their apprentice years with fondness and reverence. Aside from receiving training in the proper operation of the recording and mixing equipment, apprentices like Phill Brown would often "spend the occasional half-hour sitting in on sessions after I had finished work. I wanted to pick up as many ideas as possible" (7). Eventually, the apprentice was given permission to oversee an entire mixing session on their own. Given the economic pressure and associated risks of letting an apprentice conduct a recording and mixing session for a client, many apprentices remember their first mix as a pivotal moment, a rite of passage for their professional development. "It was surgery on their baby," Glenn Berger remembers, "with the mean old daddies breathing down my actual neck" (50).

The canon of memory has a constructive dimension because it provides a professional community with a way of continually redefining itself and its aspirations amid ever-changing circumstances. As we have seen in previous chapters, ancient scholars deemed memory critical to invention, arrangement, style, and delivery. For Plato, memory was the connection to "the divinity of the soul," and it was the "locus point" for the topoi and a key to unlocking

invention for Aristotle; for Cicero, memory provided proof of the soul's divinity, and Quintilian found strategies of remembering to be the source of the orator's eloquence and persuasive prowess (Reynolds 5). In the recording studio environment as much as it was the case in ancient culture, memory can be seen functioning as a participatory activity, one that served to maintain professional consensus (Hobart and Schiffman 2). At the height of the analog era and the commercial studio business, many, if not most professional engineers and producers worked out of the large commercial studios in New York, Nashville, and Los Angeles. Most of these recording studios such as the Hit Factory in New York or A&M in Los Angeles consisted of several studio suites under a single roof. At any given time, there would often be several artists recording simultaneously. Since there was usually a single recreational lounge area, the studio space fostered opportunities for professional engineers and musicians working on different projects to socialize and talk shop. With the general decline of that model of audio production and the subsequent shift to more modest studio spaces, such opportunities have declined significantly.

In the world of mixing, we have seen how the past shapes the present and the future. As Kathleen Welch notes in "The Platonic Paradox": "invention, style, and arrangement can exist in a vacuum; it is memory and delivery that connect us to history, culture, and the life of the polis" (9). Therefore, memory is inextricably linked to pedagogy. In *Back to the Rough Ground: 'Phronesis' and 'Techne' in Modern Philosophy and in Aristotle*, Joseph Dunne comments on the relationships among techne, mastery, and pedagogy, explaining that: "[t]echne is not itself a useful thing but rather a generative source (*arche*) of useful things, a habitual activity (*dunamis*) of the maker through which he can reliably produce and reproduce them" (249). A master of a techne is, therefore, in a position to teach and therefore transmit knowledge to others. According to Dunne's account, techne becomes a "source of the maker's mastery of his trade and of his ability therefore to not only accomplish a

successful result but in doing so to give a rational account . . . of his procedures" (250). For the field of audio production, practitioners developed techne and mastery inside the recording studio, an environment where established techniques were honed, and new techniques were developed. In this sense, the concept of "techne aims to create paths in uncharted territories," Janet Atwill claims, "to help one find one's way in the dark" (69). Techne "bend[s] limits into new paths in order to reach, or better yet, produce, alternative destinations" (68-9). Techne does not necessarily concern fixed methodologies or procedures; rather, it involves investigating ambiguities and stretching the limits of prior theories and applications in order to generate new practices.

As recording studios continue to go out of business because of economic constraints, opportunities for learning mixing have moved online. On the Internet, aspiring engineers can find an expansive market for self-help content, with online education companies promising to provide access to the cultural domain of mixing rules and expertise. In addition, there has been an emerging field of online knowledge brokers who provide hardware equipment and software plug-in reviews, often reinforcing the notion that all one allegedly needs to do is purchase the right tool to compensate for one's lack of skill. This suggests a tension whereby technology comes to compete with education i.e., theoretical understanding and professional experience. According to Mary Carruthers, "[t]he proof of a good memory lies not in the simple retention even of large amounts of material, rather it is the ability to move it about instantly, directly and securely that is admired" (19). Digital technologies are now marketed as alternatives and substitutes for supposedly 'good memory,' and it is not a surprise that audio software manufacturers have jumped on this notion to attract customers and increase their profit margins. However, albeit memory is deployed here as a purchasable pathway towards expertise and professionalism, these commodified memory artifacts can merely provide truncated models of expertise because they are not wed to the critical roles played by

professional mentors. Nonetheless, memory has become an important element within product marketing, and thus we can enlist the concept of memory heuristically in these types of cases, to identify and assess persuasion strategies employed in the audio software industry.

5.2 Conservative, Associative, Emancipatory, and Referential Appeals to Memory

In the previous two chapters, we have focused on the roles that the rhetorical concept of memory can play both for structuring a comprehensive and familiar digital work environment as well as in aiding the processes of invention. We relied on classical rhetorical theories of memory, highlighted traditional techniques of recollection, and illustrated how audio professionals utilize available features in professional software applications to foster and nurture their journeys towards professional expertise. For this chapter, however, we will not be looking at classical rhetorical theory. We will not revisit corresponding techniques designed to strengthen one's abilities to remember. Instead, we will flip the direction of the concept's influence on practice, and spend some time discussing what the industry has been doing in shaping the experience of practice through memory. After all, most (creative) professional work is done today with the help of software. It is an inevitable part of the professional experience.

Vannevar Bush imagined the 'memex' as a memory machine, as a tool capable of allowing users to *outsource* the act of remembering into technology, and a brief glance at the software applications we use in both our professional and personal lives shows the extent to which companies incorporate the latest developments in content management and automation algorithms and, thereby, cater to our varied desires for practical convenience. In that regard, memory does not merely reflect a valuable element in developing professional expertise and skill; it also begins to blend with the most prevalent province of rhetorical activity: persuasion. Aside from facilitating technical know-how and workflow improvements, this

chapter illustrates that memory also has the capacity of satisfying our appetite for simplicity; once we perceive memory as a distributable commodity, we can begin to see the types of persuasive incentives that software companies incorporate into their products and marketing strategies. We frequently encounter memory manifesting in software, and therefore we can use the concept of memory heuristically to investigate how audio software companies have utilized memory to shape the experience of practice.

There is no denying that sentimental attachments play a big role in professional mixing practice, and the previous chapters already alluded to this observation to some degree. We saw how engineers enhance their professional workflow via the use of so-called 'go-to' tools for various types of processing and how digital audio workstations offer several ways to pre-route these 'go-to' tools as mix-templates so that they remain close at hand. Moreover, we have seen that the personal and professional choices engineers make, be it for accurately capturing a performance or executing their ideas for sound processing effectively and efficiently, are often informed by taking inspiration from the past, or are guided by a simple principle: whatever works. Truly, mixing engineers are creatures of habit, and who would blame them; in a work environment that is driven by constant and tight deadlines, it is worth developing and pre-arranging a set of familiar tools that will help the engineer achieve a desired sound for a given song or record—a sound that appeals to the client, and by extension to the listening public. The same can be said for performers as well: we learned from the example of Frank Sinatra and others vocal performers how musicians—sometimes in consultation with engineers and producers—would often favor certain pieces of technology such as microphones, preamps, equalizers, and compressors over others in order to capture the best sonic representation of their particular timbre onto the recording medium.

Now, this is a more particular consideration in the area of creative decision-making in audio production practice compared to mere workflow improvement considerations.

Certainly, engineers often pick their ‘go-to’ tools (including their digital audio workstation for that matter) based on matters of efficiency. A DAW like Studio One from Presonus, for example, consolidates various aspects of mixing by default into a single-window environment, whereas the mixing and editing work in Pro Tools happens in distinct and separate window interfaces. Other software tools for processing such as Soundtoys’ suite of effects are presented in such a way that the most common parameters for processing are easily laid out, always visible, and thus always accessible in the main plugin window whereas more advanced tweaking options remain hidden and can only be revealed by clicking a corresponding button in the plugin interface. This sort of de-cluttering reduces the time it takes to find parameters for basic sound adjustment, a level of convenience that many engineers deem important. However, many engineers also gravitate to certain tools for processing based on these tools’ widely acknowledged capabilities to ‘color’ the recorded source material in unique ways and thereby impart a certain sonic imprint onto the audio track. In fact, some of these processing devices such as the Fairchild limiter, the UREI 1176 compressor, the SSL G-series Buss compressor, and the Teletronix LA-2A Leveling Amplifier—all pre-digital devices—have become famed staples in recording studios and the profession at large, so much so that they’ve entered not merely the world of mixing lore, but also the engineering vernacular.

Each of these hardware units for dynamics processing has a ‘sound,’ so to speak, and many engineers swear by these tools to achieve desired sounds for a song or a record. For example, a Fairchild limiter is capable of imparting what engineers describe as ‘warmth’ to the source material. The technical reason for this is that under the hood the Fairchild limiter, originally designed in the 1950s and built to last, consisted of a total of 20 power tubes and extensive circuit wiring. Therefore, when the limiter is turned on and the tubes have warmed up, any sound that is sent through the Fairchild—even if the metering displays on the unit

show no processing taking place—is inevitably colored by the built-in components. The same is true for the other famous devices mentioned above; based on the components used for construction, a UREI 1176 compressor is known for making sounds ‘pump’ and ‘breathe,’ an SSL bus compressor is praised for its ‘punch’ and ‘clarity,’ and the LA-2A leveling amplifier is commonly considered the processor of choice when it comes to smoothing out the overall volume of a bass performance or a vocal.

That is not to say that the main purpose of these tools, namely dynamics processing, cannot be achieved through software. If an engineer believes that compression is all that a recorded sound requires, then there are a number of viable alternatives available that are similarly capable of addressing the issue of volume imbalances in the source material. However, when it comes to imparting additional layers of harmonic content to a recorded sound, these coveted devices provide unique sonic flavors that have made them highly desirable by mixing engineers. Additionally, and this is in reference to the previous chapter on the use of past recordings as invention aids, each of these processing tools has been used on countless successful records, a fact that has made them even more desirable for many engineers to acquire and include them in their mixing arsenal. However, that poses some problems. Estimates vary, but as far as the Fairchild limiter is concerned, out of the roughly 1,000 units that were built only about fifty units have survived to this day; and on the used market it is not uncommon to see an original, vintage Fairchild to go for about $80,000 to $100,000.

Audio software companies have been very cognizant of the fact that most of these devices are simply financially out of reach for the average engineer. Their solution and one that has contributed crucially to both elevating digital mixing in general and further legitimizing software as a viable alternative to analog mixing has been to develop technical procedures designed to emulate, or shall we say ‘remediate,’ these devices as accurately as

possible in software form. Over the past ten years, many audio software companies can attribute their huge market success to emulations of vintage equipment. Today, the coveted tools of the profession are no longer out of reach for the average engineer, at least in emulated form. It is likely just a matter of time until one of these companies uncovers yet another pre-digital processing unit worthy of being emulated; and even if it's not as famous as a Fairchild or a UREI 1176, such a unit would still offer a 'sound,' a sonic flavor that would be advertised to the engineering community as a flavor worth having. These decisions—be they design-, use-, and/or promotion-centered—take form, I would argue, via a rhetoric, both visual and/or textual, that is geared towards appealing to various types of professional recollection and remembering.

There seems to be nothing that's more fondly described by mixing engineers than having that tactile sensation of fiddling around with knobs and moving actual faders. At least that has been the case for the majority of professional engineers included in this study when it comes to responding to questions about the differences and similarities between analog and digital mixing practice. For some, like Daniel Lanois or Michael Brauer for example, mixing is a very physically involved activity whereby the large-format mixing console is perceived as an instrument in its own right, an imaginary Steinway where the piano keys would resemble the channels on the console. Naturally, trackpad, mouse, and computer screen cannot provide that level of physical involvement. Others point to the notion that mixing is easier with actual knobs and faders because any adjustment would translate more seamlessly into emotional responses to the music, thus making the mixing experience more immediate and pronounced. Again, the default input devices in digital mixing i.e., mouse and keyboard, can hardly compensate. Still others, like Chris Lord-Alge, would point to the fact that in analog mixing an engineer can adjust multiple parameters on a piece of hardware simultaneously. The workflow in digital mixing, by contrast, is often constrained by having

to navigate between multiple sets of window configurations. While the tactility of hardware remains a particular advantage exclusive to the analog mixing environment (unless one invests in a digital control surface that connects to the computer via USB and simulates the console layout with a select number of faders and knobs to adjust parameters in the software), the familiarity of visual layout and sonic characteristics are not. Audio companies actively tap into these aspects of structured professional memory in the context of designing their software emulations. This can take form in at least four distinct modes which I label as follows and describe in turn: *conservative*, *associative*, *emancipatory*, and *referential*.

As to *conservative* forms of representation, we may refer to the software products from audio technology company Universal Audio (UA), for example. In particular, let us do a side-by-side comparison of the visual layouts of their Fairchild, 1176, and LA-2A to the front panels of the original hardware units. Right away the level of photo-realism in the design of the graphical user interfaces becomes immediately noticeable, so much so that the trained eye

Figure 17 Comparison of hardware units (left) and their emulated counterparts (right).

would even spot the inclusion of visible dents and blemishes that contribute to the virtual aging of the unit. Additionally, each component on the front panel i.e., buttons, knobs, and meters, is deliberately remediated in the software with regards to scale, operational parameters available, as well as labeling. The software is meant to completely and accurately represent the circuit behavior and modes of operation of the original hardware, even giving users the option to replicate the sonic behavior of a unit that is in less than pristine shape. In doing so, the design of UA's software emulations engages in appeals to memory in two distinct, yet related ways: on the one hand it meets engineers with analog mixing experience on familiar grounds in correspondence with the workflow patterns kept in their professional memory; on the other, the design is a deliberate homage to the original and coveted hardware i.e., processing units that have famous histories of their own; not only do analog emulations further encourage and legitimize the legitimacy of digital mixing, their affordability in software form is appealing not only to those initiated but also to members of the engineering community who lack the experiencing of coming up professionally in an analog-based recording and mixing environment. *Conservative* appeals to memory are multi-layered. In the context of mixing software product development, they are based on both aesthetic/user experience design decisions as well as coding/programming decisions with regards to sonic accuracy. Interestingly, design decisions are given equal importance to programming decisions, albeit design aspects don't add anything to the principal technical purpose of these types of software, which is to emulate the original hardware unit as accurately as possible into software.

By contrast, *associative* appeals to memory are less layered. A great example here is Slate Digital, which is an American audio technology company founded in 2008 that has become famous in the industry over the course of the last ten years for their analog emulations. Their product catalog includes emulations of many of the pieces of analog

equipment mentioned earlier, as well as others. However, the memorial presentation of their software follows a less *conservative*, and more *associative* mode. Take note of the screenshot below which shows Slate Digital's "Virtual Mix Rack," a plugin with a so-called modular design i.e., that the number, type, and order of the analog emulations loaded into the rack can be decided by the user. The rack idea is inspired by the analog days as well. So-called 500-format racks provide mounting for signal processors that have the corresponding physical dimensions; the sound travels through the virtual rack from left to right just like the original hardware. In the screenshot we can see a total of five effects lined up, three with a black front panel, one in blue, and one in red. The rightmost signal processor, the 'FG-116,' is also an emulation of the UREI 1176 compressor mentioned earlier. However, while the front panel includes the common parameters and the available setting options, the graphical user interface remediates the past in less *conservative*, and thus more *associative* ways. Although the front panel follows overall a vintage design, we can see the knobs are placed differently, and they are different in size compared to the original, etc. Part of this has to do with licensing options that are either given to an audio software company or not, and Slate Digital as a company is not officially endorsed by the license holding hardware companies. That is not to say, however, that *conservative* forms are reliant upon being licensed; there are other

Figure 18 The API lunchbox, a rack for mounting 500-format processors.

Figure 19 Slate Digital's Virtual Mix Rack with UREI 1176 emulation on the far right.

examples of software companies that design the graphical user interfaces of their UREI 1176 emulations as close to the emulated hardware as possible without violating licensing rules. Slate Digital's *associative* appeals, thus, are geared towards referencing the past in a more retro-inspired design while staying true to sonic accuracy. In other words, the "Virtual Mix Rack" interprets the visual aesthetics of the past through the lens of a profoundly forward-looking branding strategy. Therefore, *associative* appeals to memory follow a hybrid strategy that blends present with the past, with an eye to the future.

Emancipatory modes of appeals through memory, then, quote the past but place more emphasis on the present and the future. American audio software company iZotope (founded in 2001), which we have already come across in the introduction to this study and which will reappear again later in this chapter, is a great example of this type of appeal strategy through memory. Aesthetically as well as sonically, iZotope has positioned itself as a cutting-edge, envelope-turning company. They have become well-known for their Ozone suite of mastering processors, and they are currently the first to embrace machine learning in music mixing. With regards to analog emulations, they have entered the field rather late. In 2015, analog

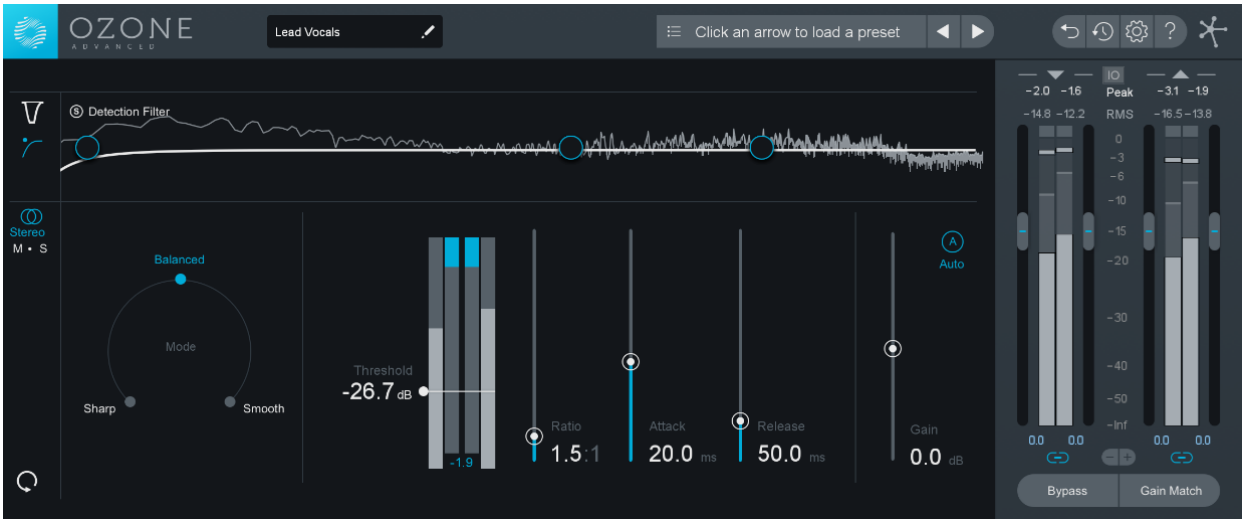

Figure 20 Vintage Compressor processor bundled with Ozone's mastering software suite.

emulation became part of the release of version 7 of their award-winning Ozone suite. The included 'Vintage Compressor' software processor exemplifies their use of *emancipatory* appeals to memory. On their website, the team at iZotope explains their approach to product design in the following way:

> The Vintage Compressor module in Ozone 7 Advanced is a feedback compressor that incorporates qualities from numerous classic compressors without being modeled on a single unit. It offers controlled dynamic range and another way to amalgamate myriad musical elements to forge a different sound . . . . Ozone's Vintage Compressor is designed for single-band workflow, with no look-ahead, which gives it a particular sound. It allows for slightly higher distortion levels, characterizing your signal in emulation of the roundness and richness of a vintage analog device. (iZotope.com, n.p.)

Both user experience strategy and emulation of sonic characteristics are shaped by an appeal to memory where the past merely functions as a springboard for the creative imagination. For example, the interface includes exclusively digital features such as a sonic spectrum analyzer in the top of the window, and it presents compression parameters in a more stylized and

futuristic manner. At the same time, rather than emulating a particular piece of hardware, the 'Vintage Compressor' module presents not one, but a vintage blend that combines and blends the principal behaviors and sonic characteristics of various analog compression processors, thereby creating a unique processor one cannot find in the world of hardware. The user has the option to dial in three different types of analog compression behaviors: 'sharp,' 'balanced,' and 'smooth.' No actual front-face labeling is provided on the unit that's been emulated in each case, though based on the behavior descriptors trained professionals might identify the 'sharp' setting as being reminiscent of an 1176 compressor, the 'balanced' setting might be a Fairchild, and the 'smooth' setting could imply an LA-2A. Such ambivalence creates a distancing from the past to the degree that this plugin lives, and can only live, in the digital realm, similar to other digital processors that have no real-world counterparts such as the 'ChannelStrip3' software processor from American company Metric Halo.

Last but not least, companies also tap into the concept of memory-as-appeal in a more *referential* way. While the previous examples illustrated the persuasive uses of memory in a predominantly historically-guided fashion, *referential* appeals to memory are, by contrast,

Figure 21 The plugin interface of the 'ChannelStrip3' by Metric Halo.

practice-based. In this mode, the appeal to memory manifests in a user experience that is framed and shaped by the professional memories of iconic engineers in the industry. A long-time favorite of professionals and hobbyists alike, Waves—a pioneering company in the field of digital mixing due to their release of the first equalizer software in 1992, the "Q10 Paragraphic EQ"—is one such company that has released software suites based on the mixing styles and equipment preferences of individual engineers (Mix Staff). In their product catalog, these types of processors—without surprise—appear in the Signature Series category. Among the engineers whose mixing styles were essentially codified and immortalized in digital form, are big names in the industry like Chris Lord-Alge, Tony Maserati, Jack Joseph Puig, and Eddie Kramer. Jack Joseph Puig, whose mixing room we have already come across at the beginning of chapter four, says of his vocal plugin:

> When I mix a vocal, my approach is intuitive and instinctive, not technical. I don't think in terms of "which delay" or "how to EQ it" or "more compression" or whatever. What concerns me is how it makes you feel. And since each singer is unique, and every song is unique, there's no single way to go about it. Is it personal, is it intimate, or is it loud and aggressive? So I do whatever it takes to make sure the vocal is open, sits well in the mix and, most importantly, helps convey the message of the song. JJP Vocals helps get you there. (Waves-JJP Vocals)

In practice, the actual software transcribes JJP's mixing style via semantically-charged descriptors and associated faders and knobs in the graphical user interface. Processing techniques that often require the combination of various units are consolidated in JJP's vocal plugin. See for example the compression knob, labeled 'COMP,' in the bottom-left part of the graphical user interface. All the user has to ensure at the outset is that a sufficient amount of signal of the recorded source is sent through the software processor at its input section, for

Figure 22 Screenshot of the 'JJP Vocals' processor.

which the programmers included a sensitivity knob and an indicator light in the top left corner of the interface. From this point on, the entire, and often usually complex process of mixing, is reduced into single knobs that apply either more or less of the associated effect to a recorded vocal. This 'more/less' concept for sound processing is kept rigorously consistent throughout the entire plugin. Various types of sonic colors that ambivalently and subjectively labeled 'MAGIC,' 'SPACE,' 'ATTITUDE,' etc., can be toggled on an off and dialed in via a single corresponding fader below; the process of mixing becomes a simple matter of either adding or subtracting an effect. But what is the processing technique that lies behind 'MAGIC'? What type of 'SPACE' effect is used? How is 'ATTITUDE' achieved? Unfortunately, this information remains a secret.

Instead, what practitioners are given, I would argue, is a truncated digital remediation of the engineer's memory palace. Labels like 'magic' and 'attitude' in JJP's vocal processor, or 'wall,' 'spank,' and 'push,' which are descriptors for compression techniques that we would find in Chris Lord-Alge's version of the vocal processor remediate the unique, professional memory repertoires of these engineers. However, they mask the actual

Figure 23 The 'Effects' processor from Eddie Kramer's mixing collection.

techniques involved, turning the act of mixing into a less of this/more of that type of activity, thereby obfuscating and trivializing the rich and important history of sound manipulation in mixing. Eddie Kramer's set of effects are set up in similar fashion. Asked about the inspiration for the 'Effects Channel' processor, Kramer muses:

> For the Effects Channel plugin, I set out to recreate some of the basic elements that I use whenever I'm painting a sonic picture. Over the years, these elements have evolved to suit a variety of sources and styles, from whispering vocals to screaming guitars and beyond. H-Slap is a shorter delay that emulates tape at 15 inches per second, with some plate reverb at a medium setting. Z-Slap is a longer delay (7 ½ inches per second) with a bit of feedback and a longer setting on the plate. Between the two, you'll easily find the ideal setting for almost anything you can throw at it. (Waves-Eddie Kramer)

The only thing we can discern from the software interface is that it offers both delay and reverb effects. And that's it. Well, not quite: we also know that each emulated technique comes from the mind/memory of an engineer who's had tremendous international success

through his work with artists like Jimi Hendrix, Led Zeppelin, and Carlos Santana. The signature series developed in collaboration with famous Canadian engineer and producer, Greg Wells, take the 'more/less' concept to its logical extreme. Unlike the signature software processor examples mentioned above, most processors in Wells' series relies on just a single knob to dial in the amount of the effect, or shall we say effects; in fact, Wells' 'MixCentric' processor combines multiple effects into a single knob that are usually involved in processing the whole mix, and some of the processing involved will not even activate before a certain amount is already dialed in by the user. To be fair, these kinds of software processors satisfy the appetite of many practitioners when it comes to convenience. Results are purportedly achievable quickly and easily, provided that the user already has a sonic picture in mind for the source material beforehand. But at what point does convenience turn into negligence with regards to skills development? That is really the more pertinent question. Given that traditional forms and places of learning have been on the decline in the course of the last decade, these types of software processors provide a tempting alternative to the drudgery of having to build up one's mixing chops over time. Yet, these processors are far from being instructive. Rather, they promote mixing by colors-type of paradigm.

Figure 24 The user interface of the Greg Wells 'MixCentric' processor.

5.3 'Let Me Mix That For You' – The 'Lure' of the Smart Algorithm

The notion of professional practice as commodified product rather than learned self-achievement is already part of the product development decisions that have gone into these signature bundles. Part of using these tools is to outsource technical as well as aesthetic judgments to the virtually remediated mixing styles of iconic figures in the industry, but this idea of outsourcing can be taken even a step further. Once more we will be taking a look at the software processors sold by iZotope. With the latest version of their highly-acclaimed digital mixing suite, Neutron 2, iZotope has been the first audio technology company to fully embrace the current possibilities of machine learning and artificial intelligence. Promoted as "A smarter way to mix," Neutron 2 is equipped with the so-called 'Track Assistant.' According to the product website, the algorithm's list of features include:

- Automatically detects different instrument types like guitar, vocals, bass, and drums
- Creates custom, optimal starting points based on your audio tracks
- Offers three levels of power, from Subtle to Medium to Aggressive
- Adds . . . Spectral Shaping . . . sound for subtle focus and clarity
- Intelligently places EQ nodes and creates an EQ curve
- Sets optimal settings for signal flow, including single or multiband processing
- Smartly places crossovers in multiband modes
- Selects Compressor style (Digital or Vintage) and automatically sets settings (Threshold, Attack, Release, and Ratio)
- Selects Exciter algorithm blend and dials in a custom amount tuned to the audio. (Neutron 2)

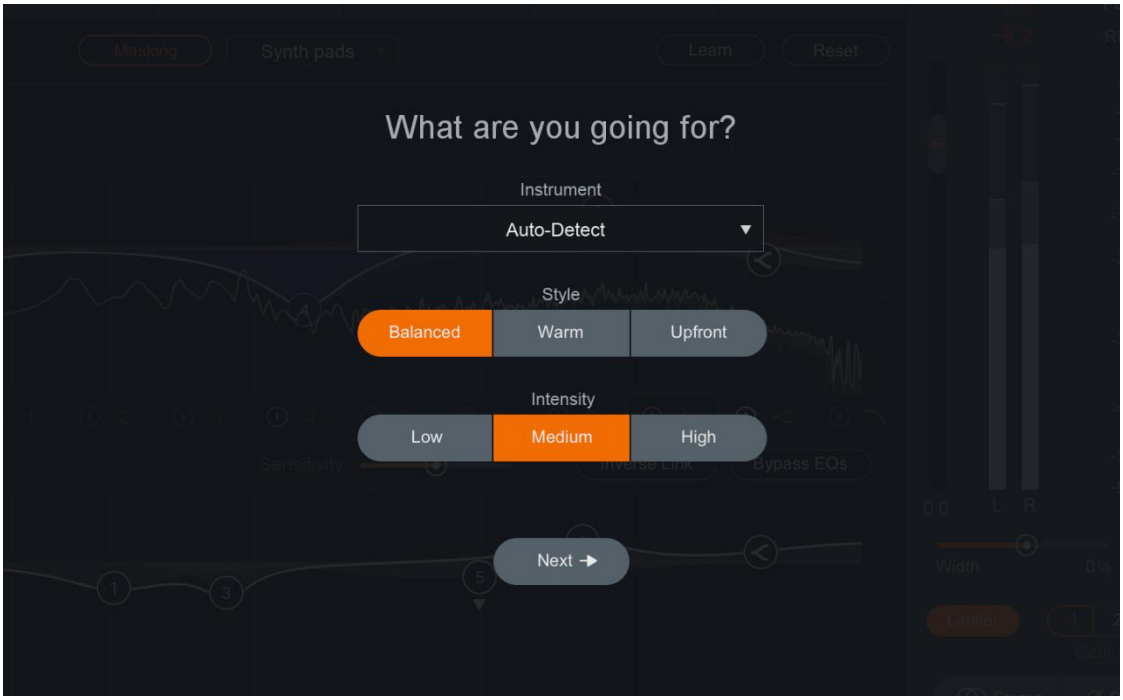

Figure 25 The selection screen in iZotope's Neutron 2.

In practice, when the user engages the assistant, a dialog window pops up and three decisions are left to be made: one for detecting the source material manually or automatically, another for choosing between three types of processing styles that the algorithm will attempt to match,[11] and finally one for setting an intensity level for the algorithm's processing decisions. Once these decisions have been made, the algorithm goes to work, and it does so quite uncannily. A suitable and familiar metaphor that comes to mind is the hands-free experience of letting a self-driving car take control, the latest trend in car manufacturing. Neutron's mixing algorithm gets to work in similar fashion. Knobs and faders start moving on their own; the processing is being applied in real time. Lean back and watch the mix coming together, one might think! The results are, the company promises, optimal settings for the detected instrument. Albeit the feature description on the product webpage states that these

[11] It should be noted that Neutron's matching capabilities are not entirely new. The first tools that allowed for signal and style matching have been software equalizers that entered the industry in the early 2010s (see Walden). These processors gave users the opportunity to load a reference track and have the plugin analyze and match the mix's frequency curves to those of the reference track. What makes Neutron's 'Track Assistant' unique, though, is the fact that the processing goes beyond mere equalization but involves other types of mixing processes such as compressing, limiting, and exciting as well, which are automatically applied by the algorithm.

settings should be considered 'starting points,' the rest of the product description presupposes a level of trust and reliance associated with current software technologies that we may reasonably wonder how many owners of Neutron would bother adjusting the settings further after the algorithm has done its job.

In such a mixing scenario, professional skills risk becoming negligible. Why go through the strenuous process of building a memory palace consisting of techniques and professional workflow knowledge when there is so much software currently available that already provides built-in memory palaces in one convenient form or another? Why remember when there is software that seems to have made Vannevar Bush's dream of a memory machine a present-day reality? There is no better cultural formation to illustrate the potentially unintended consequences of productivity technology developments than the community of audio professionals. The continued disappearance of recording studios in the United States has created a crisis of expertise, a practice vacuum that businesses in the industry are eager to fill.

Many of the professional engineers I have researched for this study have and continue to rail against these tech-convenience trends. Andrew Scheps has been one such voice in stemming the tide of software-induced indulgence, and he has been a very active one indeed. He has expressed his views on the importance of practice, knowledge, never-ending professional curiosity, and lifelong learning in various, publicly accessible venues, be they interviews, blog posts, and university lectures. However, Andrew Scheps' perspectives have also found their way into software design. Released in January of 2018, the "Scheps Omni Channel" has been the third collaboration between the Grammy-winning engineer and producer and audio technology company Waves.[12] At first glance, the design uses *associative*

[12] The first collaboration resulted in the release of the "Scheps 73" equalizer, an emulation of the very equalizer that has become a mainstay in Andrew Scheps' toolbox while the second collaboration created the "Scheps Parallel Particles," a tone-shaping device that remediates the engineer's use of parallel processing techniques.

appeals to memory. The placement and representation of faders and knobs remediate a vintage hardware aesthetic. The software is not based on any particular piece of equipment but combines inspired emulations of various processors that Scheps has been working with throughout his professional career. The compressor section (4th module for the left, labeled 'COMP' at the top of the module) offers users a choice between three wiring configurations, 'VCA,' 'FET,' and 'OPT' that represent different classical compression behaviors; while the original hardware units aren't mentioned (and for good reason, I will argue below), the acronyms refer to famous units; though we have not come across a 'VCA' compressor in this chapter, we did refer to a famous 'FET' and a famous 'OPT' processor: the UREI 1176 and the Teletronix LA-2A. The remaining parameters in the Omni Channel are hardware inspired i.e., the knobs and faders use standard labeling, and do not refer to Scheps' mixing ideas as we have seen for the previously discussed signatures series of effects processors. Therefore, the Omni Channel is generally in line with a recent resurgence in so-called 'channel strip' plugin designs for mixing i.e., the kinds of all-in-one tools that incorporate those processors usually found on each channel of an analog console by default. Equalization, compression, limiting, transient-shaping and pre-amplification are all more-or-less standard features. Additionally, the 'Omni Channel' includes a library of preset settings curated by professionals in the field and categorized by name.

While the processor includes many standard features for digital mixing, it is a unique and, I would argue, important addition because unlike other offerings it provides a unique, learning-based mode designed to aid the engineer's process of understanding, storing, and retaining tech skill and workflow-based memories. This learning-mode synchs with the preset library and can be toggled on or off by clicking the 'FOCUS' button at the top right of the plugin next to the preset library. When active, the edges of some knobs in each module

Figure 26 Andrew Scheps next to the 'Omni Channel' graphical user interface.

become highlighted in yellow to indicate that these would be the ones a professional like Andrew Scheps would adjust first to fine-tune and achieve a desired result (Waves-Scheps). In other words, loading such a 'Focus' preset presents users with a degree of mentorship within software designed to guide users towards using processing tools such as equalization, compression, and/or limiting more effectively, and thereby enhance their workflow. Once a user has committed these important controls to memory, the 'Focus' mode can be toggled off. In this sense, audio technology manufacturers in collaboration with established engineers have started to take into account the new reality of learning the craft of mixing. The Scheps 'Omni Channel' is the first offering that attempts to bridge that divide between a new, and post-apprenticeship generation of engineers and the 'treasure house' of knowledge and ideas from the past. Memory here functions as an appeal geared towards promoting an appreciation and embrace of the past, a foundational element for the craft of audio production.

5.4 Memoria Determines Pricing Strategies for Audio Software

To round out this chapter on the deployment of memory as persuasive appeal, we may look at how memory falls within an added value-for-money paradigm for software technology companies. Throughout this chapter, and in fact throughout this study, memory has shown itself as a value-adding concept. Famous engineers see it is a sign of professional expertise, of commercial success, and of a commitment towards acknowledging and honoring the past so that it may inspire their work today, tomorrow, and beyond. They also recognize the valuable structuring aspects of memory to enhance workflow and aid invention. The signature software processors we have come across indicate the role that memory plays in defining and curating mixing knowledge, techniques, and styles through memorable descriptors, and thereby developing one's (creative) professional chops. Furthermore, the field of analog emulation software and the various degrees to which coveted units of the past are digitally remediated illustrates how memory is deployed in the industry as a way of highlighting accurate representation, fidelity, as well as product legitimacy. In other words, memory has become a commodifiable concept, and in this sense access to such a commodity can be tiered.

Let us assume that we have made the decision to purchase a particular professional software package. It does not matter whether we will use it for writing, engage in any kind of creative work, or as an operating system for our computer; we will quickly realize as we are scouting today's software offerings that these productivity solutions are often available at various price points. We can choose to purchase the basic version, the standard version, or if we want to spend the extra money, we may go for the professional edition. In such a buying scenario, our decision becomes subject not only to our available budget, but it is also influenced by the included features we deem crucial, unnecessary, or what we are willing to live without. Now, if we isolate those elements that determine the relative price jump(s)

between various editions and look at comparison charts more closely, we will encounter how price differences are influenced, to varying degrees, by the inclusion of additional, memory-driven software aids. The differences between the versions of Presonus' current DAW, Studio One 4, comprehensively illustrate how memory drives pricing structures.

Studio One 4 comes in three editions: 'Prime,' 'Artist,' and 'Professional' (Studio One). The range of editions caters to novice, advanced, and professional buyers. The differences between the Studio One editions are neatly listed within four categories: general, native effects plugins, virtual instruments, and bundled content. For each category, we can see that the 'Professional' edition ticks off every item in the list while the 'Prime' version includes the least. This is all quite straightforward, and naturally, the 'Artist' edition provides a bridge between the two and is correspondingly priced. What justifies the price of the 'Professional' edition over the other two? In other words, what kinds of value-adding memory aids are missing from the less expensive versions? The 'General' and 'Virtual Instruments' categories include the least number of memory-related features. Going by the first category, for example, we notice that the 'scratchpad' is only available in the fully-featured version. The 'scratch pad' is a feature that lets a user "test out arrangements . . . that makes moving sections of songs around as easy as moving parts" (Studio One). Remember the wax tablet, the canvas for imprinting our ideas in memory? The 'scratch pad' does just that. Many engineers make creative decisions not only with regards to processing, but they also exert a level of creative influence over matters of arrangement. In Studio One 4 Professional, creative re-arrangements become easy and convenient because the software offers a 'what if' option so that engineers don't have to go through several, time-consuming steps of editing in the context of trying different arrangements. In addition, the 'Professional' version includes sampled and virtual instruments that are missing from 'Prime,' while the 'Artist' version includes a select few.

The ‘Native Effects Plugins’ and ‘Bundled Content’ categories, however, illustrate the most how memory is used persuasively as a purchasing incentive. Notice that any feature that involves an analog emulation such as the ‘Console Shaper’ or the ‘Fat Channel XT’ is missing from the ‘Prime’ version. In addition, the ‘Prime’ edition only provides access to a limited amount of ‘bundled content.’ The bulk of sound libraries that may aid the user in invention are reserved exclusively for the ‘Professional’ edition; again, the ‘Artist’ version sits comfortably in-between.

Bundling product features into separate versions has been a relatively new concept in the field of product placement and marketing. It has been a consequence of increased computer processing power coupled with increased access to and affordability of productivity software packages. The concept of memory, seen as a negotiation between manual labor and automated task execution, plays a role with regards to deciding the feature lists and price points for each version. The concept of memory offers us a comprehensive, heuristic lens through which we can discuss memories many facets and digital manifestations. The concept of memory has an economic dimension. As we have seen in this chapter, it becomes the animating principle of memorializing the past in present-day digital space in *conservative, associative* as well as *emancipatory* ways. It is deployed *referentially* as a means of commodifying the expertise of iconic professionals and making their ‘memory palaces’ available to a community of practitioners. Moreover, memory becomes versioned, and thus influences to varying degrees the pricing structures of professional software packages. All of this we can illustrate by way of considering the persuasive appeals within memory and deploying the concept as a heuristic lens. While this chapter, as well as this study, focuses on the influence of digital technologies within the field of audio production, similar analyses can be conducted within other fields of professional (creative) practice. Labels such as *conservative, associative, emancipatory,* and *referential* provided a comprehensive list of

classifiers for the purpose of this study and this particular case of professional practice. Future research to examine software used within other communities of professional practice and how it has transformed related issues of knowledge and workflow might very well require a different classification system because the degrees of memory implementation will differ from one object of analysis to the next.

Memory as both recollection strategy as well as programmed practice shapes business decisions in the audio technology industry. In a broader sense, these decisions shape the entire field of productivity software. In the case of audio production, companies have adopted business strategies that actively leverage the persuasive powers of memory: audio technology companies have been developing either software emulations of vintage equipment that rely on almost photo-realistic depictions of original hardware units, tools that embrace entirely the possibilities of digital mixing through software automation, or hybrid software products that feature the presumed benefits of both; many companies are basing the list of features and pricing structures for their products on the degree and power of included digital aids; and others have opted to create and sell expansive libraries of loops, samples, and effects. Moreover, memory becomes a persuasive strategy in both institutional and consumer advertising. Companies such as Avid, Presonus, and Apple have created comprehensive training and tutorial series on their website—often taught by renowned professionals in the field—to boost brand recognition, while others—depending on their product's purpose—have developed marketing campaigns that either promote the past or break with the past. All of these examples illustrate the degrees and trajectories taken on by productivity software companies to realize Vannevar Bush's idea of the 'Memex' memory machine, and the fourth canon of rhetoric can help answer related questions as well as examine industry successes and failures.

As software continues to permeate more and more elements of professional life, there is value in gaining a unique perspective that's capable of fostering a more nuanced understanding of digital technologies and the many ways they enable, constrain, and in fact, shape current professional practice. Professionals in the field of audio production have become very vocal over the years in pointing to the advantages and benefits of retaining a level of control over technical processes in audio mixing. Through the concept of memory we can begin to draw a curtain of professional practice that emphasizes the degree to which software helps us remember, and allows us to forget. In turn, I believe that such a perspective helps users make more informed decisions with regards to the software—both professional and personal—that aid them in conducting various types of tasks. Such an appreciation of memory can and should inform pedagogy, especially at the university level where students prepare for their professional careers post-graduation. Educators should consider designing and implementing assignments for their curricula that engage students more actively with the concept of memory and its manifestation(s) in software. Marshal McLuhan famously coined the phrase 'the medium is the message' to show how the form of a distribution medium is always embedded with the message it creates and transmits. Since this chapter and the entire study has illustrated a memory-driven technology paradigm, we may pick up McLuhan's famous argument, and through a bit of creative re-phrasing we may find that, in fact, the 'the memory is the message.'

6 SOFTWARE AIDS AND CREATIVITY: CONCLUDING THOUGHTS

> "A common mistake that's being made today is getting the order of protocol reversed. People think, have, do, be: If I have this equipment, I can do it, and I can be it. That's not the way it works: It's be, do, have."
>
> -- Tony Visconti, *Behind I* 13

> "Since building is an art [techne] and is essentially a reasoned productive state, and since there is no art that is not a state of this kind, and no state of this kind that is not an art, it follows that art is the same as a productive state that is truly reasoned. Every art is concerned with bringing something into being, and the practice of an art is the study of how to bring into being something that is capable either of being or of not being . . . Art . . . operates in the sphere of the variable."
>
> -- Aristotle, *Nicomachean Ethics*, 1140a1 23

> "Following in the intellectual tradition of Richard Young, who reinvented invention for the twentieth century, it is time for scholars to reinvent memory . . . for the twenty-first."
>
> -- Winifred Horner, "Reinventing Memory" 175-6

More than two thousand years ago, Aristotle perceived the success of any rhetorical act—and I am paraphrasing here—as a consequence of the professional speaker's ability to discover in each case the 'available means.' For Aristotle, these available means fell into three categories: (1) appeals that elevate the character and credibility of the speaker, (2) appeals that satisfy the desires and expectations of an attending audience, and (3) appeals that are grounded in logic and proper reasoning. These three categories provided public speaking professionals with a set of comprehensive and constructive conventions and guidelines that aided their technical and aesthetic decision-making process when crafting a speech; when invoked in combination, the means significantly increased a speech's overall persuasive appeal. Interestingly, the available means that Aristotle presented in his theory of rhetoric rest on the assumption that there is method in speech crafting, and that professional speakers can

develop their persuasive skills through practice and study. The success of a rhetorical act, in Aristotle's view, presupposes that professional speakers have a level of pre-existing knowledge and expertise that provides the reasons *why* some appeals might be more persuasive than others for a given the contextual circumstances of the speech act, and *how* these appeals should best be leveraged.

Today's (creative) professionals have additional sets of available means at their disposal, and these means do not necessarily require the same amount of personal study and practice. Smart algorithms and machine learning built into today's software applications offer tempting productivity shortcuts. These digital aids put into question the importance and significance of professional curiosity, practice, and study. In "Four Dimensions of Significance: Tradition, Method, Theory, Originality," Professor Emeritus of English and Rhetoric, Hugh Burns, put forth the following question: "How do computers assist the recovery and the discovery of knowledge?" (7). His article was published more than a decade ago. Today, digital technologies exist that are capable of doing more than merely assisting the professional: they can work autonomously, which in turn means that they provide incentives to users to outsource labor. Creative skillsets that used to be critical for professionals may now become disregarded in the context of professional activity.

Handing over too much labor to smart algorithms can become a problem, and the case of the audio production community has been illuminating. This was mainly the reason why I chose the field of audio for this study over the field of writing. However, that is not to say that there have not been examples in recent years that foreshadow how artificial intelligence might end up revolutionizing text composition as well. For example, in 2016 an AI-authored novella, aptly titled *The Day a Computer Writes a Novel*, passed the first round in a Japanese literary contest (Shoemaker). Albeit guided by a team from the Future University Hakodate regarding plot and characters, AI-driven composition is becoming more competitive and

sophisticated. Another potential future area of interest for AI-authored content in the world of fiction is when a book series remains unfinished, either because of the author's passing or potentially because of a lack of interest. For instance, the *A Song of Ice and Fire* series of books, which forms the basis for the critically acclaimed *Game of Thrones* television show on HBO, might end up being completed by a smart algorithm. The series, according to author George R. R. Martin, is supposed to consist of seven novels in total, yet two are still outstanding. Over the years, Martin's turnaround time has increased to the point where fans have grown quite impatient and worried that Martin might not be able to finish the series in his lifetime. This worry prompted Zak Thoutt, a fan of the series and software engineer, to create "a type of AI, know as a recurrent neural network . . . [and he] fed the machine all 5,376 pages of the five current books" to both mimic Martin's style and generate predictions for each of the main storylines (Tousignant). The results are not very satisfying, but we can see how artificial intelligence programs might end up assuming author roles in the future and, thus, redefine human creativity. American fiction writer Robin Sloan, for example, lets a proprietary machine learning software analyze short snippets of text and suggest whole sentences based on referencing the writing styles of authors that Sloan admires. "At one level," writes David Streitfeld in his profile of Sloan in the *New York Times*, "[the software] merely helps [Sloan] do what fledgling writers have always done—immerse themselves in the works of those they want to emulate" (n.p.). At least for now, AI-driven composition remains an exotic circumstance and mostly confined to supporting the work of authors.

This might very well change in a mere matter of years. Software solutions for audio production offer a glimpse of the future of professional practice and the extent to which technologies will shape it. Famed media critic, Neil Postman, has been outspoken in his critique of technology. In 1992, he coined the term 'technopoly' to illustrate the degree to which technological innovations are accepted blindly and uncritically into human cultural

affairs. He warned that "[t]echnopoly is a state of culture. It is also a state of mind. It consists in the deification of technology, which means that the culture seeks its authorization in technology, finds its satisfaction in technology, and takes its orders from technology." The case of audio professionals and their relationship with digital technologies shows us a community dealing with the ramifications of the potentially hampering effects of technology on (creative) professional practice. Asked whether technology has gotten in the way of good music, Grammy Award-winning engineer Jimmy Douglass (known for his work with American artists Jay-Z, Justin Timberlake, Missy Elliot, and Pharell Williams) gives a qualified response:

> It has not gotten in the way, but it's facilitated a lot more mediocrity, because a lot more people that really have nothing to say can now get in there and say it . . . . everyone's covering up a lack of talent with machinery. There are people who can't play, who don't have a freaking idea, but they quantize their parts, they do it a million times, they throw a dozen plug-ins over it, and then they call themselves producers. (*Behind II* 97)

The mediocrity that Douglass speaks of, I believe, is directly correlated with the availability to outsource technical and, increasingly, aesthetic judgments to available software aids. These programmed aids, as many audio professionals lament, can merely offer generalized signal processing based on the genre and style information programmed into them. Unfortunately, many professionals resort to using these tools because of the pressure they continuously feel in having to meet tight deadlines. However, they also seem to rely on software aids because of professional insecurities caused by the significant decline in recording studios throughout the United States i.e., places of knowledge and memory, where engineers used to learn the craft and art of audio engineering in the past. For example, part of the difficulty of critically assessing the importance of particular signal processors, especially for novice engineers, is

that many if not most of them, according to Steve Albini, lack the personal experience of working in recording studios. And this lack of 'real world' experience does make them more receptive to the many software aids floating about in the world of digital mixing. Software aids cannot help the engineer develop a level of professional confidence so that engineers can assess whether a piece of mixed music will find a listening audience. Software aids can merely offer a technological memory, which Lyotard has called "nature" for postmodern man, but since these aids are so pervasive in current professional practice, we need to account for them as playing a significant role in the shifting conceptions of what counts as expertise and skill (51).

I have approached these questions through the filter of the fourth canon of rhetoric: memory. Albeit having long been considered the neglected canon, we can revitalize memory to aid us in both critically reflecting current technology use and offering ways to stay in control of professional practice. An underlying finding of past research into the relationship between memory and technology has pointed towards reciprocity i.e., changes in technology have spurred changes in memory, and adapting to changes in technology requires new performances of memory. Gregory Ulmer, for example, pointedly asks, "What happens to human memory, when in addition to the prosthesis it already possesses . . . it gains the services of electronics?" (162). Here, the concept of memory applies to the experience of using productivity software in the sense that expertise in using digital technologies (still) requires practical, specialized skills. The concept of the memory palace, for instance, can help us to appreciate the ways that software can be customized and personalized so that the digital work environment remains comprehensive and flexible to tackle a variety of work situations. Also, by way of discussing classical strategies for and tenets of recollection, we have seen the canon's profound influence on invention. In the context of audio production, we have learned about the importance of active referencing. Moreover, a renewed

appreciation of the fourth canon also affords a more recursive consideration of the other canons, which better reflects our contemporary understanding of writing processes. While invention, arrangement, style, memory, delivery seem to depict a highly linear process of composition, we often encounter that writing does not necessarily function in this way and that one canon often folds back upon another. Finally, we have seen how we can utilize memory in a heuristic fashion. The concept of memory has found its way into the product development decisions and marketing strategies for software companies; here, memory manifests as a set of powerful appeals: be it an appeal to or against history, an appeal to simplicity, or as an appeal to convenience. Therefore, memory is a crucial element when we want to make sense of the ways that today's software companies cater to their customers.

Significantly, the development of professional skill is, or *techne* in the classical sense, resides in "the sphere of the variable" and constitutes a "productive state" connected to the practices that are part of creating a product. The classical tenets of *techne* were concerned with practices and means instead of end-products. As Martha Nussbaum argues in *The Fragility of Goodness*, there is not a "single prominent ancient author who speaks of techne only in connection with craft production of a separately specifiable product" (97). Smart algorithms and machine learning software are disrupting these established notions of professional expertise. We see this in the fact that newspapers such as the *Washington Post* have already incorporated software into journalistic practice capable of drafting content independently. Human performance is thrown into a professional environment where machines are more and more actively creating the products of practice, indistinguishable to average audiences. Have we become too habituated with technology?

Such a question should prompt us to include more actively the concept of memory into the classroom. As much as we are asked as instructors to teach our student 'with' the help of digital technologies, we also need to actively pursue a pedagogy that puts emphasis

on digital literacies by deconstructing and demystifying digital software: a pedagogy that teaches 'against' the technologies used by students. After all, as educators one of our principal goals is to prepare students to succeed in their professional lives after graduation. The classroom space, thus, can serve as a laboratory where students can experiment, hone digital literacy skills, and develop professional workflows that allow them to stay in charge of their practice. This is a more techno-critical approach to education in the way proposed by Cynthia and Richard Selfe in their call to embrace our roles as both "technology critics as well as technology users" (496). The alternative, as McCorkle states, is that "[w]hen the technologies of tomorrow recede from our critical gaze when their interfaces become invisible and our own 'natural,' embodied actions become enfolded into them, there will be a powerful lulling effect to forget the technology exists as technology" (225-6). As more and more of our creative professional practice is conducted, delivered, and enabled through productivity software applications—be they word processing programs, audio and visual editing platforms, as well as cloud-based, collaborative work environments—scholars and teachers of rhetoric and cultural studies have an opportunity not only to decide how much emphasis should be put on deconstructing the digital tools of current, professional practice with students to better prepare them for both professional success as well as technology adoption in the future.

We also have, as this study has attempted to show, an obligation to critically reflect about what I would call the 'lure of the machine,' the way and extent to which digital software has and continues to frame and shape the creative process. In *The Postmodern Condition*, Jean-Francois Lyotard prophesized that developing technologies will eventually replace teachers—a slightly misleading prophesy at least for our technological present as this study has shown. Teaching, at least, still implies the transfer of knowledge from one place to another and a sense of personal knowledge acquisition and development. The epistemological

changes within the professional audio production community brought about by technology reflect a more problematic trajectory of digitally-enabled practice in as far as the work of memory gets negotiated as both external archive and seemingly acquirable, professional commodity.

As digital technologies continue to develop in professional work environments, the idea of memory as techne for present and future practice continues to be articulated via the tools we use. Asked about the future of audio production, Tony Visconti makes clear:

> I know that things are going to change — 30 years from now, I don't know what we'll be recording on. Maybe a tomato, I don't know. (laughs) But it does not matter — certain principles will always apply. They applied two hundred years ago when Mozart was alive — you have to really be an artist. And being an artist means that you have to woodshed, you have to put time in, you have to practice. (*Behind I* 13)

This study has been an attempt to illustrate the need to study how memory produces and is produced within the temporalities and spatialities of digital software. We can use the rhetorical canon of memory to understand how memory constitutes professional skill and how it can be leveraged to control the digital work environments that we inhabit in our professional as well as personal lives.

REFERENCES

Allen, Virginia. "The Faculty of Memory." *Rhetorical Memory and Delivery*. Ed. John F Reynolds. New Jersey, NJ: Lawrence Erlbaum Associates, 1993. 45-65. Print.

Aristotle. *De Sensu and De Memoria.* Trans. G.R.T Ross. New York, NY: Arno Press, 1973. Print.

- - - . *Nicomachean Ethics.* Trans. Terence Irwin. Indianapolis, IN: Hackett: 1985. Print.

- - - . *On Rhetoric*. Trans. G. Kennedy. New York, NY: Oxford UP, 1958. Print.

- - - . *Poetics.* Trans. Ingram Bywater. *The Rhetoric and Poetics of Aristotle*. Edward P.J. Corbett, ed. New York, NY: Modern Library, 1984. Print.

- - - . *The Art of Rhetoric*. Trans. John Henry Freese. Loeb Classical Library, 1982. Print.

Atwill, Janet. *Rhetoric Reclaimed: Aristotle and the Liberal Arts Tradition*. Ithaca, NY: Cornell UP, 1998. Print.

Atwill, Janet and Janice Lauer. "Refiguring Rhetoric as an Art: Aristotle's Concept of Techne." *Discourse Studies in Honor of James L. Kinneavy.* Rosalind J. Gabin, ed. Potomac, MD: Scripta Humanistica, 1995. Print.

Ball, Cheryl and Byron Hawk. "Sound in/as Compositional Space: A Next Step in Multiliteracies." *Computers and Composition* 23.3 (2006): 263-5. Web.

Barnes, Jonathan. *The Complete Works of Aristotle*. *The Revised Oxford Translation*. 2 Vols. Princeton, NJ: Princeton UP, 1984. Print.

Beer, David. "Power Through the Algorithm? Participatory Web Cultures and the Technological Unconscious." *New Media & Society* 11.6 (2009): 985-1002.

Berger, Glenn. *Never Say No To A Rock Star: In the Studio with Dylan, Sinatra, Jagger, and More . . . .* Tucson, AZ: Schaffner Press, 2016. Print.

Bergson, Henri. *Matter and Memory*. Trans. Nancy Margaret Paul and W. Scott Palmer. New York, NY: Zone Books, 1982. Print.

Bolter, J. David. *Turing's Man: Western Culture in the Computer Age.* Chapel Hill, NC: U of North Carolina P, 1984. Print.

Bolter, J. David and Diane Gromala. *Windows and Mirrors: Interaction Design, Digital Art, and the Myth of Transparency.* Cambridge, MA: The MIT Press, 2003. Print.

Bolter, Jay David. “Hypertext and the Rhetorical Canons.” *Rhetorical Memory and Delivery: Classical Concepts for Contemporary Composition and Communication.* John F. Reynolds, ed. Hillsdale, NJ: L. Erlbaum Associates, 1993. 97-112. Print.

Bolzoni, Lina. *The Web of Images*. Burlington, VT: Ashgate, 2004. Print.

Booth, Andrew D. “The Future of Automatic Digital Computers.” *Communications of the ACM* 3.6 (June 1960): 339-41, 360.

Bowie, Jennifer. “Podcasting in a Writing Class? Considering the Possibilities.” *Kairos: A Journal of Rhetoric, Technology, and Pedagogy* (Spring 2012). Web.

Brooke, Collin Gifford. *Lingua Fracta: Toward a Rhetoric of New Media*. New York, NY: Hampton, 2011. Print.

Brown, Phill. *Are We Still Rolling?: Studios, Drugs and Rock ‘n’ Roll - One Man’s Journey Recording Classic Albums.* Milwaukee, WI: Hal Leonard, 2010. Print.

Burns, Hugh. “Four Dimensions of Significance: Tradition, Method, Theory, Originality.” *Computers and Composition* 21 (2004): 5-13.

Bush, Vannevar. “As We May Think.” *TheAtlantic.com.* July 1945. Web.

Buskin, Richard. “Classic Tracks: Tina Turner ‘What’s Love Got To Do With It?’.” *SoundonSound.com*. May 2004. Web.

Campbell-Kelly, Martin and William Aspray. *Computer: A History of the Information Machine.* New York, NY: Basic Books, 1996. Print.

Carr, Nicholas. “Is Google Making Us Stupid?” *TheAtlantic.com.* July/August 2008. Web.

- - - . *The Shallows: What the Internet Is Doing to Our Brains*. New York, NY: W. W. Norton, 2010. Print.

Carruthers, Mary. *The Book of Memory: A Study of Memory in Medieval Culture*. Cambridge, UK: Cambridge UP, 1990. Print.

- - - . *The Craft of Thought: Meditation, Rhetoric, and the Making of Images, 400-1200.* Cambridge, UK: Cambridge UP, 2000.

Case, Alexander. *Sound FX: Unlocking the Creative Potential of Recording Studio Effects.* Oxford, UK: Focal Press, 2007. Print.

Ceraso, Steph. “(Re)Educating the Senses: Multimodal Listening, Bodily Learning, and the Composition of Sonic Experiences.” *College English* 77.2 (2014): 102-23. Web.

Chun, Wendy. *Programmed Visions: Software and Memory*. Cambridge, MA: The MIT Press, 2011. Print.

Cicero. *De Inventione*. Trans. H. M. Hubbel. London, UK: Heinemann, 1949. Print.

- - - . *On the Ideal Orator*. Trans. James M. May and Jakob Wisse. Oxford, UK: Oxford UP, 2001. Print.

Cogan, Jim. “Profile: Bill Putnam.” *MixOnline.com.* Nov 1, 2003. Web.

Cohen, William. “Symbols of Power: Statues in Nineteenth-Century Provincial France.” *Society for Comparative Study of Society and History* 31 (1989): 491-513.

Comstock, Michelle and Mary E. Hocks. “Voice in the Cultural Soundscape: Sonic Literacy in Composition Studies.” *Computers and Composition Online* (Fall 2006). Web.

Corbett, Edward P. J. and Robert J. Connors. *Classical Rhetoric for the Modern Student*. 4th ed. New York, NY: Oxford UP, 1999. Print.

Coyne, Richard. *Designing Information Technology in the Postmodern Age*. Cambridge, MA: The MIT Press, 1995. Print.

Crowley, Sharon. *The Methodical Memory: Invention in Current-Traditional Rhetoric*. Carbondale and Edwardsville, IL: Southern Illinois UP, 1990. Print.

- - - . “Modern Rhetoric and Memory.” *Rhetorical Memory and Delivery.* Ed. John F. Reynolds. Hillsdale, NJ: Lawrence Erlbaum Associates, 1993. 31-44.

Crowley, Sharon and Deborah Hawhee. *Ancient Rhetorics for Contemporary Students.* 2nd ed. Needham Heights, MA: Allyn and Bacon, 1999. Print.

Davis, Diane (Ed.). “Special Issue: Writing with Sound.” *Currents in Electronic Literacy* 14 (2011). Web.

“Description: Cultural Memory in the Present.” *Stanford University Press*. Web. 1 Feb 2018.

De Vries, Hent and Emily-Jane Cohen. “Cultural Memory in the Present: Overview.” *Sup.org*. Web.

Dissoi Logoi. Trans. Rosamond Kent Sprague. *The Older Sophists*. Ed. Rosamond Kent Sprague. Columbia, SC: U of South Carolina P, 1972. 279-93.

Donald, Merlin. *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition*. Cambridge, MA: Harvard UP, 1991. Print.

Driggs, Sarah Shields, Richard Guy Wilson, and Robert P. Winthrop. *Richmond's Monument Avenue*. Chapel Hill, NC: U of North Carolina P, 2001. Print.

Dunne, Joseph. *Back to the Rough Ground: 'Phronesis' and 'Techne' in Modern Philosophy and in Aristotle*. Notre Dame, IN: Notre Dame UP, 1993. Print.

Emerson, Lori. *Reading Writing Interfaces: From the Digital to the Bookbound*. Minneapolis, MN: U of Minnesota P, 2014. Print.

Ernst, Wolfgang. *Digital Memory and the Archive.* Minneapolis, MN: U of Minnesota P, 2013. Print.

Feldman, Tony. *An Introduction to Digital Media*. London, UK: Routledge, 1997. Print.

Fisher, John A. "Rock and Recording: The Ontological Complexity of Rock Music." *Musical Worlds: New Directions in the Philosophy of Music.* Philip Alperson, ed. Pennsylvania, PA: U of Pennsylvania P, 1998. 109-24. Print.

Franklin, Lee. "Techne and Teleology in Plato's *Gorgias*." *Apeiron* 38.4 (2005): 229-55.

Frith, Simon. "Art Versus Technology: The Strange Case of Popular Music." *Media, Culture and Society* 8 (July 1986): 263-79.

- - - . "The Industrialization of Popular Music." *Popular Music and Communication*. James Lull, ed. Newbury Park, CA: Sage, 1992.

Galloway, Alexander R. "Language Wants to Be Overlooked: On Software and Ideology." *Journal of Visual Culture* 5.3 (2006): 315-31.

- - - . *The Interface Effect*. Malden, MA: Polity, 2012. Print.

Genzlinger, Neil. "Review: Rock Star Toasts the Glory Days of Analog." *NYTimes.com*. Web. Jan 30, 2013.

Goodwin, Andrew. "Rationalization and Democratization in the New Technologies of Popular Music." *Popular Music and Communication*. Ed. James Lull. Newbury Park, CA: Sage, 1992. Print.

Gronbeck, Bruce E. "The Spoken and the Seen: The Phonocentric and Ocularcentric Dimensions of Rhetorical Discourse." *Rhetorical Memory and Delivery*. John F. Reynolds, ed. Hillsdale, NJ: Lawrence Erlbaum Associates, 1993. 139-157. Print.

Hawhee, Deborah. “Kairotic Encounters.” *Perspectives on Rhetorical Invention.* J. M. Atwill and J. M. Lauer, Eds. Knoxville, TN: U of Tennessee P, 2002. 16-35. Print.

Hayles, Katherine N. “The Condition of Virtuality.” *The Digital Dialectic: New Essays on New Media*. Peter Lunenfield, ed. Cambridge, MA: The MIT Press, 1999. Print.

- - - . *My Mother Was a Computer: Digital Subjects and Literary Texts*. Chicago, IL: U of Chicago P, 2005. Print.

- - - . “How We Read: Close, Hyper, Machine.” *ADE Bulletin* 150 (2010): 62-79. Print.

Heidegger, Martin. “Building, Dwelling, Thinking.” *Basic Writings*. David Krell, ed. New York, NY: Harper and Row, 1977. Print.

- - - . “The Question Concerning Technology.” *Basic Writings*. David Krell, ed. New York, NY: Harper and Row, 1977. Print.

Hobart, Michael and Zachary Schiffman. *Information Ages: Literacy, Numeracy and the Computer Revolution.* Baltimore, MD: Johns Hopkins UP, 1998. Print.

Horner, Winifred Bryan. “Reinventing Memory and Delivery.” *Inventing a Discipline: Rhetoric Scholarship in Honor of Richard E. Young*. Maureen Daly Goggin, ed. Urbana, IL: NCTE, 2000. 173-184. Print.

Hoskins, Andrew. “Digital Network Memory.” *Mediation, Remediation, and the Dynamics of Cultural Memory*. A. Erll and A. Rigney, Eds. Berlin, GER: Gruyter, 2009. 91-106. Print.

Katz, Mark. *The Phonograph Effect: The Influence of Recording on Listener, Performer, Composer, 1900-1940*. Ann Arbor, MI: U of Michigan P, 1999. Print.
- - - . *Capturing Sound: How Technology Has Changed Music*. Berkeley, CA: U of California P, 2010. Print.

Kirschenbaum, Matthew G. *Mechanisms: New Media and the Forensic Imagination*. Cambridge, MA: The MIT Press, 2008. Print.

Lanois, Daniel. *Soul Mining: A Musical Life*. New York, NY: Farrar, Straus and Giroux, 2010. Print.

Latour, Bruno. *Reassembling the Social: An Introduction to Actor-Network Theory*. Oxford, UK: Oxford UP, 2005. Print.

Levinson, Sanford. *Written in Stone: Public Monuments in Changing Societies*. Durham, SC: Duke UP, 1998. Print.

LOL ComediHa! Official TV show. “Sound Engineer's Hard Work // Ingénieur de son // LOL ComediHa!” YouTube.com. Jan 11, 2013. Web.

Lyotard, Jean Francois. *The Postmodern Condition: A Report on Knowledge*. Minneapolis, MN: U of Minnesota P, 1984. Print.

Mackenzie, Adrian. “The Performativity of Code: Software and Cultures of Circulation.” *Theory Culture & Society* 22.1 (2005): 71-92.

- - - . *Cutting Code: Software and Sociality*. New York, NY: Peter Lang, 2006. Print.

Mahony, Patrick. “McLuhan in the Light of Classical Rhetoric.” *College Composition and Communication* 20 (Feb. 1969): 12-17.

Manovich, Lev. *Software Takes Command: Extending the Language of New Media.* New York, NY: Bloomsbury, 2013. Print.

Massey, Howard. *Behind the Glass: Top Record Producers Tell How They Craft the Hits, Volume I.* San Francisco, CA: Backbeat Books, 2000. Print.

- - - . *Behind the Glass: Top Record Producers Tell How They Craft the Hits, Volume II.* Milwaukee, WI: Backbeat Books, 2009. Print.

Matussek, Peter. “The Renaissance of the Theater of Memory.” *Janus* 8 (2001): 4-8.

McCarthy, John and Peter Wright. *Technology as Experience.* Cambridge, MA: The MIT Press, 2004. Print.

McCorkle, Ben. *Rhetorical Delivery as Technological Discourse*. Carbondale, IL: Southern Illinois UP, 2012. Print.

McCracken, Allison. “‘God’s Gift to Us Girls’: Crooning, Gender, and the Re-Creation of American Popular Song, 1928-1933.” *American Music* 17 (1999): 365-95.

McCutchen, Deborah. “From Novice to Expert: Implications of Language Skills and Writing Relevant Knowledge for Memory during the Development of Writing Skill.” *Journal of Writing Research* 3.1 (2011): 51-68.

McNair, John R. “Computer Icons and the Art of Memory.” *Technical Communication Quarterly* 5.1 (1996): 77-86. Print.

Merchant, John. “Multi-Platinum Mixing Video Series.” *Multi-Platinum, LLC*. 2009.

Middleton, Richard. *Studying Popular Music*. Buckingham, UK: Open University, 1990. Print.

Millard, Andre. *America on Record: A History of Recorded Sound*. New York, NY: Cambridge UP, 1995. Print.

"Mixbus: Overview of Features." *Harrisonconsoles.com*. Web.

Mix Staff. "1992: Waves Q10 Paragraphic EQ First Audio Plug-In." *MixOnline.com*. January 1, 2011. Web.

Negroponte, Nicholas. *Being Digital.* New York, NY: Knopf, 1995. Print.

Negus, Keith. *Producing Pop: Culture and Conflict in the Popular Music Industry*. London, UK: Arnold, 1992.

Nelson, Katherine. "Remembering: A Functional Developmental Perspective." *Memory: Interdisciplinary Approaches.* Paul R. Solomon et al., Eds. New York, NY: Springer-Verlag, 1989. 127-150. Print.

Neutron 2. "Product Overview." *Izotope.com*. Web.

Nussbaum, Martha. *The Fragility of Goodness: Luck and Ethics in Greek Tragedy and Philosophy*. Cambridge, UK: Cambridge University Press, 2001. Print.

Pensado's Place. "How to Use Reference Mixes – Into the Lair #71." *Youtube.com*. March 29, 2013. Web.

Plato. "Phaedrus." *Plato: Complete Works*. John M. Cooper, ed. Indianapolis, IN: Hackett Publishing Company, 1997. 506-557. Print.

---. "Theaetetus." *Plato: Complete Works.* John M. Cooper, ed. Indianapolis, IN: Hackett Publishing Company, 1997. 157-235. Print.

Porcello, Thomas and Paul Greene, Eds. *Wired for Sound: Engineering and Technologies in Sonic Cultures.* Middletown, CT: Wesleyan University Press, 2005. Print.

Postman, Neil. *Technopoly: The Surrender of Culture to Technology*. New York, NY: Knopf, 1992. Print.

Pruchnic, J. and K. Lacey. "The Future of Forgetting: Rhetoric, Memory, Affect." *Rhetoric Society Quarterly* 41 (2011): 472-494.

Puremix-1. “Andrew Scheps Mixing Template Tutorial & Session Files [Trailer]. *Youtube.com*. April 18, 2017. Web.

Puremix-2. “Fab Dupont Mixing Template – Trailer.” *Youtube.com*. August 2, 2017. Web.

Quintilian. *Institutio Oratoria.* Trans. Donald A. Russell. Cambridge, MA: Harvard UP, 2001. Print.

Reynolds, John F. “Concepts of Memory in Contemporary Composition.” *Rhetoric Society Quarterly* 19.3 (1989): 245-52.

Rhetorica ad Herennium. Trans. Harry Caplan. Cambridge, MA: Harvard UP, 1954. Print.

Rickert, Thomas (Ed.). (1999). “Special Issue: Writing/Music/Culture.” *Enculturation: A Journal of Rhetoric, Writing and Culture* 2.2 (1999). Web.

- - - . *Ambient Rhetoric.* Pittsburgh, PA: U of Pittsburgh P, 2013. Print.

Rossi, Paolo. *Logic and the Art of Memory*. Chicago, IL: U of Chicago P, 2000. Print.

Rutsky, R. L. *High Techne: Art and Technology from the Machine Aesthetic to the Posthuman.* Minneapolis, MN: U of Minnesota P, 1999. Print.

Ryan, Kevin, and Brian Kehew. *Recording the Beatles: the Studio Equipment and Techniques Used to Create Their Classic Albums*. Online: Curvebender Publishing, 2009. Print.

Sadoski, Mark, and Allan Paivio. *Imagery and Text: A Dual Coding Theory of Reading and Writing.* Mahwah, NJ: Lawrence Erlbaum Associates, 2001. Print.

Savage, Kirk. *Standing Soldiers, Kneeling Slaves: Race, War, and Monument in Nineteenth-Century America*. Princeton, NJ: Princeton UP, 1997. Print.

Sayers, Jentery. Audio Culture Series: Scaffolding a Sequence of Assignments. *Sounding Out!* (September 3, 2012). Web.

Schwartz, Barry. “The Social Context of Commemoration: A Study in Collective Memory.” *Social Forces* 61 (1982): 374-402.

Seneca. *Ad Lucilium Epistulae Morales*. Trans. Richard M. Gummere. London, UK: William Heinemann, 1925. Print.

Schmidt Horning, Susan "Engineering the Performance: Recording Engineers, Tacit Knowledge and the Art of Controlling Sound." *Social Studies of Science* 34.5 (2004): 703-31.

Schwartzmann, Helen. *Ethnography in Organizations.* Newbury Park, CA: SAGE, 1993. Print.

Selfe, Cynthia and Richard Selfe. "The Politics of the Interface: Power and its Exercise in Electronic Contact Zones." *College Composition and Communication* 45.4 (1994): 480-504.

Selfe, Cynthia L. "The Movement of Air, the Breath of Meaning: Aurality and Multimodal Composing." *College Composition and Communication* 60.4 (2009): 616-63.

Shoemaker, Natalie. "Japanese AI Writes a Novel, Nearly Wins Literary Award." *BigThink.com.* March 24, 2016. Web.

Stone, Jonathan W. "Listening to the Sonic Archive: Rhetoric, Representation, and Race in the Lomax Prison Recordings." *Enculturation* 19 (2015). Web.

Stone, Jonathan and Steph Ceraso (Eds.). "Special Issue: Sonic Rhetorics." *Harlot of the Arts* 9 (2013). Web.

Streitfeld, David. "Computer Stories: A.I. Is Beginning to Assist Novelists." *NYTimes.com.* October 18, 2018. Web.

Studio One. "Product Overview." *Presonus.com*. Web.

Théberge, Paul. *Any Sound You Can Imagine: Making Music/Consuming Technology*. Hanover: Wesleyan, 1997.

- - - . "The End of the World As We Know it: The Changing Role of the Studio in the Age of the Internet." *The Art of Record Production: An Introductory Reader for a New Academic Field.* Simon Frith and Simon Zagorski-Thomas, Eds. Burlington, VT: Asgate, 2012. 77-90. Print.

Tousignant, Lauren. "Artificial Intelligence Is Writing the next 'Game of Thrones' Book." *NYPost.com*. August 29, 2017. Web.

Turkle, Sherry. *Life on the Screen: Identity in the Age of the Internet*. New York, NY: Touchstone, 1995. Print.

Ulmer, Gregory. *Teletheory: Grammatology in the age of video*. New York, NY: Routledge, 1989. Print.

Van Dijck, José. *Mediated Memories in the Digital Age*. Stanford, CA: Stanford UP, 2007. Print.

Vivian, Bradford. "On the Language of Forgetting." *Quarterly Journal of Speech* 95.1 (2009): 89-104.

Walcott, Harry. *Writing Up Qualitative Research*. Thousand Oaks, CA: SAGE, 2001. Print.

Walden, John. "Match & Mix: Cubase Tips & Techniques." *SoundOnSound.com*. August 2013. Web.

WashPostPR. "The Washington Post to Use Artificial Intelligence to Cover Nearly 500 Races on Election Day." *Washingtonpost.com*, 2016. Web.

Waves-JJP Vocals. "Product Overview." *Waves.com.* Web.

Waves-Eddie Kramer Effects Channel. "Product Overview." *Waves.com.* Web.

Waves-Scheps Omni Channel. "Product Overview." *Waves.com.* Web.

Weiss, Matthew. "Interview with Dave Pensado." *TheProAudioFiles.com*. May 8, 2011. Web.

Welch, Kathleen E. "The Platonic Paradox: Plato's Rhetoric in Contemporary Rhetoric and Composition Studies." *Written Communication* 5 (1988): 3-21.

- - - . *The Contemporary Reception of Classical Rhetoric: Appropriations of Ancient Discourse*. Hillsdale, NJ: Lawrence Erlbaum Associates, 1990. Print.

- - - . *Electric Rhetoric: Classical Rhetoric, Oralism, and a New Literacy*. Cambridge, MA: The MIT Press, 1999. Print.

West, W. N. "Memory." *Encyclopedia of Rhetoric*. Thomas O. Sloane, ed. Oxford, UK: Oxford UP, 2001. Print. 482-493.

White, Michael. "Fundamentals of Mixing Lesson 5: The 'Secrets' of Great Mixers." *YouTube.com*. Jun 23, 2016. Web.

White, Paul. "Choosing the Right Reverb: How Best to Use Different Reverbs." *SoundonSound.com*. March 2006. Web.

Whittemore, Stewart. *Rhetorical Memory: A Study of Technical Communication and Information Management.* Chicago, IL: U of Chicago P, 2015. Print.

Wild, John. “Plato’s Theory of *Texnh* a Phenomenological Interpretation.” *Philosophy and Phenomenological Research* 1.3 (Mar. 1941): 255-293.

Wright, Elizabethada. “Rhetorical Spaces in Memorial Places: The Cemetery as a Rhetorical Memory Place/Space.” *Rhetoric Society Quarterly* 35.4 (2005): 51-81. Print.

Yancey, Kathleen. “Made Not Only in Words: Composition in a New Key.” *College Composition and Communication* 56.2 (2004): 297-328. Web.

Yates, Frances A. *The Art of Memory*. Chicago, IL: U of Chicago P, 1966. Print.

Yunis, Harvey, ed. *Written Texts and the Rise of Literate Culture in Ancient Greece*. Cambridge, UK: Cambridge UP, 2007. Print.

Zak III, Albin J. *The Poetics of Rock: Cutting Tracks, Making Records*. Berkeley, CA: U of California P, 2001. Print.

PROGRAMMED ‘TREASURIES OF ELOQUENCE’: A RHETORICAL TAKE ON PRODUCTIVITY AIDS IN AUDIO ENGINEERING SOFTWARE

von

Thomas Breideband

Deutsche Zusammenfassung:

Professionelle Musikbearbeitung wird heutzutage fast auschließlich mit computerbasierten Lösungen vollzogen. Seit einigen Jahren kommen hierbei auch verstärkt Softwareprogramme zum Einsatz, die mit Algorithmen des Machine Learnings ausgestattet sind und dem Nutzer viele Arbeitsgänge vermeintlich erleichtern sollen. Heutzutage ist es theoretisch für jeden möglich, mit vermehrt erschwinglichen Mitteln professionelle Ergebnisse auch ohne langjährige Ausbildung zu erreichen—zumindest wird es oftmals so oder ähnlich den Käufern dieser Softwarerogramme von deren Herstellern suggeriert. Was bedeutet diese Entwicklung für den Stellenwert von Ausbildung und Wissensvermittlung im Bereich professioneller Kreativarbeit? Welche Rolle spielt die Expertise des Menschen im Verhältnis zu den heutigen Möglichkeiten der künstlichen Intelligenz? Mit diesen Fragen setzt sich diese Studie am Beispiel des Berufsfeldes des Tonmeisters kritisch auseinander. Mit Hilfe von Grundsätzen der Memoria, also des Einprägens von Inhalten, welche vorrangig in der klassischen Rhetorik erlernt und zum Einsatz kamen—also im Rahmen einer Tätigkeit, in der sich die Expertise des Menschen ähnlich wie in der Musikbearbeitung sowohl technisch wie auch ästhetisch ausdrückt—werden die Methoden untersucht, mit denen Tonmeister heutzutage sowohl ihr kreatives Fachwissen wie auch den Gebrauch von computergestützten Musikproduktionprogrammen gestalten und strukturieren. Die daraus resultierenden Erkenntnisse zeigen, inwieweit Aspekte der Expertise auch zukünftig in softwaregestützter Kreativarbeit aufrechterhalten werden können.