After the Music Box:
A History of Automation in Real-Time Musical Performance

Alyssa Michaud

Department of Music Research
Schulich School of Music
McGill University, Montreal

August 2019

A thesis submitted to McGill University in partial fulfillment of the requirements of the degree of Doctor of Philosophy in Musicology

TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

After the Music Box: A History of Automation in Real-Time Musical Performance investigates the reception and use of automation in music over the past century. Employing methods from musicology and media studies, I examine the shifting discourse around music technologies in the early years before their functions and meanings had solidified, and locate the human agency underpinning each automated process. This dissertation explores three historical moments that illuminate the relationship between automation and human music-making: player piano technology in the early twentieth century, synthesizers and sequencers in the mid-twentieth century, and vocal synthesis technology in the early twenty-first century. In chapters 1 and 2, I examine three related piano-playing devices. Drawing on advertising materials, trade publications, and discussions in the popular press, I investigate the anxiety around these new technologies and examine early efforts at defining the purpose of these machines. I correct certain historical misconceptions about player pianos, restore an understanding of the importance of human creativity in the use of these devices, and situate these instruments in the context of other labour-saving technologies. Chapter 3 analyzes the reception history of two early techno-pop groups, in order to map anxieties about dehumanized music-making onto the globalized landscape of 1970s pop music. Finally, in chapters 4 and 5, I investigate *Vocaloid* singing synthesis software and holographic concerts. Examining Vocaloid performances in the context of research on creative online communities and fan culture, I argue that the contributions of users online and the structured participation of fans at concerts are evidence of a new type of performance enabled by automation in the twenty-first century. This study argues for an

understanding of human agency in performances that include automation, and shows the importance of amateur music-making in the development of new music technologies.

RÉSUMÉ

Après la boîte à musique : une histoire de l'automation dans la performance musicale en temps réel prend pour objet de recherche la réception et l'usage de l'automation dans la musique au cours du dernier siècle. Faisant appel à des méthodes empruntées à la musicologie ainsi qu'aux études médiatiques, j'examine la transformation du discours entourant les technologies musicales au cours de leurs toutes premières années d'existence, cette période qui précède la cristallisation de leurs fonctions et de leurs significations, et j'y situe la démarche humaine qui sous-tend chaque processus d'automation. Cette thèse explore trois périodes historiques qui font la lumière sur la relation entre l'automation et la création musicale par l'humain : la technologie des pianos mécaniques au début du vingtième siècle, les synthétiseurs et les séquenceurs au milieu de ce même siècle, ainsi que la technologie de synthèse vocale au début du vingt-et-unième siècle. Au cours des chapitres 1 et 2, j'examine trois modèles comparables de pianos mécaniques. À partir de matériaux publicitaires, de publications commerciales et de discours tirés de la presse populaire, je me penche sur l'anxiété générée par ces nouvelles technologies et sur les efforts faits en vue de définir la fonction de ces machines. J'y corrige certaines incompréhensions historiques au sujet des pianos mécaniques, rétablis une certaine compréhension de l'importance accordée à la créativité humaine en lien avec l'utilisation de ces appareils, et situe ces derniers dans un contexte technologique favorable à la facilitation du travail. Dans le chapitre 3, j'analyse l'histoire de la réception de deux groupes qui furent parmi les premiers à proposer une musique techno pop, de manière à identifier les différentes formes d'anxiété engendrées cette fois par la déshumanisation de la création musicale dans le panorama globalisé de la musique populaire des années 1970. Enfin, dans les chapitres 4 et 5, je m'intéresse au logiciel de synthèse vocale

Vocaloid et aux concerts holographiques. En examinant des performances réalisées à l'aide de ce logiciel dans le contexte de recherches sur les communautés créatives en ligne et la culture des admirateurs [*fan culture*], je défends l'idée selon laquelle les contributions d'utilisateurs en ligne et la participation structurée des admirateurs à l'occasion des concerts sont la preuve d'un nouveau type de performance, rendu possible par les technologies d'automation au vingt-et-unième siècle. Cette étude soutient une compréhension et une reconnaissance de la démarche humaine au cœur de performances intégrant l'automation, et démontre l'importance que prend la création musicale amatrice dans le développement des nouvelles technologies musicales.

Translated by Paul Bazin

ACKNOWLEDGEMENTS

The first and biggest words of thanks are owed—and enthusiastically given—to my supervisors, Lloyd “Chip” Whitesell and Jonathan Sterne. I have been incredibly fortunate to receive guidance from exceptional mentors in two disciplines, and I am grateful to both of them for their generosity of time and thought. Much like a great vinaigrette, in which the oil and balsamic add contrasting flavours but are equally essential, this project would be severely lacking without the input of one or the other of my supervisors. Over the years, my writing and research have benefited greatly from Chip’s unparalleled attention to detail and precision. I have long admired his flair for prose that is both clear and elegant, and I’m grateful for the ways he has helped me to refine my own style. This dissertation also stayed on track and on time thanks to his unfailing reliability and organization. While Chip’s laser focus improved the details in my project, Jonathan’s contributions helped me to zoom out to consider the big-picture questions, expanded my horizons, and guided me in working out the implications of my research. From his example, I have learned how to better articulate the stakes without sacrificing the story, forge stronger links between concepts, and incorporate the occasional bold simile and metaphor into my academic writing. I am extremely thankful for Jonathan’s willingness to take on the task of co-supervising this project, and for the way he refreshed my enthusiasm for research every single time we met.

I’m grateful to my colleagues and friends at McGill, both inside and outside of musicology, who contributed their ideas and positivity to my research process. Special thanks to the members of the Culture and Technology Discussion and Working Group (CATDAWG), who generously contributed comments on multiple versions of material from this project, as well as

the members of Glam Squad, who have shown up so many times to lend their support at conference presentations, and also offered insightful additions to my player piano material.

I would like to sincerely thank my colleagues at Ambrose University for their support over the past two years as I worked to complete this dissertation while serving on faculty. Barb, Barrett, Don, Edwin, Ian, Linda, and Rachel have offered their ideas and encouragement, taken the time to attend my talks, and kept me moving forward with their faith in my abilities. I'm truly grateful to Ambrose for generously enabling me to carve out the space to research and write during my time as Scholar in Residence, and for professional development funds that have helped me to undertake and present this research in its later stages. I'd also like to thank my students for the enthusiasm, ideas, and artifacts they chipped in to this project. Their energy and interest helped to keep renewing my own motivation along the way.

I'd like to acknowledge a debt of gratitude for an unconventional source of funding that supported the completion of this dissertation. Not only did a number of the individuals and families from my choir at Peoples Church Montreal become my family away from home during my years in Montreal, but several of them also took it upon themselves to provide financial support during times of need, specifying that they wanted to see me be able to continue my work. Some did so anonymously, and I suspect that those whose names I do know would prefer to remain unidentified here, but to each of these people who supported me so generously, I give my most heartfelt thanks.

This dissertation might not have made it over the finish line if it weren't for the help of my phenomenal roommates, who toughed out the last and most difficult stretch of this project with me, and did way more than their fair share of the cooking and errands, as well as listening to endless dissertation updates. I'm especially thankful for their humour and sanity through the

stressful times when I lacked both of those things. I couldn't be more grateful for their support and patience, and for their genuine friendship.

I'd like to express my sincerest thanks to my family, particularly my parents and my Grandpa Michaud, who supported me through this process in every way they could. I'm deeply grateful for their efforts to make sense of the strange, unknown territory of doctoral work just so that they could better celebrate the small victories with me through this process. I would not have completed this project without their ongoing encouragement and love.

It's impossible for me to express the depth of my gratitude to four friends who have been unshakeable pillars during my dissertation journey. Chris, Julio, Nina, and Stacy have been indefatigable sounding boards and supporters who have injected a gruelling process with hope, affirmation, and laughter when I needed it most. Each of them has gone above and beyond the call of duty as friends with their willingness to walk through personal or academic challenges, serve as editors and practice audiences, or simply extend their help in countless ways when the going got tough.

This dissertation is dedicated to the person who, aside from its author, likely invested the most emotional energy into it. My mom did not sign up for this convoluted and arduous journey, but has been with me every single step of the way, encouraging me when I needed it most, reading over countless laborious items "real quick when she had a sec," endlessly working to understand my world, helping me set up orderly systems, and making sure I was taking care of myself as I walked this long road. I have been able to believe in myself because she was the first person to believe in me and has always continued to do so unconditionally.

INTRODUCTION

On a hot July evening in New York City, two thousand people pack out a Midtown auditorium for a pop concert. Decked out in brightly coloured fan merchandise from past tours, the crowd sings and dances energetically to song after song. Midway through the show, the singer pauses at centre stage and calls out to the audience, “Are you having a good time?” The crowd cheers in response. The singer eggs them on, playing her part in a well-worn ritual between performer and audience: “I can’t hear you!” Predictably, the crowd roars even louder. But the irony of this exchange seems lost on the audience. This performer’s statement of “I can’t hear you” is literal—she will never hear them, no matter how loud they might scream. That is because the singer is a hologram.

Holographic concerts like this one have become increasingly common events over the past ten years. But while their popularity has grown, these performances have also prompted journalists to pen negative reviews filled with anxiety and suspicion. Seeing holograms taking the place of human singers can be unsettling, and for many, it raises questions about the meaning and authenticity of an automated performance. Is twenty-first-century automation technology leading us down a dangerous path towards the dehumanization of musical performance? Such fears are understandable, but they are not new, and recent technology not the only suspect. When it comes to automation technology, it’s not just these pre-programmed performances that are playing out over and over again, but the reception histories of the technologies themselves, as audiences recurrently view them with initial distrust, and the meaning of new innovations takes time to solidify in light of creative user practices.

On another July evening in Donaueschingen, Germany, nearly one hundred years earlier than the holographic concert, a different inanimate performer delivered a concert to a live audience. A Welte-Mignon reproducing piano, with no one seated at its keyboard, rattled off a dozen virtuosic pieces with mechanical precision, leaving the attendees unsure of how they ought to respond. One reviewer highlighted the inhuman capabilities of the machine, as well as the audience's hesitant reaction:

> The piano began to play: music like an étude, toccatas with otherwise unplayable harmonic progressions, with a speed that could never be approached even by the most virtuosic of players, with an exactitude of which a human could never be capable, with a superhuman sonic force, with a geometrical clarity of rhythm, tempo, dynamics, and phrasing, which only a machine can produce….The piano finished the composition and there was an uneasy pause. Should one applaud? There's no one sitting there. It's only a machine. Finally a quiet applause, growing louder. Calls of "da capo." And sure enough, the piano played it again, without hesitation, as precisely as the first time.[1]

Although separated by a century, these automated concerts raise similar questions, and prompted similar anxiety from reviewers. In the twenty-first century, holographic concerts with pre-programmed singing have struck many attendees as a strange new frontier in live performance that feels shocking and occasionally alienating. But this story is not new, and we can catch a glimpse of similar feelings during the "uneasy pause" in this reproducing piano concert. In the early twentieth century, automated instruments gave many such concerts, and pianos with empty benches even played pre-programmed concertos backed by live orchestras. Reproducing piano companies claimed that their instruments could transmit the "living presence" of concert pianists into the drawing rooms of those who purchased reproducing pianos, to play for them exclusively, even after the artist's death.[2]

---

[1] Erich Steinhard, "Donaueschingen: Mechanisches Musikfest," *Der Auftakt* 6 (1926): 183, quoted in Thomas Patteson, *Instruments for New Music: Sound, Technology, and Modernism* (Oakland, CA: University of California Press, 2016), 3-4.

[2] "A Notable Presentation of a Notable Instrument," *New York Tribune*, November 25, 1917, 6; Knabe, Advertisement, *New York Tribune*, March 24, 1918, F10.

The negotiation between live and automated performance goes back much further than this, however. Even in late medieval Europe, automata were familiar sights, from the mechanical man who rang clock tower bells in the fourteenth century, to automated figures that blew horns on church organs in the sixteenth century.[3] In eighteenth-century Europe, musical automata amazed viewers who paid a steep admission fee to observe "self-moving machines" perform a handful of tunes on the flute or the pipe and tabor.[4] In 1737, the Duchess of Marlborough wrote of her efforts to purchase an automated musical device, providing us with a window onto her considerations of the relationship between live and automated music:

> I am now in pursuit of getting the finest piece of music that ever was heard; it is a thing that will play eight tunes. Handel and all the great musicians say it is beyond anything they can do; and this may be performed by the most ignorant person; and when you are weary of those eight tunes, you may have them changed for any other that you like. This I think much better than going to an Italian opera, or an assembly.[5]

Although we might chuckle a little to think that someone might consider what was probably some type of barrel organ with eight tunes to be "the finest piece of music that ever was heard," the Duchess of Marlborough touches on two themes that have persisted in conversations around automation technology in music to the present day.

First, the Duchess' "thing" could be "performed by the most ignorant person," and its owners could have any tunes they preferred pinned into it. With an automated device such as this one, whether in the eighteenth century or the twenty-first, it is not necessary to practise for weeks or years to build the skills to enjoy a piece of music. Whether the machine in question is a barrel

---

[3] Jessica Riskin, *The Restless Clock: A History of the Centuries-Long Argument over What Makes Living Things Tick* (Chicago: The University of Chicago Press, 2016), 12-20.

[4] Jessica Riskin, "The Defecating Duck, or, the Ambiguous Origins of Artificial Life," *Critical Inquiry* 29 (Summer 2003): 599-600.

[5] Sarah, Duchess of Marlborough, *Private Correspondence of Sarah, Duchess of Marlborough* (London: Henry Colburn, 1838), 2: 198.

organ, a reproducing piano, or a singing synthesis program, these technologies democratize music by offering easier access to amateurs who might lack musical training.

The second point raised by the Duchess' description is the suggestion that having an automated machine might be "much better than going to an Italian opera." The Duchess does not disclose her reasons for thinking that listening to the machine was preferable to seeing an opera, but given that she later writes that she hoped to take it into the countryside with her in her old age, convenience was likely an important factor.[6] Even in the early twentieth century, writers praising the player piano and the reproducing piano emphasized how wonderful it was not to be required to put on dress clothes and appear in public just to hear some music—in other words, as Walter Benjamin would later note, mechanical reproductions had emancipated these works of art from their "parasitical dependence on ritual."[7] Writing in 1911, a music-lover who had attended concerts at every opportunity and still felt he lacked an in-depth appreciation of the works he sought to understand explained, "For if one really comes to examine it the world's music has always been remote, locked up from the generality of mankind….What, for instance, can the amateur who has had no special study hope to make of a Liszt Pianoforte concerto at a first hearing, and when may he hope to hear it a second time? Surely that great art-work had something more than that to tell him?"[8] Automation technology permits repeatability, and this repeatability enables listeners to become more familiar with music than they would if they only had occasional opportunities to hear it performed by professionals. The choral production and the

[6] Ibid.
[7] Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," in *Illuminations,* ed. Hannah Arendt, trans. Harry Zohn (New York: Schocken Books, 2007), 224.
[8] Bertram Smith, "The Piano-Player," *The Musical Times,* 52 (May 1911): 309.

piano concerto alike now "resound[ed] in the drawing room," for the convenience of anyone who could afford the technology to reproduce them.[9]

In this dissertation, I examine the reception and function of automation technology from the late nineteenth century to the present. I focus on the way in which discourse around these technologies shifted in their early years, before their purposes and uses had become clearly defined, and investigate the relationship between automation and human musicianship in three historical moments. This project includes studies of the human agency involved in player piano technology in the early twentieth century, synthesizers and sequencers in the mid-twentieth century, and vocal synthesis and holographic projection technologies in the early twenty-first century.

Although automation technology can be helpful, it has also caused concern about the potential for a loss of musical quality, or at least the absence of some intangible element of human presence. Unlike the Duchess, many attendees at holographic concerts today argue that automated performances are a poor substitute for a live performance by a living artist. However, from today's puzzled reviewers to the holographic technologies that cause them concern, at the root of the issue and the anxiety, there really is nothing new under the sun. Of holographic singers and reproducing pianos alike, listeners have stated dismissively, "She is…only a hologram."[10] "It's only a machine."[11] These statements suggest that there is something lacking when a musical performance is automatically rendered, but there is more to this concern than mere anxiety about a reduced number of jobs for singers. Automated musical performances have

[9] Benjamin, "The Work of Art," 221.
[10] Q, "Q Review: Enter Hatsune Miku's Hologram Concert," CBC Radio, May 24, 2016, cbc.ca/radio/q/schedule-for-tuesday-may-24-2016-1.3597178/q-review-enter-hatsune-miku-s-hologram-concert-1.3597187, accessed July 12, 2019.
[11] Steinhard, "Donaueschingen," 183.

been raising questions about the meaning of live performance for generations. Superficially, journalists have debated whether or not we should applaud or cheer at an automated performance, and, if we do, to whom we are attempting to direct these traditional displays of appreciation when the machines or projections onstage are incapable of hearing or responding. But there are deeper issues in play in these situations.

Examining automated performances permits us to interrogate the fuzzy boundaries between instrument and user, performer and listener. Studying these relationships is essential as we seek to understand the meaning and function of technologically mediated artistry in an increasingly automated world. Are fearful reactions justified when automated performers take the place of humans? Should musicians who take technological shortcuts to instrumental proficiency be recognized as legitimate performers? Will easy-to-use musical devices erode amateur interest in traditional musical study? All of these questions have been debated in the twenty-first century, as holographic singers, handheld synthesizers, and music video games join our musical landscape. But all of these questions have also reared their heads in decades and centuries past, as users have engaged with other automation technologies. If these questions recur with the introduction of so many different technologies, bringing with them so much anxiety, then they are worth careful consideration. But our response to them cannot be a simple knee-jerk reaction with a perspective limited to the past decade. The fact that these are persistent questions across the past century means that we must also consider technologies drawn together from the past century. Studying the ways in which these fears and conversations played out in the past offers us great insight into the way they will play out again in our future.

Music and Technology: An Overview

The past few decades have been a period of rapid change in the study of the intersections between music, technology, and culture. Until recently, musicology remained relatively separate from other disciplines, divided from other fields in the humanities and social sciences by physical distance—musicology departments were often located in the school of music—as well as by disciplinary conventions that required musicologists to possess specialized skills in reading musical notation and extensive knowledge of the Western classical music tradition. These specialized competencies were not necessitated by the nature of musical sound itself, but the solidification of these methods and the objects they typically examined came about as the field increasingly defined itself through them. However, beginning in the 1980s with work including Joseph Kerman's essay, "How We Got into Analysis and How to Get Out," and Richard Leppert and Susan McClary's *Music and Society*, scholars subscribing to what became known as "the new musicology" argued against the understanding of music as an autonomous art, calling for research to be grounded in its social contexts and to include genres of music outside the traditional canon of Western classical music.[12]

Meanwhile, towards the end of the twentieth century, scholars from emerging fields including sound studies, media studies, and science and technology studies examined musical topics in new ways by applying different methods than musicology had typically used. Researchers considered these subjects in new contexts, placing music technologies side by side with a wide range of other media technologies in comparative studies, and including musical performances in generalized studies that encompassed other types of performance across

[12] Joseph Kerman, "How We Got into Analysis and How to Get Out," *Critical Inquiry,* 7 (1980): 311-31; Richard Leppert and Susan McClary, *Music and Society: The Politics of Composition, Performance and Reception* (Cambridge: Cambridge University Press, 1987), xii-xiii.

disciplines. Collectively, these methods analyzed technologies in their cultural contexts, and explored the ways that music technologies and music techniques develop together dialectically—an approach that music scholars have only recently begun to adopt.[13] Although the incorporation of approaches from the new musicology such as feminism, queer theory, and poststructuralism is no longer a contested issue, in more recent years, musicologists have increasingly drawn on methods from fields including media studies, sound studies, and science and technology studies in a continued effort to open the field to new subjects and methodologies.

One of the first scholarly meetings to formally connect researchers from musicology and the history of technology with the shared goal of examining changes in the production and depiction of music technology took place at a two-day session in Budapest in 1996.[14] The successful disciplinary cross-fertilization at this session—a part of the 23rd Symposium of the International Committee for the History of Technology (ICOHTEC)—put new cracks into the walls that had separated scholars from different disciplines, and in the years that followed, researchers began to break down boundaries that had prevented collaboration on topics of interest to both of these groups. Today, edited collections on subjects relating to music and technology, such as Michael Bull and Les Back's *The Auditory Culture Reader* as well as Paul Greene and Thomas Porcello's *Wired for Sound: Engineering and Technologies in Sonic Cultures,* place popular music scholars alongside science and technology scholars, and music historians alongside cultural historians, melding interdisciplinary perspectives on issues relating to music and technology.[15]

---

[13] Richard Middleton, *Studying Popular Music* (Philadelphia: Open University Press, 1990), 83-92.
[14] Hans-Joachim Braun, ed, *Music and Technology in the Twentieth Century* (Baltimore: The Johns Hopkins University Press, 2002), 7.
[15] Michael Bull and Les Back, eds, *The Auditory Culture Reader* (New York: Berg, 2003); Paul D. Greene and Thomas Porcello, *Wired for Sound: Engineering and Technologies in Sonic Cultures* (Middletown: Wesleyan University Press, 2005).

Writing of the need for interdisciplinarity in the study of technology and music, Trevor Pinch and Karin Bijsterveld summarized the attitude in sound studies at the beginning of the twenty-first century: "There was agreement that none of the standard disciplinary approaches were alone adequate. In the spirit of interdisciplinary learning, scholars set aside their own perspectives to see what other approaches could bring to bear."[16] In the same spirit of dialogue, I would add that it is essential for musicologists to engage with advances in adjacent fields, bringing methods and language from other disciplines to fill in the gaps that musicological tools may leave. Historically, musicology has focused on studying music as it is notated in scores and realized in sound, and while the legacy of this specialized approach lends the field its strength, it can also pose a problem as scholars clash over what methods to include from other disciplines, and to what extent this should be done. My work offers a contribution to this discussion, showing how a blend of approaches from musicology and media studies can illuminate music technologies in their broader contexts.

This dissertation examines music technologies as their meanings and functions solidified during their early years. The devices and software themselves were developed and marketed in response to the needs and interests of the musicians who used them, and musicians using these musical instruments have composed works or participated in dynamic musical experiences that have then been structured by the affordances and restrictions of the instruments. In considering these technologies and performances from an interdisciplinary perspective, I blend methods from music scholarship with those from neighbouring disciplines, combining historical reception and performance studies with discourse analysis and archival sources.

---

[16] Trevor Pinch and Karin Bijsterveld, "Sound Studies: New Technologies and Music," *Social Studies of Science* 34 (Oct. 2004): 636.

Within musicology, a new body of scholarship seeks to update the traditional musicological field of organology to include instruments from a wider range of genres and divergent histories stemming from different user groups. In the past, organology focused primarily on investigations of the material properties of musical instruments, the ways in which they were built and tuned, how they sounded, and the techniques required to produce those sounds.[17] More recently, work by authors including Roger Moseley and Emily Dolan incorporates research on the way in which instrument builders, composers, and performers describe and use their instruments, integrating these observations into a picture of the culture of musical performance and listening, in dialogue with a material culture.

Moseley advances an understanding of the keyboard as a site at which the motion of limbs and the motion of mechanical objects meet in order to generate (rather than merely transfer) new knowledge:

> The keyboard's persistence as an interface, its patterning of fixity and flexibility that has at once resisted and accommodated change, forms a shifting boundary that connects and separates worlds, cleaving human and machine, individual and *Umwelt*, *Bebung* and *Doom*, the analog and the digital. The play of the keys demonstrates how a system operates, but also probes its limits: whether we choose to play along or to rewrite the rules of ludomusical engagement remains up to us.[18]

Ludomusicality—the intersection of music and play—invites a consideration of musical play (rather than simply correct mechanical input) as performance practice in its own right. The keyboard, in Moseley's work, serves as a medium by means of which play becomes embodied and materialized.[19] By exploring the "rules of engagement and codes of conduct," Moseley sheds

---

[17] Susan DeVale, "Organizing Organology," in *Issues in Organology: Selected Reports in Ethnomusiology*, vol. 8, ed. Susan DeVale (Los Angeles: Department of Ethnomusicology and Systematic Musicology, University of California, Los Angeles, 1990), 5-36.

[18] Roger Moseley, "Digital Analogies: The Keyboard as Field of Musical Play," *Journal of the American Musicological Society*, 68 (Spring 2015): 213.

[19] Roger Moseley, *Keys to Play: Music as a Ludic Medium from Apollo to Nintendo* (Oakland, CA: University of California Press, 2016).

light on the way in which musicians translate mechanical input into a corresponding sonic output through interaction with the interface of a particular instrument and its affordances.[20] Like Moseley, who examines the symbols and operators involved in the process of musical recreation in video games such as *beatmania* and *Guitar Hero,* I consider the users who engage with player piano technology or *Vocaloid* software as participants in a creative process that similarly circumvents the Romantic criterion of "fidelity."[21]

In a similar vein, Emily Dolan's work on instrumentality blends reception history with examinations of material configurations and compositional practices in studying the evolution of practices of listening and performing. Dolan aims to extend the earlier practice of cataloguing the shapes and sounds of musical instruments, building on these observations by examining the discourse surrounding instruments in their social contexts. Dolan writes, "The emphasis on philosophies that prize the abstract ignores the materiality of musical practice and risks undervaluing the history of listening. Furthermore, it encourages scholars to draw on those methodologies that most closely resonate with the philosophical discourse, particularly analytical methods that focus on musical form."[22] Dolan's research highlights the relationship between musical instruments and scientific instruments, from recent work calling attention to the lack of research that addresses musical practices in traditional narratives of orchestral development, to a study of the reception of machines used in French grand opera.[23]

Popular music scholar Mark Butler's work follows similar ideas in examining the unique performance equipment and interfaces used by laptop performers and DJs who perform live

---

[20] Moseley, "Digital Analogies," 153.
[21] Moseley, *Keys to Play,* 10-11.
[22] Emily Dolan, *The Orchestral Revolution: Haydn and the Technologies of Timbre* (Cambridge: Cambridge University Press, 2013), 5-6.
[23] Emily Dolan and John Tresch, "A Sublime Invasion: Meyerbeer, Balzac, and the Opera Machine," *The Opera Quarterly* 27 (2011): 4-31.

using pre-existing musical samples, co-opting technology generally perceived as restrictive in the performance of improvisations that take on flexible, modular characteristics. Music technologies, for Butler, are "principles of design affording certain kinds of performative interaction, rather than…structural units to be discovered and explicated."[24]

Discussions around the "affordances" of technologies in recent scholarship involve an understanding of the complex processes of production that include the imagined expectations of both designers and users. Peter Nagy and Gina Neff have proposed the term "imagined affordances" to underscore the dynamic nature of these affordances, owing to the fact that they are dependent on the participation of human actors.[25] In his exploration of the technologies employed by laptop performers and DJs, Butler examines the interplay between these affordances in the creation of electronic dance music, discussing the interfaces with which these performers interact, the ontology of works being created, and the way in which technologies are understood and utilized as means of sonic organization. Much like Butler's work interrogates the binaries of pre-recorded and live, work and performance, material and immaterial, my project examines the boundaries between live and automated, human and machine, musical instrument and mechanical device. The spaces and interfaces I consider are different than raves and rigs, but my examination of technology in performance uses similar methodological means to seek similar ends. Like Butler's project, my work illuminates the way in which automated musical playback that seems fixed can play a dynamic role in performance contexts, and explores the amateur and professional musicians who participate in working out the role of these technologies.

---

[24] Mark Butler, *Playing with Something that Runs: Technology, Composition, and Improvisation in DJ and Laptop Performance* (New York: Oxford University Press), 175.

[25] Peter Nagy and Gina Neff, "Imagined Affordance: Reconstructing a Keyword for Communication Theory," *Social Media + Society* 1 (2015): 1-9.

My methods will include analyses of interfaces, discourse, and affordances, similar to those used by Moseley, Dolan, and Butler. By examining and comparing the interfaces and functions of the devices in my case studies, I place each one in a richer context that questions the implications of their construction for their use in composition and performance, and examine their evolution over time as different user groups interacted with each technology.

Outside of musicology, science and technology scholars Trevor Pinch and Karin Bijsterveld emphasize that instruments must be treated as technological artifacts, and handled in their full social, cultural, and economic context. Pinch and Bijsterveld have argued that no single disciplinary approach is adequate for this study, pointing to the productive collaborations between history, philosophy, musicology, science, and technology studies in exploring the relationships between the production and consumption of music, and of sound, noise, and silence.[26]

Trevor Pinch and Frank Trocco's book on the Moog synthesizer takes this fully contextualized and interdisciplinary approach in its retelling of the history of the synthesizer's development, describing the way in which the instrument's creators adapted to meet the needs of musicians in response to their feedback. Pinch and Trocco contrast Moog synthesizers with those developed by Don Buchla, who sought to construct an instrument that would fulfill a different vision of what the synthesizer could become, and their study then traces why Moog's concept eventually won out over his West coast rival's. Their work draws together a considerable amount of descriptive narrative, including detailed retellings from interviews with prominent figures in

[26] Trevor Pinch and Karen Bijsterveld, "Sound Studies: New Technologies and Music," special issue of *Social Studies of Science*, 34 (2004): 635-48.

the synthesizer scene, and accounts of defining performances in the instrument's history. For Pinch and Trocco:

> The way to understand musical instruments is not from their essences—what their theoretical possibilities are—but from the way people who actually make the music put them into practice. Although instrument designers may have dreams and aspirations for the sorts of music to which their instruments can be adapted, the way to find the meaning of an instrument is in its use by real musicians.[27]

While this book recounts the stories of individual people who played important roles in the synthesizer's development, it is a story of collaboration, detailing the way in which engineers, musicians, and salespeople played complementary roles in the evolution of a new instrument. Pinch and Trocco emphasize that technology and cultural practice are two sides of the same coin, and demonstrate, like much other literature in this field, that meaning is not inherent in a technology itself, but is derived from that technology's use in a specific cultural context.[28]

Recent scholarship in media studies approaches the examination of technological development with an emphasis on the fact that these histories are not tales of innovations arriving in the world in a fully formed state to go on to impact people. Current research avoids these "impact" narratives, and prompts us to reject the idea that the world has been merely reacting to the appearance of new technologies. One such approach from the work of cinema-studies scholar Rick Altman that has since been cited by many scholars is the concept of "crisis historiography," which is critical of approaches that begin with the object of study in its final form. Crisis historiography chooses instead to examine failure as well as success, and the conflicting identities that exist simultaneously in new technologies.[29] Altman writes,

---

[27] Trevor Pinch and Frank Trocco, *Analog Days: The Invention and Impact of the Moog Synthesizer* (Cambridge: Harvard University Press, 2002), 10.
[28] Ibid., 308.
[29] Rick Altman, *Silent Film Sound* (New York: Columbia University Press, 2004), 15-23.

> the technology is never socially constructed once and for all. During a crisis, a technology is understood in varying ways, resulting in modifications not only of the technology itself but also of terminology, exhibition practices, and audience attitudes. These changes resist linear presentation precisely because they are generated not by a single social construction but by multiple competing approaches to the new technology. Indeed, the notion of jurisdictional conflict…depends on several user groups enjoying simultaneous access to the new technology and playing a shared role in defining that technology.[30]

In other words, technologies are defined not only by their creators, but also by their users, who adopt and adapt them in different ways to suit their current needs. This process takes place in the context of the existing technologies in relation to which a new technology must be defined, such as the player piano and its relationship to the piano. In undergoing this process, technologies and their functions are sometimes dramatically transformed from what their inventors initially conceptualized.

Lisa Gitelman's work sheds light on the economic and cultural factors that provide context for emerging technologies.[31] In *Always Already New,* Gitelman begins with the assertion that "all media were once new" and that "looking into the novelty years, transitional states, and identity crises of different media stands to tell us much, both about the course of media history and about the broad conditions by which media and communication are and have been shaped."[32] The structure of my dissertation is similar to the case study format of Gitelman's work in that it draws together objects that span a long period of time, rather than choosing a group of objects that are more closely temporally grouped. My rationale for these choices mirrors that of Gitelman, who explains that her case studies "describe…moments when the future narratability of contemporary events was called into question by widely shared apprehensions of

---

[30] Ibid., 21-2.
[31] Lisa Gitelman, *Always Already New*: *Media, History, and the Data of Culture* (Cambridge: MIT Press, 2006), 10.
[32] Ibid., 1.

technological and social change."[33] Gitelman argues that highlighting the continuities that link objects of study in addition to sharpening the contrasts between conditions at different points in history ultimately serves to provide clearer insights than either approach would on its own. The similarities between Altman's and Gitelman's approaches shape my own methodology. I will explore the implications of these approaches on my own case studies in detail below.

A key issue in this project is the way in which we define and attach value to the concept of the "live" in performance. Labelling music as "live" is itself a descriptor that has only held meaning since the advent of recording technology provided an alternative. Steve Wurtzler writes, "As socially and historically produced, the categories of the live and recorded are defined in a mutually exclusive relationship, in that the notion of the live is premised on the absence of recording and the defining fact of the recorded is the absence of the live."[34] Work by Wurtzler has demonstrated how, in the late twentieth century, recording and performance practices such as sampling, multi-track recording, virtual reality, and lip synching have dismantled the clean binary that used to exist between "live" and "recorded," allowing for the construction of recorded musical performances for which no single, unified original exists.

Several years later, *Liveness*—Philip Auslander's influential book on the concepts of liveness and mediatization—further challenged traditional ways of thinking about the live and the recorded.[35] Through analyses that included arena rock, the Milli Vanilli lip synching scandal, and courtroom proceedings, Auslander has questioned the meaning and place of live performance in our culture of mass media. More recently, Jason Stanyek and Benjamin Piekut's article, evocatively titled "Deadness," has reframed the concept of liveness, not by presenting the

---

[33] Ibid., 11.
[34] Steve Wurtzler, "She Sang Live, but the Microphone was Turned Off: The Live, the Recorded, and the Subject of Representation," in *Sound Theory Sound Practice*, ed. Rick Altman (New York: Routledge, 1999), 89.
[35] Philip Auslander, *Liveness: Performance in a Mediatized Culture* (New York: Routledge, 1999).

pair of terms as opposites, but by asking what happens at a time when technology enables living performers to collaborate with those who are no longer living. Stanyek and Piekut propose a new set of terms that facilitate a discussion of the way in which sound is perpetually rearticulated in relation to the bodies that produce it, in our world of splicing, global collaboration, and virtuality.[36] My dissertation similarly contends with issues relating to the relationship between sound production and the body, but while Stanyek and Piekut discuss "virtual" or "simulated" performance primarily in relation to recreations of dead stars, I expand the discussion to include new categories of virtual performance from the past decade as well as much earlier forms. Placing crowd-sourced holograms alongside reproducing pianos playing with live orchestras, I examine the implications of automation in situations where virtual technologies are read as antithetical to live performance.

The player piano was one of the earliest agents in the transformation of the concept of live performance. Player devices and the issue of performance have been considered in the context of Edwardian fiction in work by Cecilia Bjorken-Nyberg, whose monograph examines depictions of the material properties of the player piano in the Edwardian novel.[37] Bjorken-Nyberg shows how this discourse contested the perceived opposition between the Romantic view of performance as transcendent expression and the growth of technological mechanization. While her research pulls together fictional depictions that shed light on contemporary views of these devices, sources such as advertisements and instructional manuals receive less attention. Mark Katz' work on mechanical music has addressed this angle, looking closely at the player

[36] Jason Stanyek and Benjamin Piekut, "Deadness: Technologies of the Intermundane," *The Drama Review*, 54 (2010): 14-38.
[37] Cecilia Bjorken-Nyberg, *The Player Piano and the Edwardian Novel* (Burlington, VT: Ashgate Publishing Company, 2015).

piano and its role in amateur music making. [38] Katz argues that the amateur player-pianist was in fact a "co-performer," and shows how manufacturers strongly encouraged this view in advertising materials from the late 1910s and the 1920s. My work on the player piano takes up Katz' argument and extends the timeframe of advertisements and other materials included in the narrative to begin in 1898 and continue into the 1930s. By assembling this longer-range perspective, I show that although manufacturers in the mid 1910s were certainly unified in seeking to convince buyers that they were co-performers, in the player piano's early years, the user's role had not yet been established, and the meaning of this technology was still unclear.

Jumping forward approximately forty years, I examine two techno-pop groups, one of which has received far more journalistic and scholarly attention than the other. The German group Kraftwerk have been the subject of a large number of books from popular presses, and are treated in significant scholarly detail in Sean Albiez and David Pattie's edited collection.[39] This 2011 publication includes essays on Kraftwerk's influences and legacies, as well as the intersections of music, technology, and culture in their output. My contribution to the discussion of Kraftwerk does not offer any new biographical material or include new primary sources, but considers Kraftwerk as one of the first electronic music groups to foreground mechanization and automation as a part of their performance aesthetic. Alongside Kraftwerk, I introduce the Japanese group Yellow Magic Orchestra (YMO) to this discussion of techno-pop. YMO, which was also formed in the late 1970s, is another early synthesizer band that had a significant impact on later electronic groups. However, the only substantial scholarly treatment of YMO currently in print is a section of a chapter in Michael K. Bourdaghs' 2012 monograph, which analyzes the

[38] Mark Katz, "The Amateur in the Age of Mechanical Music," in *The Oxford Handbook of Sound Studies*, ed. Trevor Pinch and Karen Bijsterveld (New York: Oxford University Press, 2011), 459-79.
[39] Sean Albiez and David Pattie, eds., *Kraftwerk: Music Nonstop* (New York: Continuum, 2011).

tongue-in-cheek humour employed by YMO across their discography as an effort towards identity construction during the 1970s "new music" era in Japan.[40] By placing these groups side by side, I examine different possible interpretations of synthesizer technology during its early years in popular music, showing how these two bands handled tensions around the use of automation technology in different ways.

Since *Vocaloid* software has only been on the market for a few years, the academic study of music made using this technology, and of performances employing holographic techniques, has yet to see much exploration. Recently, Masataka Goto has published work that draws on computer software analysis to visualize the evolution of Vocaloid works online, showing how a "content-symbiotic society" such as the Vocaloid fan community is able to sustain its growth and development.[41] My work ties Goto's concept of a content-symbiotic society together with research on participatory fandom in other scholarly fields, including Henry Jenkins, who advocates for an ecological perspective on communication technologies and the communities that develop in conjunction with them.[42] Recently, Nina Sun Eidsheim has contributed to the discussion of the Vocaloid community by examining Vocaloid as an example of the racially subjective social construction of the voice.[43] Eidsheim sheds light on the role of Vocaloid's online culture in rejecting racialized elements of certain Vocaloid characters, demonstrating the extent of this community's influence over how these figures are represented. Research by Aaron

---

[40] Michael K. Bourdaghs, "Happy End, Arai Yumi, and Yellow Magic Orchestra" in *Sayonara Amerika, Sayonara Nippon: A Geopolitical Prehistory of J-pop* (New York: Columbia University Press, 2012)

[41] Masataka Goto, "OngaCREST Project: Building a Similarity-Aware Information Environment for a Content-Symbiotic Society," in *Human-Harmonized Information Technology, Volume 2: Horizontal* Expansion, ed. Toyoaki Nishida (Tokyo: Springer Japan, 2017).

[42] Henry Jenkins, *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century* (Cambridge, MA: The MIT Press, 2009).

[43] Nina Sun Eidsheim, *The Race of Sound: Listening, Timbre, and Vocality in African American Music* (Durham, NC: Duke University Press, 2018).

Delwiche, and Jennifer Jacobs Henderson also contributes to this discussion on fan involvement by shedding light on the implications of easy access to online publishing in the growth of participatory online cultures.[44]

My work does not include interviews with participants in these communities, but Rafal Zaborowski's contribution to the recent *Oxford Handbook of Music and Virtuality* includes interviews with creators and fans, focusing on the role of the audience's participation and the dynamics between creators and listeners in the production of *Vocaloid* music, and addressing the unique nature of reality construction in the performances of virtual idols in Japan.[45] In a study of the band Supercell, which used Vocaloid software in the creation of their first album, Keisuke Yamada has also examined the impact of Japanese "doujin," or fan-publishing culture, on the circulation of Vocaloid products and works.[46] Yamada also considers the obsessive fans known as "otaku," and locates the beginning of relevant fan trends in 1980s visual culture. As a current and rapidly changing genre of music, research on this subject is constantly evolving, and recent compositions that push the boundaries of the performance medium have yet to be addressed by scholars.

Research Methods and Chapter Breakdown

The methodologies I use in this dissertation are intentionally interdisciplinary. This expanded toolbox has provided the flexibility necessary to undertake very different case studies from two different centuries. My methodology combines approaches from musicology with those from

[44] Aaron Delwiche and Jennifer Jacobs Henderson, eds., *The Participatory Cultures Handbook* (New York: Routledge, 2013).
[45] Rafal Zaborowski, "Hatsune Miku and Japanese Virtual Idols," in *The Oxford Handbook of Music and Virtuality*, ed. Sheila Whiteley and Shara Rambarran (London: Oxford University Press, 2016).
[46] Keisuke Yamada, *Supercell Featuring Hatsune Miku* (New York: Bloomsbury Academic, 2017).

media studies, film studies, performance studies, and sound studies, drawing on methods including archival research, musical analysis, historiography, and participant-observation.

In order to properly address big-picture questions around automation technology, this study cannot be limited to technologies and anxieties from a single era. If we consider the past ten years of holographic concerts as a flashpoint in the reception of musical automation—which is reasonable given the huge volume of confused and amused reviews published in 2016, when holographic concerts began to gain visible traction in North America—then considering this case study alongside the stories of other automation technologies in their early years allows us to ask: What is different about these situations? What is the same? And how can these similarities and differences inform our understanding of performance in the twenty-first century? Writing twenty years ago, John Durham Peters argued:

> As we live through something of a digital revolution in our own time, revisiting old shocks can be highly illuminating. The urgent question about communications today—the telescoping of space-time (eg., the Internet) and the replication of human experience and identity (eg., virtual reality)—were explored in analogous forms in the eras of the telegraph and photograph, the phonograph and the telephone, the cinema and radio.[47]

This method of "revisiting old shocks" gives Peters' study of communication a broad perspective that sheds light on common hopes and beliefs in contrasting historical periods, which I will also undertake, as I explore questions relevant not only to today's revolution in pre-programmed concerts, but to the eras of synthesizers and player pianos.

Taking a similar approach, Lisa Gitelman's study of new media examines the relatively recent development of digital networks alongside the not-so-recent development of early recorded sound. Despite the fact that one of these case studies is temporally much further removed from the present than the other, Gitelman treats both objects as "new media," looking

---

[47] John Durham Peters, *Speaking into the Air: A History of the Idea of Communication* (Chicago: University of Chicago Press, 1999), 147.

back to the point in time at which each one was, in fact, new. Considering these subjects in what Gitelman calls their "novelty years," reveals a great deal about the ideas, actions, and adaptations that contributed to the development of new technologies.[48] Gitelman's concept of novelty years has much in common with Altman's "crisis historiography" discussed earlier, and both methods mould my own approach. During a technology's novelty years, it can also be said to be in a state of identity crisis. Competing "identities" perceived by inventors, manufacturers, and users in its early years collide with one another, being formed, reformed, and adapted through discussion and use. Within the early years, the terms used to describe and discuss a technology may be replaced, attitudes may change, and new customs around the use of the technology may solidify. Beginning my case studies at the very start of their stories during this period of instability, I assemble early advertisements, discussions, and performances into a picture of what the technology was at the start of its history. With this baseline established, I trace the changing uses and meanings of the technology, as well as the fallout of these changes and their implications for users, retailers, and inventors. These insights provide not only a more detailed picture of the messy beginnings of a new automation technology's history, but bring the longer history of automation technology into clearer focus, and, in the case of technologies used in live concerts, contribute new perspectives to our understanding of musical performance and reception.

Two additional considerations have shaped the subject and content of this dissertation as it developed into its current form. First, the topic of automation anxiety—that is, fears relating to potentially invasive incursions of automation technology, or the possibility of unwelcome substitutions for human experts—both inside and outside of music has seen a resurgence in

[48] Lisa Gitelman, *Always Already New: Media, History, and the Data of Culture* (Cambridge, MA: MIT Press, 2008), 1.

discussion in recent years, and although the issue itself is centuries old, the technologies around which the conversation now centres in the music world are different than those which our predecessors feared. Because these anxieties are described in similar terms, while the technologies they concern are different, it is necessary to compare these situations in order to establish whether or not these anxieties are in fact the same, or whether there are differences in play. Second, while scholars have given certain technologies of automation individual attention, there has been no large-scale study that sought to trace long-term connections between these technologies from different time periods. This means that automation technology is a timely topic, and one that affords a fruitful study of the contrast between historical expectations and outcomes, as well as the roles of amateur and professional agency in performances that use these technologies. Furthermore, it calls for an examination of how the relationships between technology and its users have changed over time. Without such a study, each scholar who takes up a subject relating to automation technology has had to begin afresh, reinventing the wheel before being able to turn to a close analysis of a particular object. In my dissertation, I offer this long-term perspective, tracing a narrative through a century of technological history in order to offer a new perspective on the shifting discourse around automation technology in musical performance, and an understanding of human agency in the development of these technologies.

While the timeline of my study is long term, however, it is not comprehensive. By particularizing my chosen case studies within the context of this long-range perspective, I aim to show the relationship between interlocking historical rhythms relating to music and automation technology. My conception of these rhythms draws from Fernand Braudel, who put forward a three-layered system in his historical analysis of social activity.[49] Braudel proposed that history

[49] Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II*, trans. Sian Reynolds, 2 vols. (New York: Harper and Row, 1972-73).

consists of overlapping layers of activity, which play out on short, medium, and long timelines, each running at a different speed. The longest of these timelines, the *longue durée,* is an overarching structure within which run medium-length rhythms that can be more easily viewed as cyclical processes, or recurring trends. The value of this view, as applied to this project, lies in its potential to consider the present automation anxiety crisis both as a recurring trend on the medium-length level—merely one of many instances in which a new technology is initially viewed with fear or suspicion—and as a smaller segment in a much larger developmental history on a longer timeline. In Braudel's words, this study, too, is "a series of overlapping histories, developing simultaneously."[50]

Chapters 1 and 2 share a common time period, collectively spanning 1898 through the early 1930s. Chapter 1 explores the early years of player piano technology, beginning with a close look at how these devices were initially understood and marketed in the late 1890s. In chapter 2, I examine the reproducing piano—an electrically powered player device which, its makers promised, could reproduce every aspect of a concert pianist's performance with perfect accuracy. Unlike the player piano, the reproducing piano was fully automatic, and required no user involvement whatsoever. In conducting research for the player piano and reproducing piano chapters in this project, I combed through the pages of publications ranging from housekeeping and fashion magazines to trade publications for piano tuners and music teachers. I collected dozens of advertisements from the pages of daily newspapers from across the U.S. in order to assemble a better picture of the cultural and economic conditions during the late nineteenth and early twentieth centuries, as well as a sense of the tactics typically employed by advertisers during this time period. In these two case studies, I cover additional materials such as reviews of

[50] Ibid., 892.

player piano rolls, interviews with the pianists who recorded for reproducing rolls, and articles by amateurs debating the merits and dangers of these technologies. Representations in advertising, music criticism, and journalism show that pedal-powered player devices were first introduced as automated labour-saving devices, and their primary function was to play the piano in place of a human pianist. These devices, however, were far from automatic, and required practice and skill to operate smoothly, never mind to produce music that showed musical sensitivity. In light of this potential for skilled use, and through the efforts of salesmen, amateur users, and copywriters, the meaning of player piano technology gradually underwent a significant shift.

The sources used in the player piano study show how companies envisioned their customers, and also shed light on the ways in which copywriters hoped their readers would understand these technologies. The materials I have pulled together hint at what the goals and outlook of these companies might have been, and suggest how the advertisers may have perceived their product's place in the public music world or the customer's home. By tracing changes in the discourse around player piano technology in the early twentieth century, I show how people who were purchasing player pianos found it appealing to consider themselves to be musical performers, rather than simply as the operators of a piece of machinery. Similarly, I track the shifts in terminology, marketing, and instructional materials that show how the player piano itself became an instrument in its own right, and shed new light on the meaning of automation technology in music.

In the reproducing piano chapter, I examine the significant differences in how the reproducing piano was marketed to potential customers, in order to understand how companies and customers navigated the relationship between automation and authenticity in the case of this

technology in its early years. I undertake a careful examination of the mechanisms inside recording and reproducing pianos, as well as interviews with concert pianists who recorded for them, shedding light on the implications of some of these companies' carefully protected secrets, and the tension between a technology that was attempting to simultaneously appear completely automated and completely human.

In the player piano and reproducing piano case studies, I incorporate methods from organology, in order to discuss how these instruments produced sound and dynamics, as well as media archeology, in considering these devices as new media against the backdrop of their own historical contexts. Through these approaches, I also aim to contribute to a process of clarifying a number of misconceptions that dogged early historical work on these instruments. Ultimately, in both chapter 1 and chapter 2, I show that automation technology does not erase human involvement in musical performance. In neither case did these devices substitute soulless automation for human artistry. Rather, human performance was better facilitated or transmitted through these media.

Situated at the nearly the exact chronological midpoint between this dissertation's two major case studies, chapter 3 discusses two techno-pop groups in the 1970s: Kraftwerk and Yellow Magic Orchestra. By bridging the stories of the player piano and Vocaloid with a brief examination of a third moment that highlights the interaction between live performance and automation technology, I explore the way in which similar anxieties around a related technology play out in a different cultural landscape. At this point in time, musicians were beginning to use mechanism as an aesthetic in its own right, rather than simply a means of producing music, as in the case of the player and reproducing pianos. Additionally, however, I highlight similarities in discourse and outcomes that connect this story with those on either side of it, and demonstrate a

common trajectory in the reception of new automation technologies in performance in which new technologies are perceived as "cold" and mechanical, only to be viewed as "warm" later on in their histories.

The most significant area of methodological overlap among the case studies in this dissertation is the examination of a developing user discourse around these technologies. "Technologies are never neutral," note Pinch and Trocco, "they are always embedded in and generated by a cultural context, and the most important cultural context is that of use."[51] In each of the cases I examine, instead of seeking to understand what a technology is intended to be, I focus on the meanings its users perceive, and on how they go on to use the technology. In the remaining chapters, rather than learning about user culture by drawing from magazines and trade journals, I delve into online fan communities, music blogs, and concert footage in order to assemble a picture of their discourse.

Chapters 4 and 5 leap forward to the twenty-first century, and take automated singing, rather than automated keyboard playing as their object of study. In these two chapters, I deal primarily with an international community that collaborates digitally to produce a virtual star; thus, the majority of the sources for this case study are also digital. Chapter 4 introduces *Vocaloid*, a computer application released in 2003 that enables users to generate a sung vocal line by inputting a melody and lyrics. Contrary to the intentions of its developers, who expected the software to be used by studio professionals, *Vocaloid* became popular with amateurs, and a community of users gathered online to share Vocaloid music and collaborate on high-quality multimedia productions. This community, which is centred around a video-sharing website called NicoNico, is characterized by high levels of creative user activity, cooperation on

[51] Pinch and Trocco, *Analog Days*, 309.

multimedia works, and community input. In this chapter, I take a closer look at the Vocaloid community online, situating it within the longer history of amateur desktop music (DTM) communities, and considering its culture in the context of recent scholarship on online fan culture. This chapter also includes a case study that focuses on music by a creative supergroup called Supercell, which comprises eleven musicians and visual artists who began collaborating on NicoNico and have produced songs that offer an insider's perspective on the significance of Vocaloid music and its community.

Chapter 5 links the concepts behind the creative community explored in chapter 4 to the growing trend of pre-programmed holographic concerts over the past decade. Beginning with an examination of the differences between three classifications for these types of performances, including holograms of dead performers, holograms with fictional identities, and crowd-sourced Vocaloid holograms, I examine the unique aspects of Vocaloid concerts and their roots in the bottom-up creative culture that produces this music. This chapter explores the meaning of holographic technology in live concerts, and responds to the anxiety expressed by journalists and bloggers who see automated singers as a troubling step towards the technological dehumanization of musical performance. Drawing on personal field research experience at a pop-styled 2018 Vocaloid concert in New York City, and footage from larger-scale performances in Japan, I discuss the potential for audience engagement and performative fandom in concerts that depart from the conventions of a typical pop show.

Chapters 4 and 5 include and analyze items ranging from concert reviews and performance footage to memes developed in online video comments and fan booklets circulating on Twitter. Taken together, these sources enable me to track the development of fan practices as they migrate from online environments to live concerts. By closely examining the way in which

the users and fans themselves describe and discuss the meaning of this music and its community, and analyzing it alongside the misgivings and anxieties of viewers and writers outside of the Vocaloid world, I am able to offer a holistic perspective on what synthesized singers and holographic performers are able and unable to offer in live concerts. However, even the best analysis of online videos and reviews comes up slightly short when compared with a first-person experience. It was for this reason that during the research phase of this case study, I found myself in New York City, in the summer heat and smell particular to that city, waiting in line for hours to get a good spot on the floor to take in a live holographic concert. The observations I was able to tap into my phone from the cramped floor of the venue while surrounded by two thousand screaming fans serve to fill in some of the gaps and questions that are left unaddressed by the rather slanted views of opinionated fans and underinformed journalists online.

This dissertation is not a story of technological development from past to present, and these case studies do not comprise an account of progress from "worse" automation technology to "better." My aim, as media scholar Geert Lovink writes, is to "[read] the new against the grain of the past," and in doing so, to map the commonalities of these case studies—in their reception, crisis discourse, and development—onto the different temporal sites of the early twentieth, mid-twentieth, and early twenty-first centuries.[52] This approach permits me to keep one eye on what is changing culturally and historically in the landscape of each case study, while keeping the other on the epistemological constants between them.

[52] Geert Lovink, *My First Recession: Critical Internet Cultures in Transition* (Rotterdam: Nai Publishers, 2004), 11.

Who are the Mechanics?

In the early nineteenth century, writing of the flute-playing automaton that delighted and baffled its audiences by playing simple tunes, Jean-Jacques Rousseau astutely observed, "It is not the automaton that plays the flute; it is the mechanic, who measured the wind and set the fingers in motion."[53] This argument was made centuries ago, and yet, critics and advocates have continued to clash over the potentially democratizing and detrimental impacts of automation technology, from mechanical music-making to holographic pop singers. For the case studies in this dissertation, my aim is not to attempt some type of assessment of the impact of automated music-making, but instead to ask, in each case: Who are the mechanics? And what is the significance of their music, produced through their chosen medium? In each instance, I will show that there is a great deal of creative human effort concealed behind an automation technology that only appears to dehumanize and neutralize music's expressive qualities. Each of my case studies encompasses a single iteration of the cyclical, mid-level timeline, in which we can see the progression from anxious reception of a new technology, through the process of users adapting the technology to suit their needs, to eventual acceptance and adoption in a stable form. Meanwhile, there is a larger story of musical democratization playing out on a slower-moving timeline behind these recurring trends. Across all of these stories, users engage with new automation technologies in a way that has gradually opened up space for greater amateur access to musical creation, from the addition of expression buttons on player pianos to the development of amateur music video software for Vocaloid fans. Automation, I argue, is not merely a poor substitute for live performance, but a tool with the potential to enable new and fascinating forms of music-making and amateur participation.

---

[53] Jean-Jacques Rousseau, "Essay on the Origin of Language," in *On the Origin of Language*, trans. John H. Moran and Alexander Gode (Chicago: University of Chicago Press, 1966), 62.

CHAPTER 1

The Player Piano: From Domestic Machine to Expressive Instrument

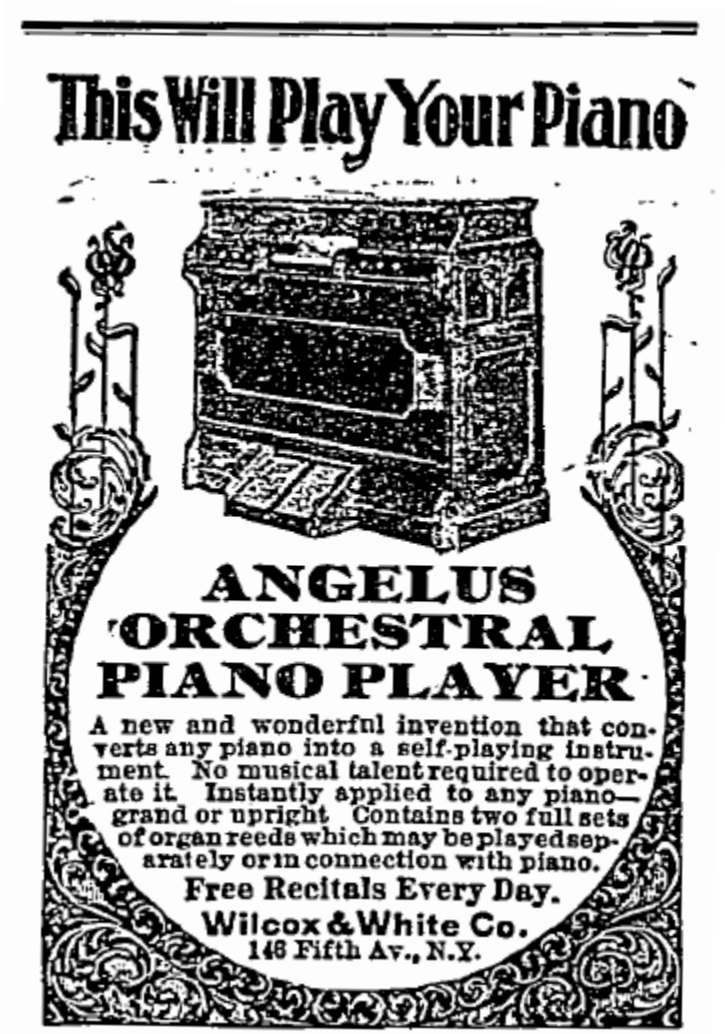


Figure 1-1: Advertisement for Angelus Orchestral Piano Player, Wilcox & White Co., *New York Times*, May 1, 1898, 20.

The first player piano advertisement printed in *The New York Times* appeared on May 1, 1898. The caption at the top of the ad which introduced this machine to the world proclaims, "This Will Play Your Piano" (Figure 1-1).[1] Beneath an illustration of a boxy device resembling a black cabinet, the advertisement describes the Angelus Orchestral Piano Player as "a new and

[1] Wilcox & White Co., Advertisement, *New York Times*, May 1, 1898, 20.

wonderful invention that converts any piano into a self-playing instrument. No musical talent required to operate it. Instantly applied to any piano–grand or upright." There is no piano depicted in this advertisement, nor is there a user shown operating the machine. The rectangular unit neatly conceals the mechanical action which promises to do the work of playing the piano. The bold caption "This Will Play Your Piano" seems to suggest that it will do so in the place of its owner.

For some readers, the offer of having a machine to play their piano for them may have been an attractive possibility. For others who already skillfully played their own piano, this may have sounded more like a threat. Rather than speaking to the concerns of people who would feel uncomfortable with this technology—a task later advertisements and other written accounts would undertake—the text of this ad focuses on the mechanical, "self-playing" nature of this technology.

Perhaps this focus on automation seems entirely unsurprising. After all, current representations of the player piano in popular culture still depict these machines in a similar way. Most recent representations either paint the device as something of a benign mechanical precursor to the jukebox, jauntily plunking out familiar tunes for listeners to enjoy, or else they play up the anxieties surrounding the dehumanized elements of automated music-making, thus framing the player piano's performance as a simulacrum of a human performance which is made unsettling by the absence of a human performer. In Kurt Vonnegut's dystopian novel *Player Piano* (1952), humanity's blind reliance on technologies of automation has ultimately resulted in a society in which human skills have become redundant, destroying quality of life and individuals' sense of purpose.

The popular HBO series *Westworld* frequently uses the player piano to underscore themes of automation, control, and repetition, featuring the instrument prominently in its opening credits. Inclusions of the player piano recur elsewhere in the series to serve as a reminder of the repetitive and inhuman nature of the preprogrammed environment. Executive producer Jonathan Nolan described the player piano that sits in Westworld's saloon as "a Rube Goldberg machine…created to evoke human emotion"—a "primordial" version of the show's automated humanoid hosts.[2] Similar to Westworld's hosts, the player piano is itself an automaton, with punched paper rolls serving as its programming. Historian David Suisman notes that, despite the fact that the player piano and the phonograph emerged side by side, the player piano has not aged well, and its historical significance has been largely forgotten.[3] Once considered to be equal in cultural and technological importance to the phonograph, the player piano's role in the history of mechanically reproduced music has faded almost to invisibility. The device is now left as a dusty mechanical curiosity with a split history, having been at times heralded as a democratizing force for the enjoyment of quality music, and elsewhere demonized as a threat to amateur music-making.

In this chapter, I examine discourses surrounding the player piano in its early years, tracking changing representations of this technology in print media including newspaper advertisements, journalism, music criticism, and instructional resources. Through glimpses of anxieties and dialogue about the player piano found in these sources, I trace shifts in rhetoric and public perception in order to demonstrate how the meaning of this device underwent a significant transition early in its history. I posit that the case study of the player piano at the turn of the

---

[2] Kim Renfro, "Here's why modern songs play on the saloon's piano in 'Westworld'," *Insider*, October 11, 2016, thisisinsider.com/westworld-piano-songs-2016-10.

[3] David Suisman, "Sound, Knowledge, and the 'Immanence of Human Failure': Rethinking Musical Mechanization through the Phonograph, the Player-Piano, and the Piano," *Social Text* 28 (Spring 2010): 13-14.

twentieth century is not an isolated case of shifting meaning. The player piano is one instance of a significant change in the function and purpose of a new automation technology in its early years. It also demonstrates the role musical amateurs play in this process through creative and expressive use. Examining the case of the player piano from these two perspectives will inform later case studies in this dissertation, and will also shed light on these processes as they play out in technologies outside of music.

One way in which we can piece together amateurs' differing conceptions of a product is by studying promotional literature that targeted the amateur consumer. Advertising copy can often be far-fetched and fantastical in its claims, and there are no guarantees that readers genuinely bought into the ideas fed to them by advertisers. Nevertheless, examining these documents serves as a valuable element of a historical study because the techniques and refrains of these persuasive documents reveal the way in which marketing staff imagined their readers, and how they hoped these potential customers would perceive their products. Advertisements also suggest what the mindsets of the advertisers may have been, and offer evidence of how the company may have perceived their product's place in the market. Player pianos were marketed continuously and aggressively, with hundreds or even thousands of ads appearing in North American newspapers each year from just before the turn of the century through the late 1920s. For a product as commercially successful as the player piano, ads are a central part of its history, because the varying approaches behind such materials reflect the changes in the player piano industry across these decades.

Advertisements from the end of the nineteenth century, such as the 1898 ad discussed above, focus on the machine's ability to automatically perform music on any piano. This commonality between early ads and today's concepts of the device as an automated machine

might seem to suggest that ideas about the player piano have remained stable since the introduction of this technology. However, drawing a straight line between notions of the player piano more than a century apart overlooks major shifts in the early twentieth century in which creative user involvement became an important part of the player piano's identity. By comparing the earliest player piano advertisements to those just a few years later, I show how later slogans and descriptions encouraged readers to purchase similar technology for entirely different reasons. Although the first advertisements assigned musical agency to the machine itself, and marketed the player piano as a device that performed the job of producing automated music, later ads used language that focused on the use of player pianos for personalized musical expression, and pitched the machine as a means to creative, individual artistry. Contemporaneous with these later ads, an increasing number of popular publications by and for amateur users sheds additional light on the player piano's use during the early twentieth century, and this writing shows which prominent advertising themes were accepted and incorporated into popular understanding of this technology. These shifts shed light on the reciprocal relationship between technological development in music and the effects of creative human use, particularly in the world of amateur music-making.

Why study amateur use? Many technological histories advance a narrative that links the stories of high-profile professional work with the history of a new technology. With the player piano, many scholars have written on composers' relationships with the instrument—including those of Conlon Nancarrow and Igor Stravinsky—but attention given to amateur users has been more infrequent.[4] And yet, amateurs were the primary users of both the player piano and the

[4] Authors who have examined Stravinsky's relationship with the player piano include Charles M. Joseph, *Stravinsky's Ballets* (New Haven: Yale University Press, 2011); Richard Taruskin, *Stravinsky and the Russian Traditions: A Biography of the Works through* Mavra (Berkeley: University of California Press, 1996); and Glenn Watkins, *Pyramids at the Louvre: Music, Culture, and Collage from Stravinsky to the Postmodernists* (Cambridge,

piano itself. During the nineteenth century, the piano had become an essential purchase for every family who had the means to afford one, and the instrument could be found in the parlour, salon, or living room of every home in which the family considered itself to be a part of the growing middle class.[5] Despite the ubiquity of the piano and amateur pianists at the turn of the twentieth century, hundreds of thousands of player pianos were sold, for use in domestic settings between 1900 and 1930. In the years following World War I, sales surged, with the number of units sold each year eventually surpassing that of traditional pianos.[6] How were these instruments marketed and sold to so many new customers, particularly when many of these customers already owned pianos? What needs were their manufacturers claiming they could fill? Was it the need for piano music on demand, or for something different?

Cultural historian Lynn Spigel's work on the early years of television's history traces a similar story, in which TV sets, initially viewed as an "alien contraption" that belonged in a futuristic home, became a fixture in the American family's living room.[7] By drawing together representations and debates found in popular sources such as newspapers and magazines, Spigel navigates a web of "interconnected texts" through which people were able to make sense of the arrival of a new object in their everyday lives. The ambivalence about which Spigel writes was

---

MA: Harvard University Press, 1994). Kyle Gann, *The Music of Conlon Nancarrow* (New York: Cambridge University Press, 1995) examines Nancarrow's works for player piano. Other scholarship which considers the player piano's amateur users includes Cecilia Björkén-Nyberg, *The Player Piano and the Edwardian Novel* (Burlington, VT: Ashgate, 2015), which discusses the relationship between music perception and player piano use as represented in the Edwardian novel; Mark Katz, "The Amateur in the Age of Mechanical Music," in *The Oxford Handbook of Sound Studies*, edited by Trevor Pinch and Karin Bijsterveld (New York: Oxford University Press, 2012), on mechanical music and the amateur user as co-performer; and Timothy Taylor, "The Commodification of Music at the Dawn of the Era of 'Mechanical Music,'" *Ethnomusicology* 51 (Spring/Summer 2007): 281-305, which examines the player piano as a commodity through which music itself ultimately became commodified.

[5] Arthur Loesser, *Men, Women, and Pianos* (New York: Simon and Schuster, 1954), 428.

[6] Cyril Ehrlich, *The Piano: A History* (New York: Oxford University Press, 1990), 134.

[7] Lynn Spigel, *Make Room for TV: Television and the Family Ideal in Postwar America* (Chicago: University of Chicago Press, 1992).

not unique to television. The history of new technologies is also a history of the hopes and fears that surrounded those technologies, and they way these attitudes shaped the meaning of new innovations. Spigel writes, "A mass medium develops in relation to its social context and…subjective responses to it can help create a milieu of ideas that help to shape its cultural form."[8] As it was with television, so it was with the player piano, when anxieties about the automation of musical expression clashed with the hopeful pursuit of a democratized musical future which the device offered. In this chapter, I examine the wide range of "subjective responses" to the player piano found in magazines, trade publications, and books, many of which are in dialogue with one another as the technology develops.

Rick Altman's term, "crisis historiography," describes this process of examining the shifting functions of a technology as it is shaped by users' perceptions and practices during the technology's early years.[9] As I will apply it here, crisis historiography is an examination of a time of "identity crisis" in which a new technology is defined by its relationship to a group of earlier technologies, at the same time as it also transforms the earlier technologies to which it is compared. The player piano was most obviously discussed in relation to the piano, but I also show how it was considered on similar terms as devices such as sewing machines and washing machines. Media scholars Lisa Gitelman and Geoffrey B. Pingree have advocated for the contextualization of historical media within their original matrices of meaning, examining them not as "old media" from our perspective in today's world, but as "new media" within the context in which they were once new.[10] Both this approach and Altman's ask us to consider the narrative

[8] Ibid., 10.
[9] Rick Altman, "Crisis Historiography," in *Silent Film Sound* (New York: Columbia University Press, 2004), 15-26.
[10] Lisa Gitelman and Geoffrey Pingree, "What's New About New Media?" in *New Media, 1740-1915* (Cambridge, MA: MIT Press, 2003), xi-xxi.

that underpins the gradual solidification of new uses, features, and meanings around a technology, including those with which it was not initially associated.

In the case of the player piano, there was no immediate consensus on what the device was supposed to do, and for whom it was supposed to do it. Advertisements offer us a window into the earlier parts of this period of potential and transition by suggesting multiple possible futures for the player piano (such as a fully automated labour-saving device which could provide entertainment, a shortcut for those who wanted to learn to play the piano, or a tool for educating people in matters of musical taste) and by addressing some of the anxieties and needs that companies perceived in potential buyers. When it comes to advertisements for player pianos from the late nineteenth and early twentieth centuries, we have thousands to consider. Competing player piano companies advertised their products constantly, contrasting their latest advances with those of their competitors, striving to set themselves apart by highlighting the features they believed potential buyers would be most interested in, acquiring testimonials from famous pianists, and employing imagery that would appeal to their customers.

The term "player piano" as we use it today often serves as a catch-all term to refer to three different categories of machines. In the late nineteenth and early twentieth centuries, each of these types of devices was referred to by its own name, and each category was understood as a product that performed a distinct function. The earliest of the three terms for automatic player devices was the "piano-player," as seen in the advertisement considered earlier. The piano-player was joined in the twentieth century by the "player piano," and finally by the "reproducing piano" which entered the market shortly afterwards. All of these machines operate using piano rolls—perforated sheets of paper which encode the information needed for playback in hole punches

which correspond to each key strike—and all three types are used to perform piano music. Beyond this basic similarity, however, each machine is distinct in its form and function.

From the late 1890s through the early 1900s, the Angelus Orchestral Piano Player and machines like it were sold separately from the pianos they played. Since they were not built into a piano cabinet and could be rolled up to any keyboard, they could indeed play "your" piano, as the ads claimed. At the time, these machines were called "piano-players." This term accurately described the function of this device. With its mechanisms enclosed in a wooden cabinet approximately the same height as a piano keyboard, the piano-player could sit directly in front of any piano, occupying the space which a human pianist's body would ordinarily occupy. In this position, a set of horizontal wooden fingers extended over the piano keyboard, in the same space in which a human performer's hands would be, with one finger above each key. With the piano-player set up in this way, the user would then seat herself behind the device and pump two foot pedals in order to power it. The term "piano-player," then, did not identify the human user, but the purpose of the device which acted on, or "played" a piano.[11] In many ways, the mechanical piano-player replaced the human piano-player's body when it sat in the performer's place front of the keyboard and extended its own fingers over the keys.

Piano-players were marketed as automatic and self-playing devices, but they were in fact far from it. Although the user did not need to supply any pianistic technique at the keyboard when operating a piano-player, he or she was still able to make decisions regarding important musical elements of the performance. The user's hands operated a series of levers which controlled the tempo, the balance between treble and bass, and the damper and soft pedals on the

[11] Calling this device the "piano-player" places it in the company of other technologies which were named after the people who originally performed the same task, such as dishwashers, governors, and computers. In this context, it becomes especially significant that the "piano-player" label was succeeded by "player piano."

piano. The feet, meanwhile, not only provided power, but by varying the strength and depth of each stroke on the pedals, controlled the phrasing, touch, and accentuation of a performance. Unskilled pedalling would result in a performance that sounded considerably worse than expressionless playback. Coaxing a satisfactory performance out of a piano-player with all of its levers and pedals required practice and musicality. An excerpt from a comic poem penned in 1919 captures the agony of listening to a poorly operated device from a neighbouring apartment:

> "Yea, bitterly cuss the sarcophagus ghoul
> Who chauffeurs with murderous fin
> Insane permutations of sad syncopations
> Accented, I'd say, on the 'sin.'"[12]

Given the poorly accented syncopations and varying permutations in this overheard performance, it seems the user in question lacked proper pedalling technique.

The second category of instruments, player pianos, were sold alongside piano-players from the late 1890s, and began gaining popularity in the early 1900s. Because these all-in-one devices were self-contained instruments, with built-in player mechanisms included inside the body of the piano, the term "piano-player" made less sense. These were not machines that acted on any piano in front of them. They were, in effect, pianos that played themselves, and so these instruments became known as player pianos. The only significant change in these instruments was the location of the player mechanisms. Player pianos required the exact same technique and skills as piano-players. They were still powered by foot pedals, and users still controlled their own dynamics and tempo with hand-levers and pedalling technique, for better or for worse. By 1905, player pianos had exceeded piano-players in popularity, owing to the convenience of

[12] J. P. McEvoy, "The Player-Piano Upstairs" in *Slams of Life, with Malice for All and Charity Toward None* (Chicago: P. F. Volland Company, 1919), 22.

having the option to play by hand or use the player mechanism without rolling a cumbersome machine up to or away from the piano keyboard.[13]

The difference in name between piano-players and player pianos is not trivial, because it describes not just a change in the mechanical setup, but also the way in which the instrument was perceived. In the earlier term, "piano-player," the word "player" is the noun, and the entire term "piano-player" identifies the actions carried out by the machine itself. In other words, the piano-player is something that plays the piano. In "player piano," on the other hand, the word "player" has now become an adjective that merely describes a type of piano. This shift subtly strips away the agency which earlier ads had attempted to confer on the instrument, assigning the control and authority in the performance instead to the human who is playing the player piano. As the meaning of this technology was cemented across this transition, it became increasingly clear that the device's primary function was not that of a labour-saving tool meant to replace a human, and both the new configuration and the new name stuck.

In 1905, the German instrument-building company M. Welte und Söhne became the first to begin marketing a new innovation, which they called the reproducing piano. The reproducing piano differed significantly from the piano-player and the player piano in its usage and purpose, and the messages of its promotional material were distinct as well. These instruments—unlike their pedal-powered, user-controlled predecessors—were built to automatically reproduce the exact musical details of a particular human performance by a famous artist. They were electrically powered and did not require any informed or practised engagement from their owner. Piano rolls for reproducing pianos had indications for dynamics and tempo changes punched directly into them, and these elements of the performance were automated during playback as

[13] Harvey Roehl, *Player Piano Treasury*, 2nd edition (New York: The Vestal Press, 1973), 12.

well. Their operation was controlled by a suction pump that allowed for instantaneous and perfectly steady playback with flip of a switch. Advertisements claimed that these instruments reproduced "the playing of the masters *at their best.* No subtle tone is lost; no shade of feeling unexpressed."[14]

During the player piano's heyday, reproducing pianos were a costly luxury item which never exceeded ten percent of piano sales in the U.S.[15] And yet, the reproducing piano, now often simply but inaccurately called a player piano, is the type of player instrument most commonly depicted in literature, film, and television, owing to the eerie allure of the performer-less performance. The fully automated reproducing piano will be the focus of Chapter 2 of this dissertation, while the current chapter deals primarily with the piano-player and the player piano.

Early Advertisements

Having detailed the differences between these three types of machines, I will turn to an examination of the discussions around them in print media, and the advertising techniques that were used to promote them, beginning with the early ads that were used to market the piano-player. In order to do so, rather than seeking out select advertisements which support one particular argument (with thousands to choose from, it could be possible to find ads to support any claim), I have chosen to focus on a coherent set that can be adequately evaluated and summarized. The table below provides the date of the earliest advertisement found in each of twenty-two newspapers in the U.S. The table lists the earliest ad by each company marketing piano-player devices in 1898—the first year such ads were included (Table 1-1). This set does

[14] Hardman, Peck & Co., Advertisement, *New York Times*, October 11, 1925, RPA6.
[15] Ehrlich, *The Piano*, 136.

not include subsequent ads printed in the same paper by the same company. As the year wore on, the number of ads appearing in newspapers each week increased substantially, since many of them were run repeatedly after their first appearance, bringing the total number of ads published in 1898 much higher than the initial number included in the table below. There are only eleven advertisements from 1898 that count as a given company's first advertisement in a particular newspaper, and only two companies advertising at this point in time. In the following year, however, this number multiplied many times over, as companies undertook increasingly aggressive marketing campaigns in a battle to define these new instruments on their own terms, and as new companies entered the market with their own devices.

Date	**Newspaper**	**Instrument**	**Company**
March 17, 1898	*Chicago Daily Tribune*	Angelus	Wilcox & White
May 1, 1898	*New York Times*	Angelus	Wilcox & White
May 27, 1898	*Cincinnati Enquirer*	Angelus	Wilcox & White
August 9, 1898	*The Minneapolis Tribune*	Angelus	Wilcox & White
October 2, 1898	*Boston Daily Globe*	Pianola	Aeolian
October 8, 1898	*New York Tribune*	Pianola	Aeolian
November 17, 1898	*The Hartford Courant*	Angelus	Wilcox & White
November 20, 1898	*Los Angeles Times*	Pianola	Aeolian
November 23, 1898	*New York Times*	Pianola	Aeolian
November 27, 1898	*Detroit Free Press*	Pianola, Aeriol	Aeolian
December 13, 1898	*The Washington Post*	Angelus	Wilcox & White

Table 1-1: First appearances of advertisements by companies in 1898.

This data set from 1898 shows that Wilcox & White was the first by several months to begin advertising their device, running an ad for the Angelus Orchestral Piano Player across a number of different newspapers beginning in March, with no competition from the Aeolian Company until much later in 1898. In October, Aeolian began to advertise the Pianola as well, although companies chose different newspapers for their ads. The *New York Times* is the only publication that advertised both devices in 1898. The themes of automation and ease of use found in the *New York Times* ad for the Angelus examined at the beginning of this chapter are common to nearly all of the ads in the above table. A Pianola ad from October 2 states, "when placed before any kind of a piano, [the Pianola] will play it with humanlike effects, rivalling the performance of a great pianist."[16] Like this one, most early advertisements attributed the act of creating a musical performance to the machine itself, rather than its human operator. An 1898 ad for the Pianola claims, "Half the pianos in existence are not played at all, or very seldom—because there is nobody to play them. The Pianola supplies the players."[17] The difference between the claims of "*This* will play your piano" of the earliest ads and the idea that "*You* can play your piano" which will be shown in later ads is crucial. A lengthier ad for the Angelus from 1899 explains, "It not only plays the piano perfectly, with all the touch and technique of the artistic musician, but it is also a Symphony (or self-playing organ), and can be instantly played as such when in ANY PART of the home….It plays any class of music you wish."[18] A human operator still needed to sit in front of this device and, at the very least, pump the pedals to enable it to play. However, these advertisements assign musical agency to the machine, using "it" as the subject of the sentences, and not to its potential buyer or user, "you."

---

[16] Aeolian Company, Advertisement, *Boston Daily Globe*, October 2, 1898, 31.
[17] Aeolian Company, Advertisement, *New York Tribune*, December 11, 1898, B1.
[18] John M. Gallup & Co., Advertisement, *The Hartford Courant*, June 5, 1899, 10.

Unfortunately for those enthusiastic users who purchased piano-players believing the claims that the machine would instantly enable them to create quality musical performances, piano-players required practice. As the comic poem excerpted earlier suggests, pedal-pumping was the bare minimum a user could do, and this nominal type of involvement could produce rather unsatisfactory results. I have personally had opportunities to attempt to pedal through a roll on a piano-player, and it never fails to surprise me how much physical exertion is required to power the device, and how absolutely terrible the resulting music sounds. Considering the importance of practicing at this machine, it is surprising that among the 1898 ads for the piano-player included in the table above, there are only a couple of acknowledgments of any time and effort that may be required to learn to operate it well. These instances are brief, and they assure the reader that anyone may acquire these skills: "A person who…never touched the keys of a piano in his life, can, in a few minutes…play upon the piano, with technical accuracy, any piece of music written for it." This ad for the Pianola also notes (almost like a "results not typical" disclaimer) that "a little practice is required in order to obtain the best results."[19] At this point in time, when this new technology was being sold as "automatic," mentioning a practice requirement would have been counter-productive.

Advertisements for the Pianola focus on features similar to those for the Angelus, positioning the Pianola as a competent machine performer. Occasionally, they also go one step further, suggesting that the mechanical performance might even be superior to a human performance. The first Pianola advertisement to run in the *New York Times* claims: "It gives the most marvelous reproductions of solo playing, but it does not stop there. It will execute things which no performer could dream of executing. Many of these effects the human performer would

[19] Aeolian Company, Advertisement, *New York* Tribune, October 30, 1898, B3.

like to produce if he could. In some respects, therefore, its feats are in the direction of ideal music. It has further powers and possibilities hardly yet suspected."[20] Here again, it is not the user who executes these spectacular feats, but the machine. The writers of this ad notably chose to describe the capabilities of the Pianola in only the vaguest of terms. What, exactly, were these things which the human performers wished they could execute? By leaving the details to the imagination of a reader who likely had no experience with this brand-new technology, the device could take on a larger-than-life quality. This tactic was especially important given the technology's "identity crisis" at the time. The piano-player itself did not yet have established patterns of use, or established purposes in music performance. Was it meant to instantly provide tasteful music when entertaining guests? Or offer a satisfying, private music experience? Was it simply amusing or educational, or was it intended to replace human pianists?

At this point, in 1898, most advertisements still described piano-players as "automatic attachments" and "self-playing instruments," categorizing them with earlier automated instruments such as music boxes and player organs.[21] In spite of these depictions, the fact remained that piano-players still required a user's involvement, and some practiced skill. The vague language of automation, superhuman feats, and ideal music used in these advertisements seems to purposefully conceal both the mechanical processes inside the piano-player which produce these performances, and the human input required. In accepting the input of the paper piano roll and power from the pedals, and putting out mechanically produced sound, the boxy,

[20] Aeolian Company, Advertisement, *New York Times*, November 23, 1898, 2.
[21] Wilcox & White Co., Advertisement, *The Washington* Post, December 13, 1898, 7; F. J. Schwanovsky, Advertisement, *Detroit Free Press*, December 11, 1898, A1.

black cabinet of the piano-player is both a literal and metaphorical "black box" that hides its own processes from its user.[22]

Carolyn Abbate has detailed a gradual shift in public attitudes towards automata across the eighteenth and nineteenth centuries, arguing that while the eighteenth century was a golden era for mechanical automata during which the nobility delighted in the devices, this attitude changed during the nineteenth century, when literature reveals a growing fear that the eventual perfection of these machines had the potential to rob humanity of the uniqueness of its abilities.[23] Describing the state of attitudes towards musical automation technology at the start of the twentieth century, Abbate writes, "By 1900 marionettes and automata, vast music boxes, and music machines with their phantom hands, are all Janus-faced, both magical and terrible."[24] This two-century-long story of progressive disillusionment and growing feelings of horror towards automated devices drops us off at the doorstep of the player piano's history. If Abbate's timeline is accurate, then potential piano-player buyers ought also to have been unsettled by the unnatural precision of these machines, especially given the focus placed on their automated nature and their supposed potential to out-perform a human pianist.

One of the best sources to shed light on the piano-player's place in the history of technological anxiety is found in these earliest advertisements, which were tasked with introducing the piano-player to people who may have been sceptical of player devices in the context of fears about automation. Returning to the advertisements from 1898, the first of many

---

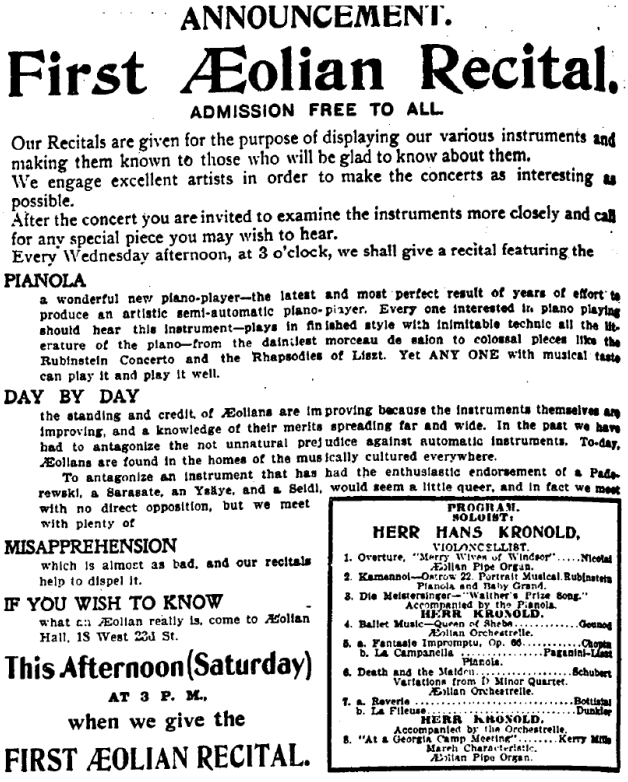
[22] Philipp von Hilgers, "The History of the Black Box: The Clash of a Thing and Its Concept," *Cultural Politics* 7 (2011): 41-58, has traced the origins of the "black box" back to the Second World War, making an application of the term to the piano-player somewhat anachronistic, but still constructive. For further discussion of the "black box" from the perspective of the social construction of technology, see Langdon Winner, "Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology," *Science, Technology, & Human Values* 18 (1993): 362-78.

[23] Carolyn Abbate, "Outside Ravel's Tomb," *Journal of the American Musicological Society* 52 (1999): 476.

[24] Ibid., 497.

ads for the Pianola found in the *New York Tribune* takes a direct approach to address this exact concern.

The advertisement (Figure 1-2), which promotes a concert featuring the Pianola as well as an Aeolian pipe organ, does not make lofty claims about performances that exceed human capabilities. It briefly introduces the concert, scheduled for that same afternoon at 3 o'clock, and then introduces the Pianola itself, not as a mysterious and all-powerful mechanical wonder, and not even as something that was entirely unique. The Pianola is described as "a wonderful new piano-player" which "every one interested in piano playing should hear."[25] The main claim in this ad's description is that the Pianola "plays in finished style with inimitable technic all the literature of the piano—from the daintiest morceau de salon to colossal pieces like the Rubinstein Concerto and the Rhapsodies of Liszt." Thus far, this advertisement is fairly typical of much of



ANNOUNCEMENT.

First Æolian Recital.

ADMISSION FREE TO ALL.

Our Recitals are given for the purpose of displaying our various instruments and making them known to those who will be glad to know about them.
We engage excellent artists in order to make the concerts as interesting as possible.
After the concert you are invited to examine the instruments more closely and call for any special piece you may wish to hear.
Every Wednesday afternoon, at 3 o'clock, we shall give a recital featuring the

PIANOLA

a wonderful new piano-player—the latest and most perfect result of years of effort to produce an artistic semi-automatic piano-player. Every one interested in piano playing should hear this instrument—plays in finished style with inimitable technic all the literature of the piano—from the daintiest morceau de salon to colossal pieces like the Rubinstein Concerto and the Rhapsodies of Liszt. Yet ANY ONE with musical taste can play it and play it well.

DAY BY DAY

the standing and credit of Æolians are improving because the instruments themselves are improving, and a knowledge of their merits spreading far and wide. In the past we have had to antagonize the not unnatural prejudice against automatic instruments. To-day, Æolians are found in the homes of the musically cultured everywhere.

To antagonize an instrument that has had the enthusiastic endorsement of a Paderewski, a Sarasate, an Ysaye, and a Seidl, would seem a little queer, and in fact we meet with no direct opposition, but we meet with plenty of

MISAPPREHENSION

which is almost as bad, and our recitals help to dispel it.

IF YOU WISH TO KNOW

what an Æolian really is, come to Æolian Hall, 18 West 23d St.

This Afternoon (Saturday)

AT 3 P. M.,

when we give the

FIRST ÆOLIAN RECITAL.

PROGRAM.
SOLOIST:
HERR HANS KRONOLD,
VIOLONCELLIST.

1. Overture, "Merry Wives of Windsor".....Nicolai
Æolian Pipe Organ.
2. Kamennoi—Ostrow 22. Portrait Musical.Rubinstein
Pianola and Baby Grand.
3. Die Meistersinger—"Walther's Prize Song."
Accompanied by the Pianola.
HERR KRONOLD.
4. Ballet Music—Queen of Sheba.....Gounod
Æolian Orchestrelle.
5. a. Fantasie Impromptu, Op. 66.....Chopin
b. La Campanella.....Paganini-Liszt
Pianola.
6. Death and the Maiden.....Schubert
Variations from D Minor Quartet.
Æolian Orchestrelle.
7. a. Reverie.....Bottisini
b. La Fileuse.....Dunkler
HERR KRONOLD.
Accompanied by the Orchestrelle.
8. "At a Georgia Camp Meeting".....Kerry Mills
March Characteristic.
Æolian Pipe Organ.

Figure 1-2: Aeolian recital advertisement, *New York Tribune*, October 8, 1898, 2.

[25] Aeolian Company, Advertisement, *New York Tribune*, October 8, 1898, 2.

the promotional writing for the many concerts that featured new player instruments during the late nineteenth and early twentieth centuries. It touts the excellent technique with which the Pianola plays, but it also still attributes the work of the performance to the machine. The largest block of text in this advertisement, however, does something unique: the Aeolian Company chose to use a significant amount of paid space to directly address the anxieties and opposition of their readers to automatic instruments. This portion of the advertisement reads:

> DAY BY DAY the standing and credit of Aeolians are improving because the instruments themselves are improving, and a knowledge of their merits spreading far and wide. In the past we have had to antagonize the not unnatural prejudice against automatic instruments…. To antagonize an instrument that has had the enthusiastic endorsement of a Paderewski, a Sarasate, an Ysaye, and a Seldi, would seem a little queer, and in fact we meet with no direct opposition, but we meet with plenty of MISAPPREHENSION which is almost as bad, and our recitals help to dispel it.[26]

The writers of this ad certainly had no doubts that such prejudices did in fact exist, since, if this had not been the case, mentioning them would have been highly counterproductive. The use of all caps for "MISAPPREHENSION" quickly draws the reader's eye to a word with strong negative connotations. Choosing a word as unsettling as this to serve as a focal point for an advertisement is unusual, but it would not have been selected were it not responding to genuine anxiety. While the writers acknowledge that many people felt misapprehension towards automated devices such as these, by the Aeolian Company's logic, if experts such as the great performers of the day were endorsing this instrument, then any amateur who didn't do the same was being unreasonable.

From the first Angelus advertisements' boasts of "no musical talent required to operate it" and "converts any piano into a self-playing instrument," it is quickly apparent that these advertisements were not intended to catch the eye of readers who already played their own

[26] Ibid.

pianos with dedication and enthusiasm—readers who already possessed pianistic skills likely considered the device to be a threat to the tradition of practice and performance at the keyboard. Some of these hesitant or antagonistic initial reactions to the piano-player are captured in music periodicals and trade publications from the early 1900s. One such contributor, who chose to be named only as "Anti-Pianola," complains:

> I naturally feel a little jealous, being a pianoforte player myself, in listening to what appears to be a fine performance of a classical piece by a person with musical feeling, but who cannot even play a hymn tune; whereas I have spent so much time and trouble in acquiring a technique much inferior in quality and dexterity to that displayed by the above named instrument.[27]

For Anti-Pianola, the piano-player provided an unfair shortcut to users who did not actually possess the musical skills the device appeared to confer on them. Apart from this question of fairness to pianists who had studied for years, other writers were asking whether the ability to bypass traditional study and practice was actually beneficial. One writer for *The Musical Times* offered an analogy, noting that mountain travel had the potential to improve people's mental and physical health, but that they may not reap the same benefits if they were taken to the top of the mountain by a flying machine or some other "expeditious motor-power."[28] The author argues that only people who travel slowly and use good observation skills can fully appreciate the mountain experience, and in the same way, only pianists who have practised enough to become familiar with all the details of the music they are learning can enjoy it thoroughly.

In contrast to these cautionary essays, other authors penned observations and reviews that were enthusiastically optimistic, especially regarding the advantage this offered to those who, as Anti-Pianola put it, could not even play a hymn tune. The text of the piano-player ads discussed

---

[27] Anti-Pianola, "Mechanical Pianoforte Players," *Musical Opinion & Music Trade Review* 25, no. 290 (Nov. 1901): 101.

[28] William H. Cummings, "Mechanical Music," *The Musical Times* 46, no. 744 (Feb. 1905): 93-4.

above suggests that the piano in the home of a potential customer was likely standing silent and unused, and for readers whose families did not include someone with skills at the piano, a device that facilitated quality music in spite of an absence of talent was perhaps very appealing.

An article on piano-players written in 1905 by H. J. Eilers clarifies its updated use of terminology at its outset: "In considering this subject, I assume that it has been the intention of our highly esteemed executive committee to have the term 'piano player' accepted in its up-to-date trade sense,—that is, as meaning the machine or instrument by means of which it is possible for any one (even though he knew nothing of matters musical) to play the piano."[29] The new, mechanical piano-players, Eilers explains, were remedying the shortage of trained pianists, a problem which had resulted in "thousands upon thousands" of pianos standing silent or "dead." In explaining the reason for these pianos that had fallen into disuse, a different author, writing in *Musical Opinion & Music Trade Review* in 1903, noted that Americans simply had no time to master the complexities of piano technique.[30] This same author wrote effusively of the piano-player's potential:

> The increasing vogue of the piano player is causing widespread comment, not only in musical circles but in the private homes of American citizens who possess no musical education. This vogue is now regarded—and rightly regarded—as one of the most significant phases in the life and advancement of this mechanical age. It is heralded by the enthusiastic as a portent of the dawning of a new epoch, when machinery will still be the motive power of civilization, but will be applied to uses hitherto deemed sacred from its invading banners.…If this vision is to be realised, the piano player will certainly be the most prominent factor in its accomplishment.[31]

[29] H. J. Eilers, "Piano Players & Piano Sales," *Musical Opinion & Music Trade Review* 28, no. 335 (Aug. 1905): 827-8.
[30] "The Piano Player Vogue," *Musical Opinion & Music Trade Review* 26, no. 304 (Jan. 1903): 309.
[31] Ibid.

Although some writers from this time period did view the piano-player as a threat, articles such as these suggest the presence of a strong curiosity and optimism as well, especially for those who had never learned to play the piano themselves.

The themes and emphases of the 1898 ads extended into 1899 and the early 1900s. An ad for the Angelus that ran in 1899 reads, "It…plays the piano perfectly, with all the touch and technique of an artistic musician."[32] Here again, the human user is not the one who plays the piano perfectly; the device does. Promotional material for a free Pianola recital offered in November 1899 introduces the device by making a similar claim: "The Pianola is a piano-player, which has been perfected so that it has become a satisfactory substitute for the human performer."[33] In these advertisements, not only is the piano-player occupying the physical space a pianist's body and hands would normally occupy, as discussed earlier, but the piano-player is now said to perform the same function as a human performer. Neither of these advertisements are saying that an untrained musician using a Pianola can perform like a trained musician. There is no agency assigned here to the human actually using the Pianola. Rather, the claim is that the Pianola, which Aeolian is depicting as a mechanical performer, is an adequate replacement for the human performer.

This substitution, and the transferral of agency from human to machine is made explicit in a short promotional piece for a concert in 1904. The concert was to feature the Triumph Piano Player, at which a user would perform several works alongside other instrumentalists:

> A grand concert is to be given by the Triumph player in St. James's Hall on March 11th. The Triumph will accompany Mr. Ben Davis, Miss Elizabeth Parkins, Miss Margaret Thomas, and Földesy. The Triumph and Ashton's selected orchestra will perform the complete Mendelssohn Concerto in G minor (Op. 25). The principle [sic] features in this player—which make it possible to undertake a task like this—are flexible aluminium

[32] Wilcox & White Co., Advertisement, *Cincinnati Enquirer*, February 19, 1899, 12.
[33] Aeolian Company, Advertisement, *New York Tribune*, November 9, 1899, 10.

> fingers (which give a touch exactly like the human hand) and the direct stroke from the pedals (which enables instant accentuation of notes or chords).[34]

The language used here is striking: this concert was not being given by a group of human musicians, it was said it would be given "by the Triumph player." The machine itself would be performing Mendelssohn, and it, and it alone, would be accompanying the other musicians. Of course, the unstated fact in the matter is that an unnamed, unmentioned human user would have been operating the Triumph. We know this for certain, since the Triumph is specifically described as having pedals that enabled the user to instantly accentuate certain notes or chords. But the individual performing on the Triumph at this concert received no credit for this effort, even though it would have been a considerable effort, indeed, that required both musicianship and practice. Of course, this write-up was promoting the Triumph, and it is therefore reasonable for the writer to have kept the focus on the machine, but if this concert and this article were helping to sell piano-players, it had nothing to do with the machine giving its user the ability to perform artistic and individualized music, and everything to do with mechanical automation replacing the musician.

The Triumph concert was not unique. In the advertisement included above (Figure 1-2) for the "First Aeolian Recital," beneath the bold title of "SOLOIST," a musician named Herr Hans Kronold is featured. But Kronold was not the performer at the Pianola. He was performing on the violin in just three of the ten pieces on the program. Kronold's human collaborator, seated behind the Pianola, is nameless. The performer responsible for the rest of the music on the program has been rendered invisible. The human piano player has been replaced by the mechanical piano-player. This is the most important idea behind much of the promotional

[34] "The Triumph Piano Player," *Musical Opinion & Music Trade Review*, 27, no. 318 (March 1904): 483.

material and articles, and the anxiety and excitement surrounding the piano-player in the late nineteenth and early twentieth centuries.

Changing Rhetoric

Taking a small set of the earliest advertisements and carefully examining their tactics establishes a baseline against which later advertising trends can be compared, during the time period when the piano-player and the player piano gradually became better recognized and understood in musical communities. Collectively, the 1898 ads offer a snapshot of the piano-player when its meaning was still nebulous, and when the device was mainly understood as an automatic instrument. Within a few short years of the advertisements examined thus far, two significant shifts took place. First of all, self-contained player pianos began to overtake the push-up piano-players in popularity. At the same time, advertisements and journalism began to use different language and persuasive tactics to sell player devices. The new rhetoric encouraged amateurs to use the emerging technology in increasingly artistic ways. This section explores the second of these two shifts.

The change in advertising focus is evident in the following player piano ad run by Kranich & Bach in 1912. The advertisement claims:

> Only the technique–the striking of the right notes at the right instant–is automatic. Every phase of musical-expression is under absolute *personal control of the performer*. And "expression" is what makes music–not technique… Among the many exclusive features of superiority, one of the most important is the TRI-MELODEME or TRIPLE SOLO device, which enables you *personally* to "bring out" the melody whether in the bass, tenor or treble, and subdue all else.[35]

[35] Kranich & Bach, Advertisement, *American Homes and Gardens*, September 1912, back cover.

This emphasis on personal expression and the downplaying of mechanical agency and automation is markedly different from the language used in the early advertisements for piano-players. The focus has now flipped from a foregrounded machine to a foregrounded musician.

An ad by Sohmer in 1913 provides a detailed illustration of this type of marketing, painting a fantastical picture of musical freedom, competence, and artistry for its readers. "On this new Sohmer Player Piano you can render artistically any music which appeals to you; you can interpret the world's choicest music to your own satisfaction."[36] Sohmer proceeds to describe the various expressive buttons available on their instrument, but, unlike early ads, is careful to prevent the focus of the advertisement from resting too long on the mechanical. In many later ads such as this one, the focus always returns to an idealized image of artistic expression and technical mastery. Beneath a heading which insists, "You PLAY the Sohmer Player Piano—You Don't Merely 'Operate' It," this same ad explains, "The expression devices of the Sohmer Player Piano are the opposite of mechanical. When you play the Sohmer Player Piano the expression and feeling in the music which you produce are your own – produced directly by yourself." Again, we see an emphatic insistence that player pianos are not allied with the "mechanical menace" that created so much anxiety around the turn of the twentieth century.

In the 1910s, even the people who were selling player instruments in person were encouraged to frame them carefully, and to downplay their mechanical nature. Lisa Gitelman has shown a similar persuasive trend in the guidelines and tips offered to player piano salesmen in trade publications from the 1910s. As Gitelman highlights, dealers were urged to avoid using words that brought machines to mind, focusing instead on artistic possibilities. A 1911 issue of the trade magazine *Player Piano* suggested:

---

[36] Sohmer & Co., Advertisement, *New York Times*, October 30, 1913, 18.

> As far as possible, the mind of the purchaser should be diverted from the idea that he is buying a piece of mechanism….The player piano should never be referred to as a 'machine'.…By the same token the player instrument should never be referred to as a 'self-player' or 'automatic'….Never use the word 'operator' when referring to one who uses or demonstrates a player piano. A person operates a sewing machine or a lathe…it requires intelligence and musical taste to play a player piano, and such a person is a 'performer' as much as one who uses the fingers.[37]

It is striking that the author here advises salesmen to avoid using words such as "self-player" and "automatic"—the exact same words that appeared so frequently in advertisements in 1898. Advertisers and salesmen in the 1910s were selling player pianos not as automated playback devices but as instruments that could facilitate satisfying and high-quality musical performances for people who lacked technical skills. Given the spike in player piano sales in the late 1910s and early 1920s, it is reasonable to conclude that these marketing tactics resonated with many buyers.[38]

Having examined the terminology and techniques used by advertisers, in the second half of this chapter, I will turn first to an examination of a different type of contemporary source: discussions of the player piano in books and periodicals. I will then conclude by situating the piano-player in the context of labour-saving appliances at the turn of the twentieth century. The new understanding of the player piano as an expressive instrument in its own right was advanced by a number of writers, especially in the 1910s and 1920s. One of the most well-known advocates was British musicologist and critic Ernest Newman. Perhaps best remembered for his four-

---

[37] "Player-Piano Nomenclature: Words to Use and Avoid," *Player Piano* 1, no. 5 (September 1911): 5-6.

[38] Advertisers would later find success in deploying similar appeals to taste and control to sell high-fidelity sound equipment in the 1950s (Keir Keightley, "'Turn It Down!' She Shrieked: Gender, Domestic Space, and High Fidelity, 1948-59," *Popular Music* 15 (1996): 149-77). Promotional materials for hi-fi stereo systems encouraged potential customers to think of themselves as being in control of powerful equipment through which they could enter into transportative musical experiences—not unlike the piano-player, with its promises of personal musical fulfillment.

volume work, *The Life of Richard Wagner*, which he spent fourteen years writing, Newman also penned a 187-page book titled *The Piano-Player and Its Music* in 1920.[39] This book was published as a part of a series called *The Musician's Handbooks*, which included other titles such as *The Complete Organist* and *Memorising Music*—titles that were clearly aimed at performing musicians, and not just people who were interested in automated playback on a machine. Given the educational nature of the other titles in the series, a reader might expect that *The Piano-Player and Its Music* would offer instructional content, but, perhaps surprisingly, Newman's contribution to the series does little in the way of teaching hopeful piano-player users how to make music with their device.

The books opens with a chapter titled, "A Defence of the Piano-Player." Certainly, *Memorising Music* does not begin with a chapter penned in defence of memorizing music, nor would most other books discussing any other instrument need to begin by asserting the validity of their subject matter. Newman admits early on that "for a musician to put in a plea for the piano-player in these days is to make a good many worthy people doubt his sanity or his honesty or both" (11). Newman wrote this comment, not in the late nineteenth century, when the device was still new and unknown, but in 1920, near the peak of the player piano's popularity. Newman later remarks that people had hinted he must have been paid by "the makers" to support the player piano (11). These comments confirm that there was still suspicion surrounding the device, and that the glowing reviews contributed by great pianists were not necessarily taken at face value by the public who read them. Newman argues that opposition towards the player piano came mostly from two categories of people: those who had never seen it working at its best when played by a skilled performer, and those who taught piano and were afraid for their jobs (13-14).

[39] Ernest Newman, *The Piano-Player and Its Music* (Edinburgh: Riverside Press, 1920).

In response to the naysayers who objected to the player-piano on the grounds that it produced "mechanical music," Newman asks, "Where, in truth, *is* the non-mechanical musical instrument?" Arguing that humanity has been gradually improving the quality of the mechanical components of their musical instruments ever since we moved beyond the unaccompanied use of the voice to perform music, Newman notes that this increase in mechanical quality has produced music of steadily increasing quality as well (16-18).

Responding to critics of the player piano who contended that "the performer has less to do with the making of the music than the hand-pianist has," (19) Newman argues that if player pianos were really nothing more than soulless, automated devices, then each piece played back by the player piano would be absolutely identical in sound to every other performance of it. Indeed, the fact that performances at the player piano vary greatly, the many different ways in which a performer can alter various dimensions of the playback on purpose or by accident, and even the very occurrence of terrible player piano performances rendered by instruments at the mercy of unskilled users all attest to the accuracy of Newman's point. (Newman states in chapter one that "there is as much difference between the performances of a good and of a bad performer on the piano-player as there is between the performances of pianists or violinists in general" (31).) This, however, does not fully address the original criticism: the argument that performers at the player piano have *less* to do with the music-making taking place. In further answer to this, Newman argues from a different angle, and contends that music-making and technique on a mechanical instrument are entirely separate matters (20). The time spent practicing mindless exercises to achieve strength and independence in the fingers does not train musicianship and artistic sensibility in the student. With a player piano, the need for manual keyboard skill can be

bypassed, and the user can make use of the mechanical assistance lightening the load of technique in order to have the freedom to apply their musicality to more complex musical works.

In these arguments by Newman, the player piano begins to sound less like automation technology and more like a simple mechanical addition to an already-mechanical instrument, with more in common with flute keys and pipe organ bellows than automatons and music boxes. When does a mechanical aid to a music-making process become categorized as automation? How much control does a user need to retain in a musical performance in order for the outcome to still be considered "human" music-making? Each of the case studies in this dissertation tests this question in a different way. The piano-player and the player piano, although they were initially framed in advertisements and other writings as "automatic," actually preserved a certain level of user control over the course of the performance. This control was gradually expanded as the technology improved, and the player piano was equipped with more buttons and levers that gave users the ability to shape the finer details of the piece, and to express their artistry without as much time spent on technique. In the early twentieth-century world of piano-players, player pianos, and reproducing pianos, it is not the former two instruments but the last of these three in which the user relinquishes the most control over the musical output. The reproducing piano—with its hefty price tag relegating it to the role of an expensive luxury item with only a tiny share of the market—will be considered in more detail in the next chapter, as a part of an examination of these instruments in public, outside of the family home.

Where Newman drew up short of providing practical training for hopeful player pianists, Sydney Grew's comprehensive instructional guide, *The Art of the Player-Piano: A Text-Book for Student and Teacher* continues, offering its readers a detailed method for practice. Published just two years later, in 1922, *The Art of the Player-Piano* spends more than three hundred pages

describing the finer points of player piano technique for those interested in acquiring the ability to skillfully deliver an individualized musical performance. The opening sentence of the book's preface states: "The Art of the Player-piano lies in the pedalling and in the use of Tempo-control Lever or Buttons."[40] For Grew, the use of the player piano is elevated from a mechanical exercise to an art form, not just through the use of the optional functions like voicing mechanisms, but through pedal use that is intentionally artistic, and sensitive tempo control use. Throughout this book, pedalling is clearly at the heart of player piano technique. This was not the conventional use of the piano's damper pedal, but the two large foot pedals on the player piano that controlled the bellows and influenced aspects such as volume and phrasing. Grew compares the manipulation of a player piano's pedals to the fundamentals of other musical skills: "Pedalling is as breathing in singing or fingering in pianoforte playing" (v).

Comparing the player piano to other musical instruments, Grew takes a similar approach to the sales tactics quoted by Gitelman, discussed earlier, in which representatives were urged to divert their customers' minds from the idea that the player mechanism was a machine. Grew attempts to convince his reader of the same separation between instrument and machine, explaining that "The player-piano, like the pianoforte and the organ, is a musical instrument; its control is an art, and the performer an artist….The instrument is to be stimulated, not driven. It is to be made to operate, not by crude physical force, but by movements induced by musical feeling and guided by musical knowledge" (1). Grew's book is divided into two sections, with the first focusing on comprehension of the basics of musical form and structure, the use of levers, and studies in counting. The second section, which occupies twice as many pages as the first, delves deeply into rhythmical pedalling and different prosodic meters.

---

[40] Sydney Grew, *The Art of the Player-Piano: A Textbook for Student and Teacher* (London: Kegan Paul, Trench, Trubner & Co. Ltd., 1922), v.

As a textbook, Grew's method integrates not only descriptive writing, but pieces "for close intellectual study," which he expects the reader to attend to with focus and persistence: "The intellectual effort required…is slightly less than that required in the study of instrumentation, canon, building construction, algebra, and so on; but it requires the same qualities and similar determination" (v-vi). Clearly, there is a sizeable gap between Grew's perspective, which groups player piano practice with architecture and algebra, and the early advertisements which claimed that anybody could seat themselves at a piano-player and be instantly and effortlessly able to produce great music. Grew outlines a specific method for studying the musical examples he provides. He suggests that students pedal through a piece twelve to fifteen times in order to familiarize themselves with it, and then attempt to reconstruct its form, rhythm, and patterns of accentuation from memory. This method is intended to facilitate total structural memorization of the work, in the same way someone reciting poetry would have a similar working knowledge of form, rhythm, and accentuation in a poem (v).

Grew notes that he assumes the student using his book has no ability to read music (vi). Whether this was because he hoped to start at a place that would be accessible to anyone picking up his book, or because he had evidence to suggest that there was little overlap between those who would learn to use the player piano and those who could read music, he does not indicate. But regardless of the absence of note-reading ability, Grew lays out a timeline for competence at the player-piano that is longer than one might expect after reading advertisements, but still faster than traditional instruments. While he claims it takes approximately seven years for someone to be considered a good pianist, organist, or singer (though he does not indicate where he obtained these numbers), for the player piano, Grew states, "I find it takes about three years to make a good player-pianist of a man or woman of average musical intelligence" (1). From the

perspective of a customer who purchased a player piano and expected to sit down and instantly and artistically be able to perform every piece they desired, three years might have sounded like an incredibly discouraging length of time. On the other hand, if the claims in textbooks such as Grew's and in later player piano advertisements were accurate, and player mechanisms could produce an expressive musician with no loss to quality of artistry, and do it in three years rather than seven, then what the player piano really offered its buyers was quicker and easier access to quality performance skills and listening enjoyment than the piano traditionally afforded.

According to Grew, the player-pianist would attain a level of basic skill with the pedals after approximately a month of effort, becoming proficient at pedalling easily and quietly, controlling dynamics, and altering the tempo with sensitivity. This, Grew notes, would enable them to "add warmth and personality to the performance" (2). What came next, if a player-pianist already possessed these skills? More sensitive pedalling. This, as textbooks and magazine columns tell their readers, was where the performer had the greatest control. According to Grew's book, a skilled pedaller could place a single pedal stroke at just the right moment, drawing on just the right amount of stored power, in order to shape the phrase exactly as desired. Good pedalling should be economical, delicate, and match the cadence of the piece (2). Grew describes the pedals of the player piano with almost reverent language, comparing them to the tools of skilled artists, and to delicate systems in a living body:

> The player-pianist caresses the pedals. He controls them as a driver controls high-spirited horses. He transmits to them the subtle spirit of the movement which music sets dancing through his soul. He employs them with the delicacy the sculptor employs his tools; he also hews with them, as the woodsman drives into the tree with his axe. He treats them as the conductor treats his baton, marking not only the beats, but the rhythm also, and effecting phrasing, tone contrast and quality, climax, and the thousand and one details of effect—objective and subjective—which go to the making of musical performance. The Pedals are as the centre of a nerve system, from which are radiated commands to every part of the instrument—the most delicately intimate, as well as broadest and most sweeping (7).

In Grew's language, the pedals themselves almost seem to become living beings, like horses that can be driven, or creatures to which a user can transmit the feelings that well up in his soul. "The player-piano is no dead mechanism," he admonishes his readers (10).

If we were to rely on advertisements alone for an understanding of the player piano, we might think that it was the various proprietary buttons and levers present on certain companies' instruments that enabled users to transmit their creativity into sound. The attention Grew devotes to the use of the pedals in his book is noteworthy because it underscores the fact that learning to play the player piano well was a long-term investment, and not simply a matter of purchasing a device that had certain novelty functions. Pedalling was a nuanced skill, and not simply a matter of applying more pressure right at the moment of a note or chord which the user intended to be louder. Grew narrates a new user's experience when encountering this lesson for the first time:

> In our first hours we meet with failure in the playing of loud full chords. The perforations stretch themselves across the roll, firm, solid, and temptingly emphatic. They promise good ringing tone and crashing climax. We watch the roll carefully and on the instant the perforations reach their slots, we deliver a powerful stroke. But the result is bad. The chord is born in weakness. It is supine, backboneless; and we realize that we have failed to command the situation (23).

This description stands in stark contrast with the advertisement depictions of new purchasers' instantaneous mastery of the player piano, and of young children at the pedals producing beautiful music.

Why did the large chord in Grew's description fall short, when the user delivered a powerful pedal-stroke on the relevant chord? It was because the user failed to build up enough pneumatic pressure in the instrument prior to the arrival of the chord. Grew refers to this pressure as "motive-power" in his textbook, and uses the metaphor of a springboard to help the reader to visualize its purpose (23). Stored motive-power acts as a springboard, serving to add power to

the leap, which in this case is a powerful chord stroke. Building up motive-power requires stronger pedal strokes, but this stored energy needs to be constantly monitored and balanced. Users must navigate the balance between having chords fail to sound, as in Grew's example, and having the pedals become impossible to pump. Grew notes, "The foundation of the art of player-pianism is establishing and maintaining elastic firmness in the pedals" (23). This middle ground would change throughout a piano roll, with sparse textures requiring very little power, and dense, chordal passages consuming far more. A skilled user would be aware of these shifts and adjust the strength of their pedalling accordingly, in addition to continuing to pedal appropriately for the rhythm, meter, and accentuation as needed. On top of all this, despite the task that pedalling definitely required a fair amount of athletic exertion, Grew admonishes his students not to overextend themselves: "Do not develop a heavy perspiration…if you sweat visibly or require to dry your face at the end of every movement, people will gradually realize that you lack…mental strength" (17). Note that Grew does not suggest that the perspiring user lacks leg strength. Taken in the context of his instructions to avoid overpedalling and creating a situation in which the pedals of the instrument become stiff, Grew is implying that it is the user's lack of sensitivity and balance that has created a situation in which he starts to perspire. Certainly, this was not a task that one could be expected to execute at once with any measure of skill.

If stronger pedalling is required to produce a stronger sound, and softer passages place less demand on the supply of motive-power, then moving gradually between louder and quieter passages can be accomplished by means of a gradual and controlled increase in pedalling strength. But for subito forte passages, additional controls are necessary to manage the supply of power. This is where control levers came into use for the experienced player-pianist. Control levers directly control the amount of "motive-power" that is delivered to the player mechanism.

If the control lever is activated, it cuts off the control the pedals have over the dynamic level, maintaining a uniform volume level regardless of what the pedals are doing. This enables users to continue playing at a pianissimo dynamic level, while storing motive-power to prepare for an upcoming fortissimo. The trade-off is that the user loses the ability to accentuate or otherwise shape the phrase using the pedals. For passages with a sudden and extended change in dynamic levels, however, the control lever is a valuable tool.

With so much nuance involved in the manipulation of the pedals and levers at the player piano, it was in fact far easier for a user to power through a virtuosic work with few dynamic gradations than to craft a sensitive interpretation of a more subtle work. Grew suggests that a competent player-pianist might even consider flashy pieces to be an embarrassing indulgence: "*Bravura* music is child's play for the player-pianist. It is so elementary a detail of his art that after a little while he is almost ashamed to be found indulging in it, and in the end he finds greater pride in ability to play a simple lyric like MacDowell's *To a Wild Rose* than in the ability to play brilliant passages like Liszt's *La Campanella*" (15). Certainly, a thoughtless, mechanical pedal-through of a piece that called for more sensitive use of the tempo lever in phrasing and rubato effects as well as more refined pedalling would have sounded far worse than a similar rendering of a denser piece at a faster tempo.

Evidence from periodicals in the 1920s suggests that some consumers who purchased player pianos did end up following advice like Grew's, and practising on their instruments enough to obtain satisfactory results. From May 1925 through January 1931, a column titled "Player-Piano Notes" was published in *The Musical Times*, providing readers with reviews of recently released player piano rolls. For the most part, the piano roll reviews read similarly to

today's album reviews, but one of the most unique elements of "Player-Piano Notes" is the focus on performance and practice suggestions for player pianists.

Regarding a roll containing Smetana's *Bohemian Dance*, reviewer William Delasaire writes:

> The principal subject rushes upwards with a fine thrill, and provides an excellent study in rhythmical pedalling. Such a passage naturally demands a *crescendo*, but an ear must be given to the intensity of this by those who wish to match their performance as nearly as possible with the original. Pneumatics can so easily do what human fingers—even though they be those of a Backhaus—cannot accomplish: *i.e.*, apply great power at speed.[41]

Each "Player-Piano Notes" column is packed with performance and practice advice on piano rolls of all types, from classical works to popular music and songs. These recommendations could easily have been penned, not for those using a player piano, but to advise pianists playing by hand using sheet music, as a later review illustrates: "Played inattentively it is dull, but with a proper rhythmic accent and observance of dynamic contrast it not only provides good practice, but is an excellent example of early sonata form."[42] The "Player-Piano Notes" column is important to an understanding of amateur use because it sheds light on which aspects of player piano practice users were thinking about as they sought to render their own interpretations. The author's remarks assume that some of his readers are in fact interested in devoting attention to a study of rhythmical pedalling, or heeding instructions to attend to the dynamic contrasts. Certainly, if this were not the case, the column would not have continued successfully for so many years. By this point in time, the player piano had firmly established itself, not as a mindless playback machine, but as an instrument in its own right that offered users the opportunity to

[41] William Delasaire, "Player-Piano Notes," *The Musical Times* 66 (July 1, 1925): 620-1.
[42] William Delasaire, "Player-Piano Notes," *The Musical Times* 66 (October 1, 1925): 918-9.

exercise their artistic imaginations and their manual dexterity in the production of musical performances.

First-hand accounts of users becoming acquainted with and practicing on their new player devices are rare, but one particularly detailed and passionate description of this process was penned by Bertram Smith in 1911.[43] Smith's report dates from slightly earlier than the sources discussed thus far, but it addresses the question of whether or not some users did actually dedicate the time necessary to master the pedals. Smith purchased a piano-player (he does not name which brand) for personal use in his drawing room, and, according to his story, spent his first two days shouting at it in frustration. At first, it seemed to him incapable of producing finer gradations of expression, and he was nearly prepared to throw it out, until his struggle gradually began to produce quality results. After much practice, Smith writes that he found his player to be "an ally of wide and splendid capabilities."[44] Unlike some of the promotional literature for the piano-player, Smith does not make grandiose claims about the device and its supposed abilities to perform at a level better than, or at least comparable to, the great pianists. In fact, he spends almost no time at all lingering on the details of the "splendid capabilities" of his device. His primary focus in his narrative is on the way in which the piano-player democratizes classical music—a domain which was previously inaccessible to amateurs without highly practiced musical skills.

Describing himself as someone who cannot perform on an instrument himself, but who is familiar with all of the Beethoven symphonies, and would recognize any Wagner leitmotif, Smith writes of his frustrations with the superficiality of concert attendance after ten years of "steady and consistent" presence at any performances he could attend.

---

[43] Bertram Smith, "The Piano-Player," *The Musical Times* 52 (May 1911): 308-9.
[44] Ibid., 309.

> For if one really comes to examine it the world's music has always been remote, locked up from the generality of mankind. I have been more assiduous than most in my pursuit of it. I have attended literally hundreds of concerts. I have armed myself with miniature scores, and richly annotated them in red ink….But what of the [Beethoven] Sonatas? I have heard perhaps—it is quite an outside estimate—a dozen of them….With the best will in the world, and without missing any reasonable opportunity, we may well go to our graves without having explored one quarter of our heritage.[45]

Smith was no casual attendee. And yet, even when music-lovers such as himself had the opportunity to attend concerts regularly, they could not hope to apprehend all of the nuance and meaning in a work on just one hearing. But for an audience in the early twentieth century, one hearing may in fact have been all they would ever be afforded. Smith asks, "What, for instance, can the amateur who has had no special study hope to make of a Liszt Pianoforte concerto at a first hearing, and when may he hope to hear it a second time? Surely that great art-work had something more than that to tell him?"[46]

For a work like a concerto or a symphony, Smith is not arguing that the piano-player can replicate the full grandeur and timbral complexity of an orchestral performance. Nor is he arguing that an amateur at a piano-player can produce an interpretation of a work on the level of a world-class artist or ensemble. Smith openly admits its deficiencies. He relates a story of a friend who refuses to listen to the machine, notes that a trained pianists' skilled hands and practiced intellect can produce results superior to any mechanical device, and that there is a significant amount of music that the player will never render in a truly pleasing manner. However, for owners who simply want a playback device that will produce adequate results, the piano-player was perfectly sufficient, and in some cases, perhaps even more desirable. "The great pianists," Smith explains, "are not *here*: nor any pianist. I do not want to have to put on my dress-clothes and go and sit in a draught whenever I listen to music. I want to remain at home

[45] Ibid.
[46] Ibid.

and take it at my leisure. And finally and above all there is the great fact of repertoire. With a few unplayable exceptions, all music is within my reach at last. It is *mine,* mine to explore and study and enjoy." This heartfelt defense of the piano-player succeeds in identifying the machine's shortcomings, while summing up its advantages, especially for users who cared to take the time to study pieces of music at their leisure, or who wished for an opportunity to encounter works they might never hear in a concert by a professional.

Smith's arguments have certain elements in common with the defense of the piano-player penned by Ernest Newman nine years later, as well as some important differences. Both writers discredit the idea often found in early advertisements that a piano-player could "automatically" produce satisfactory musical results with next to no effort and practice. Newman also concurs with Smith in affirming the piano-player's potential usefulness as a democratizing tool for the appreciation of classical music, explaining:

> Music in the schools would no longer be at the mercy of a teacher of limited technical attainments. A child in the remotest districts would be able to hear finer music and greater artists than was possible twenty years ago in most English large towns….a quarter of an hour of the piano-player each day would give him, in a few years, a repertory that his father could not have acquired in half-a-century.[47]

But while Smith depicts the piano-player primarily as a study aid that enables him to explore the classical repertory at his leisure, Newman's views align more with other writings and advertisements from later in the player piano's lifespan, presenting it as a musical instrument in its own right, but one which can elevate the performance capabilities of a musically sensitive user who is constrained by limited practise time.

[47] Ibid., 178-9.

The Piano-Player as a Labour-Saving Device

Thus far, this chapter has examined the shift in focus in advertisements and writings between 1898 and the late 1920s that show the evolution of the player piano's function and purpose. Chapter 2 will continue the story of the reproducing piano as it developed alongside the player piano. However, at the early end of the timeline covered in this chapter, the ads from 1898, with their distinctive emphases and repeated themes, seem almost to appear out of thin air. In what context was the piano-player originally developed and understood, and why did the earliest ads use the language they used? In the final section of this chapter, I will contextualize the earliest piano-players in relationship to household technologies just prior to the turn of the twentieth century.

In his work on the social construction of bicycle technology, Wiebe Bijker has demonstrated the extent to which the interpretation of technological devices is flexible.[48] Taking the development of the bicycle as a case study, Bijker examines the way in which social groups can attribute unique meanings to artifacts, arguing that technologies do not intrinsically possess fixed properties. Zack Furness has also used the bicycle as an example of a seemingly neutral technology being used as a political tool in different cultural and social contexts.[49] The player piano, too, has been intentionally framed and reframed to serve different ends and to situate it within certain cultural contexts. It is especially interesting that the advice given to player piano salesmen discussed earlier in this chapter specifically mentions that the player piano should never be compared to sewing machines and lathes. In fact, it was these very machines, among

[48] Wiebe E. Bijker, *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change* (Cambridge, MA: The MIT Press, 1995).
[49] Zack Furness, "Biketivism and Technology: Historical Reflections and Appropriations," *Social Epistemology* 19 (2005): 401-17.

others, that early piano-players, and even pianos themselves were frequently grouped with and considered alongside. In the nineteenth century, pianos as well as small, pedal-powered organs were increasingly found at the centre of domestic life.[50] Owning a keyboard instrument was a marker of social status, and daughters belonging to families which considered themselves to be at least middle class would have received instruction at the keyboard, preparing these young women to demonstrate the requisite skills of polite society.[51]

These instruments were extensively advertised and discussed in periodicals, circulars, and trade journals such as Britain's *The Musical Times* and the American publication, *The Musical Courier*. Before the latter journal adopted its more familiar title, however, it was published starting in 1880 under the name *Musical and Sewing Machine Gazette*, followed by a stint as the *Musical and Sewing Machine Courier*. Sewing machines were eventually dropped from the title, leaving the periodical with the musical focus it was later known for. Under its earlier titles, the publication ran advertisements from sewing machine companies including Singer Manufacturing Company alongside ads for piano companies such as Steinway & Sons, and published trade news on a variety of musical instruments and sewing machines. Part of the logic behind this pairing included a shift in the sewing machine's intended users towards the end of the nineteenth century. At the same time as the piano was becoming a fixture in the home, sewing machine companies were turning their attention from an exclusively industrial market to an inclusion of the domestic market. Companies were hoping to set up the sewing machine as an object of similar ubiquity and importance to the piano. During the latter half of the nineteenth century, sewing machines with detailed designs and cabinetwork were advertised especially for family

[50] Sondra Wieland Howe, "Music in the Private Sphere, Churches, and Community," in *Women Music Educators in the United States: A History* (Lanham, MD: Scarecrow Press, 2014), 51.
[51] Mary Burgan, "Heroines at the Piano: Women and Music in Nineteenth-Century Fiction," in *The Lost Chord: Essays on Victorian Music*, ed. Nicholas Temperley (Bloomington: Indiana University Press, 1989), 42.

use. Sewing-machine companies that had previously installed their products in industrial settings began to work to secure a foothold in the family home.[52]

Owing to the fact that pianos and sewing machines were marketed to the same demographic, for use in the same location, it made sense for salesmen to sell them together. Salesrooms in the late 1800s featured both sewing machines and keyboard instruments, and travelling salesmen hauled both products in their wagons between rural communities.[53] There were even devices that took this coupling one step further and combined both a reed organ and a sewing machine in a single cabinet. The instrument and the machine were both powered by foot pedal, and so the combination cabinet placed the pedal for each side by side, allowing the user to conveniently switch between the two functions.[54] This unusual device emphasized the connection between feminine skill at the keyboard and the use of the sewing machine as a similar domestic task, rather than an industrial activity. At this point in time, pairing the piano and the sewing machine strengthened the latter device's association with the home. In the section that follows, I will examine the way in which these same types of strategic connections contributed to early conceptions of the piano-player.

The piano was often grouped together with more domestic appliances than just sewing machines. Retail stores in the late nineteenth century also sold household technologies such as toasters, freezers, and wringing machines, alongside keyboard instruments.[55] Entire publications and exhibitions were dedicated to these types of household appliances. The *Journal of Domestic*

---

[52] Ross Thomson, *The Path to Mechanized Shoe Production in the United States* (Chapel Hill: University of North Carolina Press, 1989), 102.
[53] Howe, *Women Music Educators*, 51.
[54] Thomson, *Mechanized Shoe Production*, 102; Howe, *Women Music Educators*, 51.
[55] Leslie C. Gay, Jr., "Before the Deluge: The Technoculture of Song-Sheet Publishing Viewed from Late-Nineteenth-Century Galveston," in *Music and Technoculture*, ed. Rene T. A. Lysloff and Leslie C Gay, Jr. (Middletown, CT: Wesleyan University Press, 2003), 211.

Appliances and Sewing Machine Gazette was printed between 1877 and 1930, and detailed for its readers the latest improvements to devices such as coffee pots and knitting machines, the outcome of legal cases concerning relevant goods, brief descriptions of new patents granted, and blank hire agreement forms for readers who rented out items such as sewing machines and bicycles.

A large percentage of each issue of the *Journal* was filled with advertisements for the latest products, from steam washers to typewriters. Many of these advertisements share a common theme: they focus on the labour-saving features of their products. An ad for the Caligraph claims that it is "The Fastest, Lightest, and most Durable Writing Machine." Next to an image of the machine in question, which outwardly resembles a typewriter, the ad explains, "By its use more than Fifty per cent. in time and labour is saved, and it turns off [sic] work that is as easily read as printing."[56] On the same page, Greenall's Steam Washer, which the makers claim to be "The Great Domestic Labour-Saving Machine" is introduced as the "Most efficient, easiest, and quickest Washer made. Accomplishes in Two Hours what is now a Hard Day's Work. Washing Day made a Pleasure."[57] Across advertisements for everything from washing machines to button-hole machines, descriptors such as "automatic," "efficient," and "simple" promote products that promise to make domestic tasks quicker and easier to perform.

Given its title, it would make sense if the *Journal of Domestic Appliances and Sewing Machine Gazette* included only devices used for household chores, but keyboard instruments are included frequently. On the front page of the January 1886 issue, Steinway Pianofortes are advertised as "The most Perfect Pianofortes in the World."[58] Elsewhere, "An old-established and

---

[56] T. Davison, Advertisement, *Journal of Domestic Appliances and Sewing Machine Gazette*, January 1, 1886, 33.
[57] John Greenall, Advertisement, *Journal of Domestic Appliances and Sewing Machine Gazette,* January 1, 1886, 33.
[58] Steinway Pianofortes, Advertisement, *Journal of Domestic Appliances and Sewing Machine Gazette*, January 1, 1886, 1.

profitable SEWING MACHINE, PIANO, and FURNISHING BUSINESS" is up for sale.[59] Numerous descriptions of patents that provide "improvements to the pianoforte" appear in the "Applications for Patents" sections, and an article offering advice on renting out pianos and sewing machines describes a course of action for cases when a rented piano or sewing machine was accidentally destroyed or damaged while on the renter's property.[60]

In spite of the frequency of its appearances within the pages of the *Gazette*, the piano at first seems out of place side by side with material discussing machines at which women performed domestic tasks for their households. Although a musical instrument might appear to have little to do with washing and wringing machines, the piano was also a tool with which women were expected carry out domestic responsibilities. As discussed above, young women in the nineteenth century were given piano lessons in order to help them develop a socially acceptable artistic skill. At the keyboard, they could display themselves to potential suitors in an appropriate manner. Once they had secured husbands, however, women continued to play for their spouses, and men's expectations of being able to listen to their wives at the keyboard is reflected in literature and art in the latter half of the nineteenth century.[61] Considering the piano as a product that would have been used primarily by women, and additionally as a household item with which women performed services for their families, keyboard instruments fit in quite well with washing machines and sewing machines in terms of their purpose and target audience.

There still remains an apparent separation, however, between the wringing machines and writing machines, with their claims of labour saved, efficiency increased, and difficulty eased,

---

[59] Advertisement, *Journal of Domestic Appliances and Sewing Machine Gazette*, July 1, 1886, 13.
[60] "Hire Agreements.—Important.," *Journal of Domestic Appliances and Sewing Machine Gazette*, July 1, 1886, 13.
[61] Petra Meyer-Frazier, "Music, Novels, and Women: Nineteenth-Century Prescriptions for an Ideal Life," *Women and Music: A Journal of Gender and Culture*, 10 (2006): 45-6; Charlotte N. Eyerman, "Piano Playing in Nineteenth-Century French Visual Culture," in *Piano Roles: A New History of the Piano*, ed. James Parakilas (New Haven: Yale University Press, 2001), 180.

and the pianos, for which companies simply boast superior quality, but no further automation. And yet, the speed and simplicity offered by the mechanical devices for washing clothes and making button holes parallels the development and increasing mechanization of one of the most complex machines for speed and simplicity in the music world: the piano itself. In a critical history that links keyboard instruments and Western cultural development with economic and social structures, David Suisman has noted that all musical instruments are machines that serve as tools, and like washing machines and typewriters, musical tools have their own technological history.[62] As a particularly intricate machine (even peculiarly intricate, when compared with the simpler instruments that have historically been most prominent throughout much of the rest of the world), the piano itself is, according to critic Ernest Newman, a "record of an incessant piling up of mechanism."[63] Tracing the history of the mechanization of music, Newman notes that violin players have achieved their high levels of expressivity by improving on human body parts with man-made tools: the creation and use of the bow in effect served to elongate the fingers and soften their pressure. The piano, too, Newman argues, is essentially a mechanical dulcimer, with complicated pieces of machinery designed to strike pieces of wire.[64] And when it comes to wire-striking, the complicated mechanism does in fact do a better job than the human hand. Just like washing machines and writing machines, the piano is more efficient, more consistent, and more effortless, because the tool—in this case, the hammer striking the string—is no longer held and manipulated by a human hand, but by a mechanism.

Suisman draws on Karl Marx's discussions of machine-based production as well as Harry Braverman's *Labor and Monopoly Capital* in arguing that mechanization is not a single-stage

---

[62] David Suisman, "Nancarrow in Context: A Critical History of Player-Pianos and Mechanical Automation," paper presented at *Online Symposium: Conlon Nancarrow, Life and Music*, September 27 – October 27, 2012, 15.
[63] Newman, *The Piano-Player and its Music*, 18.
[64] Ibid., 18-19.

occurrence, but a process that proceeds little by little.[65] Braverman singles out the point in a technology's history at which a mechanism regulates the path of motion taken by a tool—even if that motion is not automated—as a significant moment in the technological evolution of a machine.[66] The sewing machine, with its pedal-powered needle following a fixed path up and down, is taken as an example of machine-regulated motion in Braverman's work. But sitting alongside sewing machines on the back of travelling salesmen's carts was an instrument Braverman didn't consider: the piano. If pianos already took advantage of regulated motion and increased efficiency in the mechanized production of sound, then it could be argued that the player piano was not a shocking shift from wholly human musicianship to soulless recreations, but merely another step in the "incessant piling up of mechanism" that the piano already represented.

Given *The Journal of Domestic Appliances and Sewing Machine Gazette*'s focus on mechanized, labour-saving devices, it would be surprising if devices such as the piano-player had been excluded. In fact, early versions of these instruments do appear in the pages of the *Gazette* in the late nineteenth century, even before they were advertised in newspapers. An article from 1887 covers the details of an early "International Sewing Machine and Domestic Appliances Exhibition," which ran from the 12th to the 26th of November of that year, at which products from manufacturers around the world were displayed.[67] The writer reported on various sewing machine exhibitors, remarking on the nicest machines, and even critiquing the lighting in certain booths. The exhibition included knitting machines, which produced works that were "so

[65] Suisman, "Nancarrow in Context," 15-16.
[66] Harry Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York: Monthly Review Press, 1974), 188-9.
[67] "First International Sewing Machine and Domestic Appliances Exhibition," *The Journal of Domestic Appliances and Sewing Machine Gazette*, December 1, 1887, 24-25.

exquisite…in design and finish that it was hard to believe that they were produced absolutely perfect by the machines on exhibit."[68] Knitting wasn't the only handicraft being automated at this exhibition. The reporter for the *Gazette* also described Von Pittler's Pentagraph Apparatus for Darning, Embroidering, &c., a device which took pencil-drawn designs as its input and guided a sewing machine to reproduce the design at one-sixth size on fabric.

A significant number of musical instruments were on display at the exhibition, including Aeolian organs, orchestral cabinets, aristons, and even singing dolls which could produce various tunes. Here, the reviewer makes reference to a device called the "automatic piano," introducing it with little fanfare, but going on to describe the Aeolian organ with a fair amount of detail in the same section:

> The automatic piano is a splendid instrument, which can be converted into an ordinary piano by merely removing the automatic arrangement. Another excellent invention is the Aeolian organ which can either be played by a skilled player by hand, or by one who has never before seen an organ, if he merely presses down the pedals. A perforated tune sheet is inserted at the back of the keyboard, to render the instrument automatic. If desired, the instrument can be played independently of the perforated sheet of music or in conjunction therewith, when a striking effect is produced.[69]

From this description, we cannot be certain what the "automatic arrangement" was, or even who was exhibiting this instrument, but the author assumes here that readers would have all the information they would need with this brief statement, adding only the note that the automatic piano can be converted into an ordinary piano. Of particular interest in this write-up is the description of the organ built by the Aeolian Organ & Music Company, which focuses on the ability of a completely untrained user to operate it effectively.[70] This emphasis parallels themes

---

[68] Ibid., 25.

[69] Ibid.

[70] Aeolian was founded in 1887 and, before they became known as a producer of the Pianola, they built automatic organs. The choice of name likely refers to the Aeolian harp: an instrument that produces sound when air currents pass through it as the wind blows.

similar to those of early piano-player ads, which touted the devices' ease of use and quick results.

At the close of the review of the exhibition, the author states, "The above, with a few insignificant exceptions, comprise all the exhibits that can be described as sewing machines or domestic appliances."[71] It is interesting that the author chose to specify "sewing machines or domestic appliances," separating these two categories of items, and it is also interesting that the author chose not to divide these categories further, with labels such as "sewing machines, musical instruments, or domestic appliances." Musical instruments, since they are not sewing machines, are grouped together with the domestic appliances, with no further explanation needed. Elsewhere, on the cover of the periodical, a larger number of categories of machines are separated out in order to give the reader a better idea of what is contained within the pages of the *Gazette*, but pianos receive prominent mention: "Sewing machines, knitting machines, bicycles, pianofortes, washing, wringing, and all kinds of domestic labour-saving machinery."[72] Beneath this list, the Gazette printed a slogan. It reads: "Time saved is money gained." Pianos, with their intended destination (the family home), function (facilitating a domestic task in a simple and efficient manner), and target market (women) in common with coffee pots and wringing machines—especially pianos or organs that included additional machinery that eased the difficulty of playing—fit in well with the rest of the products on display at the exhibition, and within the pages of a journal like the *Journal of Domestic Appliances and Sewing Machine Gazette*.

The exhibition described in the 1887 issue was not the first time an automated musical instrument was mentioned in the *Gazette*. In April 1881, the journal printed a number of reports

[71] Ibid.
[72] *The Journal of Domestic Appliances and Sewing Machine Gazette*, January 1, 1881, 1.

on the 1881 Exhibition of Domestic Labour-Saving Appliances. One mentions a mechanism for playing the piano, although it does not describe it as "automated." Alongside a list of devices such as those for slicing and buttering bread, crumbling bread, mincing meat, peeling potatoes, sewing, knitting, washing clothes, and wringing clothes, this reporter dedicates a large amount of space to describing a machine for playing the piano, which "created much interest" at the exhibition. Describing the function of the apparatus, the author writes: "The tune is cut out on cards somewhat in the mode of preparing patterns for a Jacquard loom, and the performer merely turns a handle, the perforations in the card allowing the motions needed to strike the proper keys."[73]

Since practicing and performing at the piano was a type of domestic duty, and since the automatic piano (and, shortly thereafter, the piano-player) was grouped together with other labour-saving domestic machines in the minds of tradespeople and users in the late nineteenth century, the language found in the early piano-player advertisements considered previously in this chapter seems unremarkable. "This will play your piano" becomes a typical claim when set in context with other labour-saving devices that offered to wring your laundry or do your embroidery. An advertising slogan that reads, "So simple a child can work it" sounds like one of the claims of piano-player and player piano advertisers who famously depicted a baby operating the pedals of a player piano or promised instant results without the drudgery of practice. But in fact, this particular phrase was also used to sell Singer sewing machines in the late nineteenth century, and was also deployed verbatim by Herbert, Haynes & Co. in the early twentieth century for machines which boasted "Sewing Made Easy."[74] Promises of gentle learning curves

[73] "Press Notices on the Exhibition of Domestic Labour-Saving Appliances, 1881," *The Sewing Machine Gazette and Journal of Domestic Appliances*, April 1, 1881, 32.
[74] Singer's Sewing Machines, Advertisement, *The Sewing Machine Gazette and Journal of Domestic Appliances*, January 1, 1881, 12; Advertisement, *Otago Daily Times*, July 27, 1911, 3.

and simple usage certainly weren't limited to these decades. In the twenty-first century, even apps for creating advertisements themselves promise that they will be "incredibly quick and easy to use" for those who wish to make advertisements—perhaps even advertisements to sell other easy-to-use products.[75] This type of language aims to make a potentially intimidating technology or mechanism seem more accessible and comfortable. Early piano-player advertisements examined in this chapter which contained these kinds of simple and pragmatic statements look quite typical when considered in their initial context next to other brand-new labour-saving mechanisms at exhibitions, or in the pages of periodicals and newspapers.

Less than twenty years after piano-players made their debut in the advertising world, the messages surrounding this technology had changed dramatically. Potential customers found it appealing to imagine themselves as genuine performers and not just providers of kinetic energy, and this theme became more prominent in advertising as the success of the player piano continued to accelerate. Later trends in advertising as well as representations in popular sources and instructional literature saw the concept of the player piano moving ever further from its original identity as a simple machine, towards new uses as an expressive tool for creativity, and as an instrument in its own right. By comparing these messages from later in the machine's history with the baseline derived from the earliest ads for piano-players, we can observe the way in which player devices emerged from their hazy beginnings as open-ended "new media," through a period of definition against a backdrop of earlier technologies, towards a unique and established purpose. During this time, a reversal took place in which the automatic piano-player became a musical instrument, and its operator became the piano player. Although the

[75] Biteable ad maker, accessed October 19, 2018, biteable.com/advertising.

reproducing piano is sometimes viewed as the final step in the development of player piano technology, this device served a different purpose than the piano-player and the player piano. Reproducing pianos were an automated playback device which offered their owners a means of accessing music they might never otherwise hear, did so with no effort on the part of the user, and promised to convey the details of the pianist's original performance with perfect accuracy. Despite these new capabilities, the player piano was never replaced by the reproducing piano, and sales of the former continued to dwarf those of the latter, leaving the manually pumped, hand-controlled player piano as the dominant force on the market. Furthermore, contrary to the anxieties of those who felt misapprehension towards automata and mechanical music, the rise of the player piano did not sign a death warrant for piano performance. Music technologies like the player piano, when combined with the creativity of human users, create new spaces for musical expression and for competencies that did not previously exist. In this instance, by tracing the trajectory of the player piano's meaning as it solidified, we can witness the shift from the slogan of "this will play your piano" as found in the earliest ads, to the suggestion of "with this, *you* can play your piano."

CHAPTER 2

The Reproducing Piano: Capturing and Recreating "Living Presence"

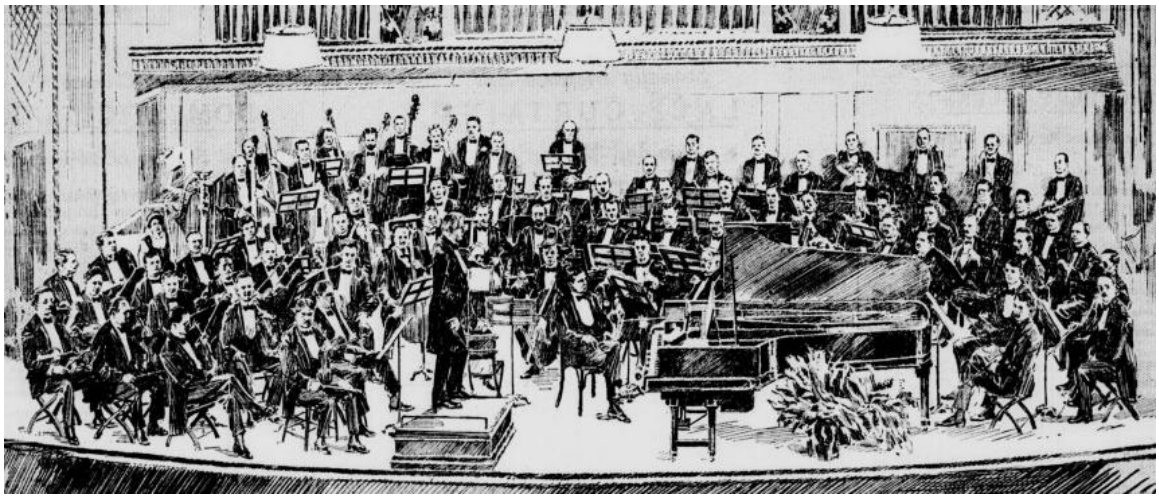


Figure 2-1: Sketch of New York Symphony Orchestra concert, November 1917, "A Notable Presentation of a Notable Instrument," *New York Tribune*, November 25, 1917.

On November 17, 1917, the New York Symphony Orchestra, conducted by Walter Damrosch, accompanied a performance of Saint-Saëns' G-Minor Piano Concerto played by Harold Bauer (Figure 2-1). On this same evening, more than 1200 kilometers away in Chicago, Harold Bauer also took to a different stage and performed a solo recital.[1] Of the New York Symphony performance, the *New York Sun* noted that it was "the first time in musical history" that such a performance had taken place—not because of any high-speed travel or space-time anomalies, but because while Bauer's Chicago performance was delivered in person, his New York appearance was executed with the assistance of a Duo-Art reproducing piano. The *Sun*'s account of this event describes how "When Mr. Damrosch stepped upon the conductor's platform to conduct the concerto he had a button pressed and the large concert grand on the stage fell into the opening

[1] "Symphony Players in Novel Concert," *New York Sun*, November 18, 1917, 9.

bars of the concerto, and for thirty minutes, actuated by the Duo-Art record as made by Mr. Bauer himself, it played the work with the orchestra to the end."[2]

Another account in the *New York Tribune* of the same performance stated, "Mr. Harold Bauer, at the moment presenting a concert program in Chicago, a thousand miles away, had exhibited his highest art as literally as though he sat in person at the keyboard. His extraordinary genius transcribed upon a music-roll in the fullness of both its technique and its spirit was a present living actuality to every listener."[3] The difference in attribution of the performance between these two accounts is noteworthy. In the summary from the *Sun*, the piano onstage at the concert simply "fell" into motion, and played the concerto by itself. Harold Bauer seems twice removed from this description, with his playing actuated by a Duo-Art roll, and the roll played back by the piano. In the *Tribune*'s words, however, Bauer's musical genius "was a present living actuality to every listener." In this description, the transcription of Bauer's performance onto a roll is mentioned almost parenthetically. This account conveys much more of a sense of immediacy and human presence, despite the fact that there was still no pianist at the keyboard.

The piano-player and player piano, as I have shown, were also used in a large number of public concerts. In comparing these performances with Harold Bauer's Duo-Art concerto, however, an important inversion has taken place in the way these events are described. In recitals featuring the earlier, pedal-operated instruments, in spite of the fact that a human user needed to be actively involved in controlling the instrument and the course of the performance, the performer's name often went unmentioned. For Bauer's 1917 concert appearance (or, more accurately, his lack thereof) with the New York Symphony Orchestra, the soloist's place at the keyboard was conspicuously empty, and no human effort was exerted at the piano that night, but

[2] Ibid.
[3] "A Notable Presentation of a Notable Instrument," *New York Tribune*, November 25, 1917, 6.

Bauer's musicianship is front and centre in accounts of the event. In this surprising reversal, the more automation these concerts used, the more credit writers gave to any human musicians involved. What were the goals behind these sharp contrasts in the descriptive language used for these performances? Why did writers take such different approaches to framing performances involving similar technologies? To answer these questions, I begin with a comparison between reproducing pianos and earlier player piano technologies, and examine the circumstances surrounding the reproducing instrument's initial successes and eventual demise. I follow with a study of advertising techniques that were used to sell the reproducing piano, and contrast these materials with focused research on the technological process by which these companies recorded and reproduced the playing of the great pianists of the early twentieth century. Together, these different approaches paint a picture of the desires which companies sought to fill (and create) in their customers, and the extent to which the reproducing piano was actually delivering on the technological promises its makers offered.

The devices I have examined so far have been pedal-powered devices that required a significant amount of user involvement. I will now turn to a consideration of one of the instruments left out of the narrative thus far: the reproducing piano. Since they required more sophisticated encoding technology, these fully automated devices were developed more than half a decade later than the piano-player. By the time the first reproducing instrument on the market, the Welte-Mignon, was introduced to the public in 1904, Aeolian and Wilcox & White had been printing competing advertisements for the Pianola and the Angelus for years, and a number of newer companies had begun to produce their own piano-players. Much of the work of convincing a skeptical public of the value of the piano-player was already done. Given that the reproducing piano required more complex technology, was developed later, and was more

expensive, some accounts of the history of the player piano position the reproducing piano as the final stage in a three-part story of the development of player piano technology. I take a different view of reproducing piano history. The makers of the reproducing piano built an instrument which they claimed could accurately and automatically play back the performance of a great artist, down to the finest detail.

The difference between this concept and that of the pedal-powered player piano is significant. The player piano achieved much of its eventual popularity not as the automated playback device it was originally conceived as, but as a tool that positioned its user as a true musician by providing mechanical keyboard assistance while allowing its user to control every facet of the artistic performance by herself. The reproducing piano did not serve these same ends, but was a move in a completely different direction, and stripped away all of this artistic agency from the user. Technicians developing these two devices continued to work towards completely different goals. In the player piano's later years, advances in player piano technology focused on the addition of new buttons and levers that provided the user with even greater ease and depth of control over their musical performance. The reproducing piano, and other electrically powered player pianos, which played without any user input, served entirely different purposes, delivering fully automated performances that disallowed user control.

This difference was clear enough a century ago that in 1917, a columnist published a piece discussing the future of both the pedal-powered player piano and its electric counterparts (this category included not only reproducing pianos, but electrically powered versions of the player piano which populated pool halls and candy stores), comparing these "rival" instruments whose makers advocated for "two widely divergent views on the future of the player."[4] The

[4] Harvey Roehl, *Player Piano Treasury: The Scrapbook History of the Mechanical Piano in America, As Told in Story, Pictures, Trade Journal Articles and Advertising* (New York: Vestal Press, 1961), 47.

reproducing piano was not simply a better player piano that replaced older instruments, and setting it up as such commits what Paul Duguid has called the error of technological supersession, in which newer and more complex technologies are thought to spell the end of simpler technologies.[5] Pedal-powered and electrically powered player pianos existed side by side for years, until the prohibitive cost of the instruments and the widespread availability of the more affordable and more adaptable phonograph led to their decline in popularity. Today, extant instruments from the golden age of the reproducing piano are few and far between, and those that still remain are increasingly difficult to maintain as the specialized parts age.

Previously, I have primarily focused on the piano-player and player piano as they were used in private, domestic spaces, primarily by amateurs. I will continue to examine the use of automated instruments in private homes, but the homes I will consider are not the residences of the middle-class families, and the instruments considered are not the affordable, pedal-powered player pianos. I will begin with an examination of automated instruments in the homes of the wealthy families who were purchasing the elaborate and costly reproducing pianos. These instruments comprised just ten percent of annual player piano sales at the height of their popularity in the U.S.[6] Bringing patents and historical research alongside advertisements and testimonials, I will examine the claims companies made about their reproducing pianos, in order to compare the technology used in these devices and the stories told about them. Alongside the reproducing piano's use in domestic spaces, I will also explore a different context for the device: the studio. In order for a performance to be reproduced, it first needed to be captured, and companies sought out notable pianists of the early twentieth century to play for their reproducing

[5] Paul Duguid, "Material Matters: The Past and Futurology of the Book," in *The Future of the Book*, ed. Geoffrey Nunberg (Berkeley: University of California Press, 1996), 65.
[6] Cyril Ehrlich, *The Piano: A History* (New York: Oxford University Press, 1990), 136.

piano rolls. I will explore different descriptions of these companies' capture technologies, and comments from the pianists who used them, in order to evaluate the claims found in endorsements and advertising materials for reproducing pianos.

In order to consider the role of reproducing pianos, we must first examine the differences between reproducing pianos and player pianos. I have argued that the player piano, contrary to the projections of early advertisements, became not merely an automatic instrument, but a tool that facilitated personalized musical expression. In spite of popular anxieties at the time, and critics of so-called "mechanical" music, the player piano did not replace pianists, professional or amateur. Even the most ardent defenders of the player piano acknowledged that even with the best technique at the device's pedals and levers, there was some music that could not be rendered well with the device.[7] Player piano manufacturers may not have been claiming that their piano rolls could match the playing of the great artists, but this is exactly what the manufacturers of reproducing pianos were boasting. Furthermore, unlike the player piano, the reproducing piano did in fact begin to replace human musicians in settings where live performances would have taken place. Reproducing pianos replaced human artists in a much more visible way than player pianos. Not only were the user's hands removed from the piano keyboard by a short distance, as they were with the player piano when the user operated its levers, but the reproducing piano obviated any need for their body, their musicality, and their involvement. What the player pianist once supplied to the instrument through the use of the pedals (energy to power the device, and, through the use of good pedal technique, musical dynamics), the reproducing piano now managed on its own. Power was usually electrical, and dynamics were encoded on the piano roll.

[7] Bertram Smith, "The Piano-Player," *The Musical Times* 52, no. 819 (May 1911): 309.

The fundamental shift between player pianos and reproducing pianos was not as simple as a lateral shift between pedal-controlled and pre-programmed elements, however. Rather, it was a complete reversal of function and purpose. If the player piano was a device that facilitated performances of limitless variety, and which situated the user as an active performer in a unique performance, then the reproducing piano inverted these meanings. Music produced by a reproducing piano left no possibility for variety whatsoever. Short of mechanical issues, every instance of every playthrough of a reproducing piano roll was identical. Furthermore, the customer who purchased and operated a reproducing piano could no longer be considered a performer at all. This is perhaps the most important change between two technologies that are sometimes seen as similar: the site of the performance was transferred completely from a player pianist (usually an amateur) who sat at the bench and pumped the pedals to shape his own performance, to a pianist who sat in a studio (a professional) and delivered the singular performance that would be encoded into the reproducing piano roll and played back without variation for every customer who purchased it. Previously, with the player piano, the vast majority of rolls were cut by a technician at a desk, who referred to a score and punched corresponding holes into a roll of paper. No original performance took place until a user brought the roll home and interpreted it (either with great skill, or, more likely, with unfortunately little skill) with the pedals and levers of a player piano. With the reproducing piano, the situation is turned on its head, with the only live, real-time performance taking place well before a customer's purchase. In other words, with the player piano, the customer paid to have the opportunity to interpret a piece of music; with the reproducing piano, the customer paid to have the piece of music interpreted for her.

For some, the opportunity to hear professional musical interpretations away from the public concert hall was a thrilling possibility that promised to democratize quality music and the development of good taste. For others, such as John Philip Sousa, the reproducing piano was part of the "multiplication of the various music-reproducing machines" which threatened to cause the exact opposite: "a marked deterioration in American music and musical taste."[8] During the early twentieth century, the reproducing piano was just one competitor among several devices for mechanically reproducing music. Emily Thompson has examined the use of the Edison phonograph in "tone test" concerts that featured live singers and their recordings side by side. Like the Duo-Art concert featuring Harold Bauer discussed above, these tone test concerts sought to legitimize phonographic reproductions as "real music." [9] These different technologies show multiple competing ideas of what automation looked like, and of the meaning of the various methods and media for recording and reproducing musical performances.

Considering the meaning of the reproducing piano across its brief history enables us to examine a concept of automation in which the connection between the physical actions taken by the original artist at the keyboard and the replicated physical actions on the keys of a reproducing piano were said to transmit some perceptible aspect of the artist's presence. Understanding the implications of this concept of reproduction and automation technology in the early twentieth century will serve as a contrast with earlier and later examples of automation in musical performance. I argue that, although there are differences between automation technologies such as the reproducing piano and the player piano, or the reproducing piano and holographic singers, one important element remains the same: the outcome of musical automation is not the

---

[8] John Philip Sousa, *New York Morning Telegraph,* June 12, 1906, quoted in Neil Harris, *Cultural Excursions: Marketing Appetites and Cultural Tastes in Modern America* (Chicago: University of Chicago Press, 1990), 224.
[9] Emily Thompson, "Machines, Music, and the Quest for Fidelity: Marketing the Edison Phonograph in America, 1877-1925," *The Musical Quarterly* 79 (1995): 159-60.

substitution of machine for human, but a relationship between the two. Even a technology such as the reproducing piano—which appears to take the automated elements of player piano technology to their ultimate, soulless end—requires human involvement at every step, including decisions in the execution, capture, interpretation, and recreation of a piano performance. I will explore each of these elements here, with particular attention to the ways in which performers, advertisers, and technicians worked to foreground and conceal particular elements of human involvement in these processes as the meaning of this technology crystallized in the early twentieth century. Ultimately, I argue that the reproducing piano is not actually selling automation, but a means of encountering and possessing human performance.

Endings and Beginnings

The history of this technology began with a murmur and ended with a crash. This decisive end to the reproducing piano's history at the start of the 1930s has been much more clearly documented than its beginnings. Historical accounts generally agree on two main causes for the reproducing piano's downfall. The first was the stock market crash of October 1929 that brought the Roaring Twenties to a grinding halt. The second was the growing supply of radio broadcasts and phonograph recordings, both of which had been improving in quality and availability in the years leading up to this point. These two reasons are more intertwined than they may appear, as they relate to reproducing pianos. The difference between the phonograph and the reproducing piano was that with the reproducing piano, automatic reproduction was a re-enactment of the physical movements of the piano components involved in a performance. These detailed mechanical reproductions, however, were not cheap. The reproducing piano was beyond the financial means of all but the wealthiest families in the 1910s and 1920s, even before the Wall Street crash

occurred. Ownership of a reproducing piano conferred prestige on its buyers. One of the reasons these automatic musical performances held cultural cachet at this time was because professional-calibre music existed almost exclusively in the public sphere. Hearing a reproduction of an expert performance on a reproducing piano in someone's home would have been a highly impressive event—not least of all because the expert was visually absent from the keyboard, which appeared to move up and down as though manipulated by an invisible pianist.

The prohibitive cost of reproducing pianos was a strong contributing factor in their eventual fall from favour, but so was the presence of the phonograph as a competitor. Reproducing piano and player piano companies were in competition with phonograph companies for more than two decades before their decline. Early advertisements highlight the versatility and affordability of the phonograph in comparison with the automated piano devices, and even pianos themselves. "Why tie yourself down to the limited enjoyment that a piano or player-piano gives?" asks an advertisement for Victor Talking Machines. "The VICTOR is not one instrument, but every instrument. It delivers the whole realm of music into your hands."[10] At the bottom of this advertisement, and each one like it, the slogan "a 'Victor' for every purse" promises affordability to anyone interested in the machine, from the $500 machine destined for a mansion, to the offer of "$10 for a serviceable one for the modest apartment."[11] Even the $500 model was far more inexpensive than a reproducing piano. Companies selling reproducing instruments could not compete on the basis of lower prices, and so they focused for many years on cultivating an image of luxury and exclusivity.

Larry Givens has offered a unique approach to the visualization of the reproducing piano's decline, by showing how extravagant catalogues from Ampico (selling reproducing

[10] Landay Bros., Advertisement, *The New York Times*, July 27, 1908, 2.
[11] Landay Bros., Advertisement, *The New York Times*, December 24, 1908, 2.

pianos) changed over the years.[12] In 1916, the Ampico catalogue was an ornate, elaborate book, which spread just 286 roll listings across 72 pages. In the 1919 edition, as the Ampico gained traction in the market, the company expanded the catalogue to 124 pages containing 589 rolls. This lengthier book was equally lavish, featuring photographs and descriptive material.[13] The 1925 catalogue was the largest yet, extending to 351 pages, and bound in hard cover, with black, green, and gold detailing on the cover. Catalogues from 1929 and 1933 have smaller physical dimensions, and have begun to include extraneous items for sale, such as cabinets for music rolls. Rolls in these later catalogues are also heavily cross-referenced, with pieces sorted into categories such as "Dreamy Flowing Melody" and "Pieces with Pretty Melody and Rhythm."[14] The shift here is markedly from a high-class and exclusive product that perhaps one could get their hands on if they had the right references, to a product that needed to be promoted with less-than-highbrow tactics. In the same vein, by 1930, the Ampico magazine, formerly printed on high-quality, costly paper, became the "Ampico Bulletin," printed on a cramped and plain sheet of paper. At this point in time, the formerly lavish and detailed periodical began to include things like a list of discounted rolls.[15] The 1933 catalogue is a scant 64 pages, and the 1940 is nearly identical to its 1933 predecessor. The writing was on the wall: just a year later in 1941, Ampico ceased roll production altogether.[16]

Sales of pianos without player or reproducing mechanisms had also reached new lows during the Great Depression, but, according to Arthur Loesser, the decline was not triggered by

[12] Larry Givens, *Re-Enacting the Artist: The Story of the Ampico Reproducing Piano* (Vestal, NY: The Vestal Press, 1970).
[13] Ibid., 78-9.
[14] Ibid., 82-6.
[15] Ibid., 90-5.
[16] Ibid., 47.

the stock market crash, and in fact had begun by 1919.[17] After several years of small but steady losses in production since 1909, by 1925, piano production had dwindled by approximately 15 percent, during a period of time in which the population of the U.S. had grown significantly. Loesser notes that in 1925, player and reproducing pianos had reached their zenith in popularity and sales, comprising 55 percent of all pianos sold.[18] For Loesser, the player piano vogue was "an effort of artificial respiration" which briefly validated the piano's role in domestic life, but ultimately accelerated the instrument's decline. Whereas the piano was once a status symbol that required practice and dedication to master, the ability to flip a reproducing piano's switch and reap the musical rewards without the effort meant that the instrument was now little more than a music box.[19] This meant that when more affordable and more varied music boxes were available, such as the phonograph and the radio, the reproducing piano was easily supplanted.

The history of the reproducing piano's demise is fairly clear, but the details behind its rise are murkier. Pinned barrel organs and music boxes, two ancestors of both player pianos and reproducing pianos, have been built for centuries, and all of these technologies are essentially storage and retrieval systems containing encoded data required to produce music. Reproducing piano systems include one more important step: they first make a record of a performance event that is then stored and recreated. One of the earliest attempts to create a system of capturing a musical performance was the piano-harpsichord developed by Joseph Merlin in 1780.[20] Merlin's instrument was equipped with a mechanically driven paper belt and sixty-one graphite pencils which recorded the duration of each note depressed on the keyboard. This system, however

---

[17] Arthur Loesser, *Men, Women, and Pianos* (New York: Simon and Schuster, 1954), 599-602.
[18] Ibid., 601.
[19] Ibid., 602.
[20] Kent Holliday, "Some American Firms and Their Contributions to the Development of the Reproducing Piano," in *Perspectives on American Music, 1900-1950*, edited by Michael Saffle (New York: Routledge, 2012), 106.

innovative, lacked a means of playing back the pencil-marked record, and required a technician to translate the graphite lines into a musical score, which a human musician could later play from, if desired.[21]

It would be more than a century before a complete system capable of capture, storage, and reproduction was developed, and it would come from the unlikely backwater town of Freiburg, Germany, where Michael Welte ran a company which constructed orchestrions. The first reproducing piano mechanism on the market was the Welte-Mignon, and although we know its place of origin, historians who authored early accounts of reproducing piano history written in the mid-twentieth century disagreed on exactly when this device was originally available, with possible dates including 1904, 1905, and a vague guess at "about 1906."[22] More recently, Rex Lawson has provided a more specific location and date for the Welte-Mignon's first public showing, placing it at the 1904 Leipzig Autumn Trade Fair, which took place at the latest in August of that year, and was reported in the September 1st issue of "Zeitschrift fur Instrumentenbau."[23] The first Welte-Mignon device produced was a push-up cabinet-style model, although it was of a very different sort than the push-up piano-players of the late nineteenth century, with its electric motor replacing the prominent pedals of the earlier devices. Welte acquired their first competitor when the Leipzig-based company Hupfeld began marketing their Dea reproducing piano shortly afterwards, in 1907 or 1908.[24]

---

[21] Ibid.

[22] Authors were mainly divided between 1905 and 1904 (Kent A. Holliday, *Reproducing Pianos Past and Present* [Lewiston, NY: The Edwin Mellen Press, 1989], 7; Arthur W. J. G. Ord-Hume, *Pianola: The History of the Self-Playing Piano* [London: Allen & Unwin, 1984], 175.), but "about 1906" was something of an outlier suggested in earlier work. (Givens, *Re-Enacting the Artist*, 8-9.)

[23] Rex Lawson, "On the Right Track: The Recording of Dynamics for the Reproducing Piano (Part One)," *The Pianola Journal* 20 (2009): 6.

[24] Ord-Hume, *Pianola*, 178.

Across the Atlantic in the U.S., The American Piano Company began selling their first model of Ampico reproducing pianos in November 1912, sixteen months before Aeolian introduced their Duo-Art in March 1914.[25] During the years immediately following the reproducing piano's introduction, the pedal-powered player piano was continuing to develop. Companies were adding proprietary buttons and levers intended to assist users in interpreting pieces with more control and flexibility, and, as we have seen, although the reproducing piano appears to be closely related to the player piano (it uses paper rolls to produce music, and produces this music with piano strings and hammers), it serves different ends altogether. Serving primarily as a playback device that did not require any user input, the reproducing piano has important commonalities with the phonograph—both technologies sought to encode and accurately reproduce a particular sound event.

Selling the Reproducing Piano

As is the case in many technological histories, we can gain important insights into a product's purpose as it was originally conceived by identifying the public needs which inventors or companies were seeking to fill—or, in some cases, the needs which they were seeking to create. In his article on mid-twentieth-century piano advertising, Paul Michael Covey has traced the gradual differentiation of multiple marketing strategies which targeted a range of customers with varying means, needs, and experience levels.[26] Covey's analysis of advertisements and slogans for pianos between 1940 and 1957 shows expanded efforts to reach a wider range of households, and also to suggest the piano as an appealing purchase outside of the home, for an institution or a

[25] Lawson, "On the Right Track (Part One)," 7.
[26] Paul Michael Covey, "Selling 'The Things Money Can't Buy': Piano Advertising in the Mid-Twentieth Century," *Journal of the Society for American Music* 13 (2019): 54-77.

school, by selling the piano as a means to display status or educate children, and as a piece of furniture or a professional tool. In order to convince potential customers to invest in a purchase as significant as a piano, advertising had to appeal to the intellect as well as the emotions, and it had to do so more convincingly than marketing materials for clothing or household items.[27] For that reason, companies put significant effort into painting a picture in the mind of the reader of the intangible benefits and cultural capital to which the piano would open up access—"the things money can't buy."

The products and advertisements I will examine date from approximately thirty years earlier than Covey's materials, but considering reproducing piano technology through the lens of advertising materials is valuable because the economic and cultural trends that drove the shift in piano marketing mid-century were also in motion in the early twentieth century. Reproducing piano advertisements initially targeted wealthy customers by cultivating a sense of exclusivity, and gradually expanded their target audience by diversifying their marketing tactics to reach different audiences. Covey notes that even shortly after the turn of the century, the time period in which reproducing pianos were being marketed, an increase in individual wealth and access to consumer goods prompted merchants to consider marketing to new types of potential customers:

> As culture became ever more a realm of products, and an individual's relationship with those products grew ever more open to personal choice, more permeable ideas of cultural affinity emerged to supersede the stricter social divisions that had defined past eras….The first step toward segmentation was acknowledging that although not everyone began as a potential customer, some people might be convinced with appropriate effort.[28]

In advertisements for reproducing pianos, a similar concept of "the things money can't buy" also underpinned sales tactics, conjuring images in readers' minds of status, emotional satisfaction, and ownership of the ephemeral. As an expensive piece of machinery and furniture, the

[27] Ibid., 76.
[28] Ibid., 56.

reproducing piano was an asset that conferred objectified cultural capital on its buyers. As a device that played back the performances of great pianists, the reproducing piano could enable its owners to develop their musical taste, and thus develop embodied capital. The messages in reproducing piano advertisements underwent a shift similar to the one in player piano ads, moving from assuming interest towards working to cultivate interest from new types of customers, as more makers entered the market and changed the nature of competition in the industry.

In the early years of the reproducing piano's history, through to the middle of the 1920s, advertisements for reproducing pianos overtly target the wealthy. Advertisements were featured in publications with affluent readers, and shared advertising space with other luxury products. In a 1912 supplement to *Country Life*, an advertisement for the Welte-Mignon run by Steinway & Sons shares a page with an advertisement for freezing rooms in which one could store their collection of furs.[29] Elsewhere, an ad for the Ampico is positioned directly above an ad for chauffeurs' uniforms in the *New York Tribune*.[30] One full-page advertisement for Ampico reproducing pianos that was printed repeatedly in the *St. Louis Post* uses lavish lettering and imagery alongside emotionally charged descriptions to present one of the most sensational advertisements for a reproducing piano (Figure 2-2). The leading line on the advertisement simply suggests in elegant script that the Ampico reproducing piano is "The Finest Gift in all the World!"[31] In a black and white sketch beneath this heading, a well-dressed man gestures to a glossy grand piano, upon which sunlight streams down from a tall, arched window. On the man's other side, a woman descends a staircase, hands clasped before her chest in a posture of delight.

[29] Steinway & Sons, Advertisement, *Country Life* 31, no. 803 (May 25, 1912): lxxxix.
[30] Knabe, Advertisement, *The New York Times*, January 15, 1920, 16.
[31] Conroy's, Advertisement, *St. Louis Post – Dispatch*, December 11, 1921, B17.

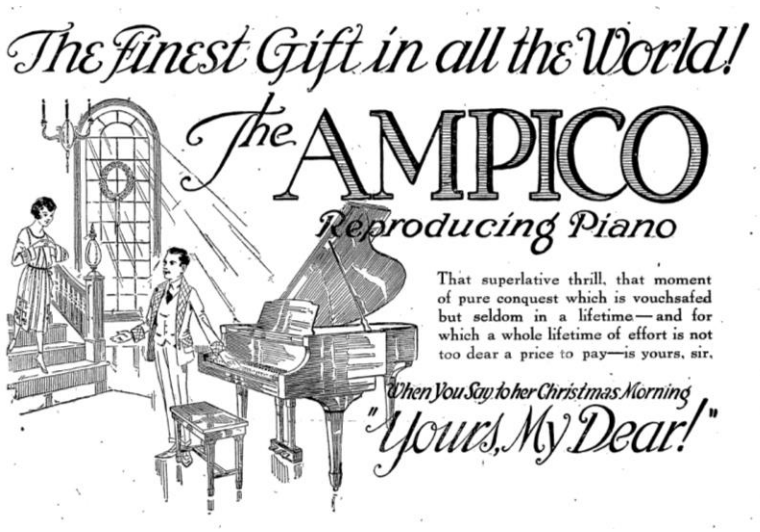


Figure 2-2 Ampico Christmas advertisement, Conroy's, Advertisement, *St. Louis Post – Dispatch*, December 11, 1921, B17.

So far, nothing seems too far out of the ordinary for an advertisement for a luxury product. This heading and sketch, however, are accompanied by a single sentence, which does nothing to describe the Ampico: "That superlative thrill, that moment of pure conquest which is vouchsafed but seldom in a lifetime—and for which a whole lifetime of effort is not too dear a price to pay—is yours, sir, when you say to her Christmas Morning, 'Yours, My Dear!'" This caption is not describing or selling a piece of technology or a musical instrument. It is selling a feeling, and suggesting that money can purchase this rare thrill (a thrill that, apparently, is worth an entire lifetime of effort!) and sense of accomplishment. Farther down in the small-print body of the page, the advertisement makes perhaps the most dramatic claims yet: "The AMPICO for yourself—the AMPICO for all the family, it means a new lease on life, a new interest in living."[32] At this point, one has to wonder a little at these copywriters' estimations of either the psychological condition of their customers or perhaps their credulity, but the ad continues still: "Joy, joy, that you never dreamed existed is yours when the AMPICO comes." Here, certainly, is a blatant instance of Ampico working to sell "the things money can't buy"!

[32] Ibid.

The tactic used in this ad is not unique to piano advertisements, or even this one era, of course—in the twenty-first century, advertisements for products from diet pop to colognes to cars play on consumers' desires to feel young, popular, powerful, or attractive. However, the directness of this appeal to the emotions, and the excess with which it is employed here makes this advertisement stand out from other reproducing piano ads which simply featured photographs of the drawing rooms of the rich or offered testimonials from pianists who had made rolls of their performances. Even within the publication that ran this ad shortly before Christmas, hosiery was politely advertised as "A Most Acceptable Gift," and while diamonds were lauded as "The Ideal Xmas Gift," the accompanying advertisement refrained from making emotional claims and simply encouraged customers to come in the next day to choose their diamond while a special pricing offer was still in effect.[33] Many ads for luxury items such as watches use the largest text size to promote offers such as "Easy Credit Terms," "$1.00 DOWN $1.00 A WEEK," and "Select Your Gifts, Pay Next Year."[34] Compared with advertisements like these, the Ampico ad makes its target audience clear. Unlike many advertisements for the more affordable pedal-powered player pianos, in which the language used is more similar to the diamond and watch ads, the reproducing piano advertisement offers no monthly payment plans or special trade-in discounts to make the reproducing piano more affordable. Many reproducing piano advertisements did not list any prices for their wares at all, subtly suggesting that "if you have to ask, you can't afford it."

In 1920, grand pianos with Ampico mechanisms installed were priced from $2000 upwards.[35] According to the 1921 ad examined above, a top-of-the-line model would sell for

---

[33] Vogue Hosiery Shops Inc., Advertisement. *St. Louis Post – Dispatch*, December 2, 1921, 10; McCoy-Weber, Advertisement, *St. Louis Post – Dispatch*, December 2, 1921, 10.
[34] *St. Louis Post – Dispatch*, December 2, 1921, 10-44.
[35] Knabe, Advertisement, 16.

$4000.[36] Given that the average annual earnings for full-time employees in the U.S. in 1921 ranged from $1161 (telephone and telegraph utilities employees) to $1868 (anthracite coal mining employees, one of the higher-paying jobs reported), the "superlative thrill" which the above advertisement alluded to certainly would have taken many years for an average worker to save up for—perhaps not too far from the "whole lifetime of effort" in the advertisement.[37] Reproducing pianos were not meant to be accessible purchases for lower- or middle-class consumers.

Many advertisements included photographs of the drawing rooms of the families who owned reproducing pianos, supplied lists of the names of prominent purchasers (including political figures, artists, and business owners, such as the Prince of Wales, the president of Cuba, August A. Busch, Clement Studebaker, and Mrs. Alfred G. Vanderbilt),[38] and featured testimonials from prominent local residents who described how the reproducing piano added enjoyment and satisfaction to their lives. One example of such an advertisement was run in the *New York Tribune* in 1918 and features Yonkers resident and noted author Dr. Cyrus Townsend Brady. The ad contains scarcely any words penned by the Knabe piano company running the ad. A photo of Dr. Brady seated next to his reproducing grand piano occupies a third of the advertisement, and another half of the page contains an uninterrupted quote by the famed writer, which begins by weaving a story in second person:

> You come home from a day's work thoroughly tired out. You find the evening papers flat, stale and unprofitable; the war news adds to your depression. What can relieve it so well as a little music? The great Godowsky is playing to-night at Carnegie Hall, or the fiery and passionate Volavy is to be heard in recital at a nearby theatre; and there are other exponents of the great art available. But you feel strangely disinclined to don your evening clothes and adventure forth in cold or rain. Pipe and slippers, easy chair and fire,

[36] Conroy's, Advertisement, B17.
[37] U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970* (Washington: U.S. Dept. of Commerce, Bureau of the Census, 1975), 166.
[38] Conroy's, Advertisement, B17.

> win the day, or the night, rather. And then you reflect that you are not going to lose anything after all. For while you take your ease in your house Mr. Godowsky and Miss Volavy and all the rest play for you exclusively, and for you alone.[39]

Brady's disinclinations to leave home for a concert hall echo those of Bertram Smith—who wrote of the advantages of the pedal-powered piano-player seven years earlier—down to the complaint of having to don one's dress clothes in order to hear good music: "The great pianists are not *here*: nor any pianist," Smith wrote in 1911, "I do not want to have to put on my dress-clothes and go and sit in a draught whenever I listen to music. I want to remain at home and take it at my leisure."[40]

Beyond this point, the similarities begin to dissipate. Smith, the proud owner of a pedal-operated instrument, would have seated himself before the pedals and levers of his piano-player, and physically pedalled his way through the pieces he wished to hear, interpreting them for himself. Easy chairs and pipes were not a part of his evening experience. For users like Smith, there were still no pianists present in the room; nor did the makers of piano-players and player pianos ever claim this. But with the reproducing piano, companies and owners alike spoke of how great pianists were present in the room in some intangible way, playing privately for owners' pleasure. Those who owned a reproducing piano did not need to exert physical labour for their music. Although advertisements for both the player piano and the reproducing piano suggested that buyers could edify themselves with great music played on their new instruments, player pianos had still acquired a reputation for pumping out expressionless, mechanical renditions of these works. Reproducing piano companies offered not only music by great composers, but suggested that the listening experience could be elevated even more with the recreation of performances by great artists. The justification for the price tag on reproducing

---

[39] Knabe, Advertisement, F10.
[40] Smith, "The Piano-Player," 309.

pianos was the suggestion that not only did their owners not need to sweat and strain their way through a Beethoven sonata, but the concert pianist whose roll was being effortlessly played back was delivering a far superior, far more musically edifying interpretation of that same sonata than any amateur could manage.

Regardless of what any of these companies and users were claiming, however, it is obvious that in neither case were any pianists, great or otherwise, truly physically present in the drawing rooms where these instruments stood. But ads for the reproducing piano sold units in part by seeking to convince consumers of the idea that an artist's concert presence could be recreated by the reproducing piano in their own home. Many ads draw up just barely short of saying that the performer is bodily present, and instead hint that some immaterial but significant element of the professional recording artist's aura can be conjured in one's living room through the reproducing piano. Somewhere in between the ghostly dance of the piano keys and the vacant space on the bench, a sort of invisible artistic intention seems to drive the music being advertised here. The pianist is not present, but neither is he or she fully absent.

Different companies focused on different aspects of this almost-presence, but what most of them had in common was an emphasis on the idea that this presence was active, or even living. In Brady's account, while he sits in his easy chair, he is supposedly entertained not by any artificial simulation of a performance, or even a playback of a performance, but literally "Mr. Godowsky and Miss Volavy…play[ing] for you exclusively." The type of presence suggested here is similar to that evoked in earlier accounts of Harold Bauer's reproducing piano concerto, where the pianist's "extraordinary genius…was a present living actuality to every listener."[41] Bauer's concert was given on an Aeolian Duo-Art, and Brady praised the Ampico, but Welte-

[41] "A Notable Presentation of a Notable Instrument," 6.

Mignon also took up this approach, and edged closer still to making claims about living presence: "The Welte-Mignon Autograph Piano Is The Living Soul of the Artist," claimed the headline of a 1911 advertisement. The body of the ad further emphasizes, "It has the *living touch* which differentiates the Welte-Mignon from every other piano playing device in the World. So accurately does the Welte reproduce each note—each delicate shade of contrast—and the individuality of the player, that famous critics declare it impossible to believe that the artist in person is not actually playing."[42] These claims sound significant, but what does it mean for the Welte-Mignon to have "the *living touch*"? Later in this chapter, I will explore the details and repercussions of the "touch" of various contributors to these rolls. First, however, the "living" component of this idea merits more consideration.

There is certainly nothing living about the automated playback of a reproducing piano, nor the paper roll from which the machine reproduces the notes and dynamics. This stands in contrast to the genuinely "living" touch a player pianist would apply to the pedals and levers of a player piano. Considered alongside the player piano and the piano-player, it seems that any living element once involved in the process has been replaced by automation. A performer was required to pedal and interpret the player piano's rolls in live playback, but the reproducing piano could now run itself. If we broaden our perspective a little in our consideration of this form of music production, however, we find that the living human involvement has not been removed entirely, but it has certainly been relocated to a new and different role. With the player piano, rolls were most often cut by a technician at a bench, using a score for reference. There was no original performance event to speak of. The living touch was contributed only by the users, who, seated at their own player pianos, pumped through the roll and created a unique performance.

[42] The Welte-Mignon Autograph Piano Co., Advertisement, *The New York Times*, Dec 7, 1911, 13.

With the reproducing piano, which eliminated these users' agency, the truly living touch involved in the musical production process was now, in large part, that of the professionals in the recording studios during the creation of master rolls for reproducing piano companies—at least, this is what companies hoped customers would think. As I will discuss in more detail below, there were many mediating steps in the relationship between the pianist's finger on the studio piano key and the note produced by the reproducing piano in a customer's home. Compared with player piano rolls, however, certain aspects of a reproducing piano roll were still a type of record of a real-time event. Accounts of the reproducing piano in advertisements and write-ups on live concerts often treated this paper record as though it contained and was able to recreate not just the notes and dynamics but this living presence as well.

Examining this concept of "living" presence calls for some investigation into its inverse: what about the dead? Reproducing piano companies took up this theme as well, and we can find mentions of the dead both at opportune moments in history, and also as a way of selling instruments based on a sense of anxiety or loss. Four days after the death of Edvard Grieg on September 4, 1907, the Rudolph Wurlitzer Company, which included the Welte-Mignon in its product lineup, seized the opportunity to profit from the renewed attention given to the deceased composer by running an advertisement featuring his reproducing rolls.[43] The all-caps text at the top of the ad reads, "GRIEG THOUGH DEAD LIVES THROUGH THE WELTE-MIGNON." Next to a portrait of the composer, the ad includes Grieg's endorsement of the instrument, as well as some context for those who may not have recalled what the Norwegian composer wrote: "GRIEG the Immortal – Composer of that weird drama in music – 'Peer Gynt' – whose death in Norway on last Wednesday caused universal regret throughout Christendom, spoke of the

[43] The Rudolph Wurlitzer Co., Advertisement, *The Cincinnati Enquirer*, September 8, 1907, 4.

WELTE-MIGNON as 'that ingenious idea that uses power in the service of musical intelligence, surpassing all other essays in the way of mechanical pianos.'"[44] Grieg did record a set of three pieces for the Welte-Mignon in the year prior to his death, but these rolls are not mentioned here. This advertisement works mainly to draw on Grieg's fame in a particular historical moment to endorse a particular make of piano—even though the endorsement isn't even a particularly strong one.

The Welte-Mignon wasn't the only reproducing system to take up this theme of "living though dead." Returning to the description of the Ampico given by Dr. Cyrus Townsend Brady, discussed above, we find the same idea brought up towards the end of his narrative:

> And then, one day, you read that some favorite artiste like Teresa Carreno is dead. Her hands will witch no more noble music from the keys. But she being dead yet plays on. The frail records give her immortality. You need not long for the magic touch of vanished hands. It is there. You have it, at your command. For the Ampico, which gives permanence to the evanescent, which embodies the immaterial, is an immortal instrument. Favorite of the gods is he who can manage to possess one by whatsoever sacrifice.[45]

The executives at Ampico were of course not primarily concerned with archival preservation when they recorded the great artists of the day. They were concerned with turning a profit, and a major pianist's name on their reproducing rolls was good for marketing. But Brady's remarks here tie into the recurring theme of embodiment that is prominent in so much material on the reproducing piano. This instrument, with the space at the piano bench empty, and the keys seeming to go up and down of their own accord, evoked a sense of ghostly presence, in much the same way as John Durham Peters describes the initial reception of the radio and the phonograph, which had the power to "suppress absence" or even "conjure the dead."[46] Often, the original

---

[44] Ibid.

[45] Knabe, Advertisement, *New York Tribune*, March 24, 1918, F10.

[46] John Durham Peters, *Speaking into the Air: A History of the Idea of Communication* (Chicago: University of Chicago Press, 1999), 166.

pianist was simply somewhere else geographically, as in the demonstration concerts discussed earlier, but the ghostliness of the reproducing piano performance is amplified even more when the artist has passed away.

Here, the "vanished hands" are not simply in a different location on the globe, but have vanished permanently, and seem to be resurrected from beyond the grave to invisibly grace the keys of the reproducing piano—a performance that is at once evanescent and immortal. In this strange marketing spin, we have, in essence, two lifeless things—a machine, and a deceased composer—being enlisted to attempt to confer life on the rolls of the reproducing piano. Marketing staff at telephone, phonograph, and radio companies similarly worked, as Peters writes, to "reassure their customers by reconnecting the mechanically reproduced representations to an originating body (via testimony and authentication)."[47] For reproducing piano rolls, these reassurances came in the form of pianists' signatures printed on their rolls, written testimonials published in brochures and advertisements, as well as photographs of the artists taken at their recording sessions.

Peters describes a nineteenth-century revolution in technologies which knit together either points separated by distance (space-binding media, e.g. the telephone), or points separated by a span of time (time-binding media, e.g. the phonograph).[48] These two categories highlight a particular tension that arises in early efforts to define the meaning of the reproducing piano. Many accounts and advertisements seem to paint the reproducing piano as a space-binding medium, such as the story of Harold Bauer's simultaneous concerts, or Cyrus Townsend Brady writing of Godowsky and Volavy playing exclusively for him alone in his home. In these narratives, the playing of the pianist in question seems to be occurring in real time, conveyed

[47] Ibid., 143.
[48] Ibid., 142-3.

directly to the listener's physical location. This framing sought to authenticate the link between the pianist's invisible body and the auditory results of their original performance at the keyboard by hinting at the almost-presence of the pianist. The reproducing piano was not a space-binding medium, however, but a time-binding medium, in which a record of a performance was punched into paper and stored for reproduction at a later time. The means by which companies did so, and the implications of this process, will be explored below.

Inside the "Marvelous Mechanisms"

The Welte-Mignon, the Duo-Art, and the Ampico were by far the most popular and successful reproducing pianos in the U.S. to the end of the instrument's era of popularity. Thus far, I have examined some of the emotionally charged tactics used to convince people to purchase these costly items, but although these ads have provided some information concerning the workings of each company's instruments, they leave many mysteries as well. Many reproducing pianos from the heyday of these instruments still survive in relatively good condition, but the recording pianos—the mechanisms by means of which companies recorded the great pianists of the day—have been dismantled or destroyed, and many of their secrets perished with their inventors as closely guarded proprietary knowledge. Technical descriptions and first-hand accounts of the recording process frequently conflict, or at the very least, seem improbable. Most often, ads are deliberately vague, especially when describing the way in which dynamics were reproduced. Welte-Mignon advertisements avoided disclosing their processes altogether, describing their system in enigmatic terms across nearly twenty years of ads.

Early on, in 1909, an ad in the Los Angeles Times explained, "By another secret process these performances are reproduced, always retaining every characteristic of tone, touch, phrasing

and volume—just as expressed in the original performance."[49] Given the importance of these sizeable claims, it seems surprising that Welte-Mignon expected potential customers to take them at face value. But the company did not yet have any serious competition on the American market with which their products and processes could be compared, and, as Kent A. Holliday has suggested, this lack of detailed information lent their instruments a certain mystique.[50] By the late 1920s, however, even with newer competitors on the market, Welte-Mignon continued to maintain silence regarding their own methods. One ad claims, "Through this marvelous mechanism the artist's playing is actually photographed—by a secret process known only to Welte-Mignon. That is why these are the only recordings that reproduce every delicate shading—and why editing a recording is not necessary with Welte-Mignon."[51] The "marvelous mechanism" touted here still receives no explanation anywhere else in the ad, even though this advertisement appeared nearly two decades later than the 1909 ad using the same "secret process" phrase. At this time, articles in periodicals like *Scientific American* were detailing aspects of the recording process behind other companies' piano rolls, and yet Welte-Mignon still insisted that theirs was "a secret." Saying that their methods "actually photographed" the playing of their performers seems to be a stretch bordering on a falsehood. No accounts from artists recording for Welte-Mignon indicate that there was any type of performance capture taking place that paralleled photography in any meaningful way, and the rough information we do have concerning this company's technology suggests the use of methods that not only were distinctly non-photographic, but also would have been unable to fully recreate expressive shading to the extent promised in advertisements.

---

[49] Geo. J. Birkel Co., Advertisement, *Los Angeles Times*, November 21, 1909, II.
[50] Holliday, *Reproducing Pianos Past and Present*, 54.
[51] Barker Bros., Advertisement, *Los Angeles Times*, March 14, 1926, C20.

A description from 1963 suggests that the Welte-Mignon recording process involved a set of carbon rods attached to the keys of the keyboard, and that these rods would dip into a trough filled with mercury when their respective keys were pressed.[52] The contact between the rod and the mercury would produce a current, which in turn caused a soft rubber wheel with a wedge-shaped outer edge coated in ink to press against a moving roll of paper as the pianist played. If the pianist pressed the key harder, then the carbon rods would dip deeper into the mercury, and the soft rubber wedge would press harder against the paper, leaving a wider mark. According to this author's account, Welte-Mignon apparently used conductive ink, which enabled a special reproducing piano to read the printed record directly, in a way similar to automatic banking equipment. This roll would then be hand punched to translate the inked performance record into perforations playable on a reproducing piano in a customer's home.

Kent A. Holliday, writing more than twenty years later, took issue with this explanation, noting potential mechanical issues with a system of this type, and also pointing out that surviving master recording rolls from the company seem to disprove the possibility of this method having been used.[53] Holliday writes that if Welte dynamics were indeed captured using the carbon-and-mercury system, then some elements of this description must be missing. No matter how hard a piano key is struck, the key depth does not change. How, then, would the carbon rods have been submerged and held deeper in the mercury trough? The above description of the carbon rod system does not suggest any alternatives as to how velocity—the only factor that varies in relation to dynamic level—could have been converted into rod depth. Furthermore, the documentation we do have that reveals some aspects of Welte's process seems to contradict the

[52] Richard C. Simonton and Ben Hall, liner notes to *The Welte Legacy of Piano Treasures*, Hathaway and Bowers, Inc., HSTR-5370, 1963, LP.
[53] Holliday, *Reproducing Pianos Past and Present*, 55-6.

carbon-and-mercury description. A Welte-Mignon Licensee service manual from 1924 depicts a segment of the master roll from a recording session, and shows the way in which the approximate dynamic levels of the performance were recorded.[54] Standard player-piano hole punches indicate the durations of the notes in the centre portion of the roll, but both margins contain markings that resemble seismograph lines, serving as a record of dynamic readings from the treble and bass ends of the piano. These wavy representations of approximate dynamic levels could not be directly read by a reproducing piano. After recording, they would have needed to be converted into punches that a reproducing piano in a customer's home could read, and then added to a master stencil from which rolls could be cut. Every reproducing piano system used a proprietary system of coded perforations in a section of the piano roll that ran parallel to the note perforations. These punches controlled suction levels to provide a range of dynamic levels in playback.

Having conducted a study of dynamics as they are reproduced by Welte rolls, Holliday posits that microphones may have come into use in Welte recording processes by 1920, noting that at this point in time, there was an audible jump in quality in the dynamics on rolls by Welte.[55] Since key-specific ink marks of variable widths generated by the carbon rod system would likely have offered a far more precise record of the note-specific dynamics used by the performer than a pair of microphones which would only convey the overall volume in the treble or bass at a given moment in time, Holliday suggests that the jump in quality of expression found in rolls using microphones after 1920 casts doubt on the existence of a carbon-and mercury system prior to this time.

[54] Roehl, *Player Piano* Treasury, 72.
[55] Ibid., 56-7.

Holliday was not the only historian to consider possible explanations for Welte's expression recording process. In an in-depth investigation of the surviving resources and first-hand accounts available in the twenty-first century, player piano performer and historical expert Rex Lawson claims that past accounts and debates have missed the main point when it comes to reproducing piano dynamics.[56] Lawson argues that earlier authors took seriously flawed or misleading descriptions at face value, resulting in a skewed conception of what these rolls represent—a problem, Lawson notes, which is exacerbated by "ill-informed" musicologists who have continued to cite these uncorroborated descriptions as fact.[57] In his inventory of the historical artifacts still available to researchers, Lawson identifies the locations of many master rolls and original trial rolls for reproducing piano systems, notes that a recording system for reproducing organ rolls (not reproducing piano rolls, but there are some similarities between the two systems) still survives in two pieces, and also includes photographs of recording sessions, which he examines in greater detail than earlier historical accounts have done. These artifacts have enabled Lawson to fact-check certain descriptions, and, as he notes, leave room for further research.

Like Holliday, Lawson takes issue with the carbon-rod-and-mercury-trough account offered up fifty years ago by Richard Simonton in the liner notes of *The Welte Legacy of Piano Treasures* which has been cited many times since. But unlike previous authors who sought to offer additional explanations that would make the proposed apparatus seem feasible (such as spring-loaded carbon rods), Lawson takes an additional step back to consider not only whether the account attributed to Simonton is trustworthy, but also whether he was even the one who

[56] Lawson, "On the Right Track (Part One)," 10.
[57] Ibid., 13.

actually wrote the account.[58] In a recollection that casts some initial doubt on the veracity of the technical elements of the liner notes, Ken Caswell, owner of the Welte reproducing instrument that was used in the *Welte Legacy* recordings, recalls asking production assistant Ben Hall about the reliability of the descriptions of the Welte recording process. Hall responded, "Well, we had to sell the recordings somehow!"[59] If, in fact, music researchers have been quoting a spurious account of this technology that was penned mainly to sell albums, then the record needs to be set straight.

Lawson's article draws together three other accounts of the Welte recording process from Richard Simonton, either in print or on audio recording. In doing so, he makes a strong case that Simonton's descriptions are the unclear and contradictory efforts of an individual who lacked an understanding of basic piano mechanics, and furthermore, that Simonton had never actually seen the Welte recording mechanisms up close, and only had a vague impression of their workings. Rex Lawson's work offers much-needed context around a small but problematically pivotal piece of writing that has inaccurately underpinned much work on the Welte reproducing system. Further work by Lawson includes a description of his own proposed system by means of which Welte dynamics were more likely to have been recorded, but although the process is viable, a detailed description is not central to the discussion here.

Three important points arise from this extended debate on dynamic recording systems. First of all, although Lawson's hypothesis is viable, we will likely never receive a definitive answer regarding the exact details of the "secret process" behind Welte's rolls. As far as we know, no piano recording system survives intact today, leaving us to piece together our best estimates based on incomplete recollections like Simonton's, master rolls, and a handful of fuzzy

[58] Ibid., 31.
[59] Ibid., 37.

photographs. Second, abundant evidence shows that editorial teams had an important part to play in the production of all reproducing piano rolls, and the process was certainly not, as some sources encourage readers to believe, a completely automated process whereby stripes of conductive ink printed by the recording piano could be read directly by a special reproducing piano. The suggestion that there was any kind of automatic process that directly recorded the dynamics of a performance in an immediately reproducible format is completely false.

In this respect, the reproducing piano is one device in a long history of automation technologies which have concealed elements of fraudulent automation, beginning in the eighteenth century with Jacques Vaucanson's defecating duck, which appeared to eat grain, digest it, and then relieve itself. Decades after the duck was first displayed, a viewer discovered that food swallowed by the duck did not in fact move into its stomach, but was held at the bottom of the mouth tube.[60] This meant that fake excrement had to be loaded into the back of the duck before its fake digestive process was shown. Jessica Riskin has observed that "this central fraud was surrounded by plenty of genuine imitation. Vaucanson was intent on making his Duck strictly simulative, except where it was not."[61] In the reproduction of "living touch" on a reproducing piano roll, a great deal of the touch was, in fact, that of the editors, and not a direct transcription and reproduction of the artist's playing. Like Vaucanson's duck, which was "partly fraudulent and partly genuine…partly transparent and partly ingeniously opaque," companies were open about certain aspects of the recording process while concealing others, and while recording pianos did capture certain aspects of the original performance, human intervention and translation were required to produce a musically coherent roll.

---

[60] Jessica Riskin, "The Defecating Duck, or, the Ambiguous Origins of Artificial Life," *Critical Inquiry*, 29 (Summer 2003): 609.
[61] Ibid.

This leads us to an important third point: regardless of how accurate any system—real or imaginary—of *recording* the dynamic levels may have been, the fact remains that *reproducing* pianos, regardless of make and model, were only capable of producing two different dynamic levels simultaneously. This means that if a pianist played a chord with four notes in it, and delicately voiced each note so that there were four different dynamic levels in play, then regardless of how accurately a recording piano captured that voicing, a reproducing piano could only reproduce two of those levels at once. These two levels were further restricted to the treble and bass ends of the piano, with the exact divide between the two ranges differing slightly between companies. In spite of these limitations, technicians at reproducing piano companies were highly skilled at producing rolls that give the illusion of far more than two simultaneous dynamics levels. They also had tricks up their sleeves, such as slightly staggering a pair of notes in order to assign them different dynamics in close proximity.

This isn't what reproducing piano companies wanted their customers to think in the early twentieth century, and it also isn't what some researchers want to believe today when they study piano rolls recorded by great composers and performers from a list that includes Sergei Rachmaninoff, George Gershwin, Gustav Mahler, Leo Ornstein, Camille Saint-Saens, and Ignace Jan Paderewski. In recent years, computer scientists have devoted considerable effort to modelling and analyzing reproducing piano rolls, owing to the belief that these rolls faithfully preserve every detail of the playing of these great artists, and can therefore serve as authoritative evidence of the composers' interpretation of their own works, or clear examples of a performer's individual style.[62] "When artists made a master roll…they registered not only the pitches, but

[62] Gustavo Colmenares et al, "Computational Modeling of Reproducing-Piano Rolls," *Computer Music Journal* 35 (Spring 2011): 58-75; Zoltan Janosy, "Computer Analysis of Player Piano Rolls," *Computer Music Journal* 18 (Autumn 1994): 9-10.

also the expression…and pedal operation, which were added to the margins of the roll so it would play back the original performance as accurately as possible….Thus, the many important performances that were recorded on reproducing-piano rolls in the early 20th century can be realized anew."[63] Automation technology, as it is presented in ads for reproducing pianos, seems to confirm this perspective. Were these marketing campaigns all an elaborate deception, presenting an unrealistic picture of what automation technology was capable of delivering? Welte concealed its exact recording methods behind vague gestures to "secret processes," perhaps to maintain the integrity of this image. Other companies were more forthcoming, but the information they chose to reveal is informative in a different way. The history and technological development of the Ampico reproducing pianos produced by the American Piano Company provide a different angle on this issue, which will afford a more complete picture of what reproducing piano technology does and does not offer.

The Ampico was the first reproducing piano to be produced in the U.S., reaching the market in 1911, more than half a decade later than the Welte-Mignon. The inventor behind the Ampico's early success was a former employee of the American Pneumatic Service Company named Charles Fuller Stoddard, who quit his job in order to devote a year and a half to the private development of a system of dynamics reproduction for automatic pianos.[64] Stoddard brought in a stream of piano builders to view his mechanism, in the hope that someone would be interested in purchasing it. Although he received little interest at first, the American Piano Company eventually committed to buy the invention, and furthermore, the company made Stoddard the head of their player piano department and sold the Ampico under the name

[63] Colmenares, "Computational Modeling of Reproducing-Piano Rolls," 58-9.
[64] Givens, *Re-Enacting the Artist*, 13.

"Stoddard-Ampico" for approximately four years.[65] A great deal more information remains available to researchers today regarding Ampico systems, compared with the relative mystery of the Welte-Mignon. Stoddard applied for no less than twenty patents with the US Patent Office, detailing the workings of his system for recording and reproduction. This group of patents shows that while Stoddard's early model had eight levels of dynamic intensity as compared with a later model of the Ampico which was pared down to seven levels, there were not yet any systems to handle crescendos or diminuendos.[66] Stoddard's own description of his dynamics recording system details the way in which electric contacts placed on the piano keys would create marks on a moving sheet of paper. When a pianist strikes a key to play a fortissimo note, the length of time required for the key to reach the bottom of the key bed is much shorter than if the pianist pressed the key slowly to obtain a pianissimo sound. Stoddard's system recorded this span of time (with some inaccuracies) using longer and shorter marks on the moving paper.[67]

In spite of the detailed documentation for this system, Larry Givens' early historical account and quotations from Ampico staff seem to indicate that prior to 1926, this dynamics data was scarcely used in the editing process. Givens states that prior to 1926, no dynamics were recorded whatsoever in the capture process, and that they were added afterwards by editors in all cases.[68] Lawson draws together accounts from Ampico editors Angelico Valerio and Edgar Fairchild, neither of whom have any recollection of dynamics recording systems prior to 1926. Valerio, who began working for Ampico in 1923, describes the dynamics editing process: "We'd know generally what dynamics to put in, because any piece they played we would have the

---

[65] Givens, *Re-Enacting the Artist*, 14; Rex Lawson, "On The Right Track - Dynamic Recording for the Reproducing Piano (Part Four)," *The Pianola Journal* 23 (2013): 11.
[66] Lawson, *On the Right Track (Part Four)*, 17.
[67] Ibid.
[68] Givens, *Re-Enacting the Artist*, 28.

music for it. We would read it over ourselves if we didn't know it, and we'd get a general idea of what they wanted."[69] In the same interview, Valerio responds to a question regarding how the editors made use of Stoddard's dynamics data by insisting that "there were no dynamic markings" prior to 1926.[70] Fairchild corroborates this recollection, noting that Stoddard's mechanism "recorded the notes, the sustaining and una corda pedalling, and nothing else."[71]

Kent Holliday notes that a studio master at Ampico, who remained anonymous while giving these statements, revealed that the goal was merely to convince not only potential customers, but also recording artists that every detail of their dynamics and technique was being captured.[72] Because many pianists were recording works that were known as their signature pieces in concert, it was essential for them to have confidence—founded or not—in the fact that the nuances that made their performance unique were being recorded accurately and clearly. Convincing reputable pianists to record reproducing piano rolls was central to a company's ability to compete on the market. Ampico was eventually able to secure Sergei Rachmaninoff as a recording artist for their rolls, which provided them with a huge boost in prestige and publicity, enabling them to rival the prominence of the Welte firm, for whom Edwin Welte and Karl Bockisch had personally travelled to Switzerland in order to convince Paderewski to record for them.[73] Had these recording artists lacked confidence that reproducing piano rolls faithfully rendered their playing, efforts to convince them to record would have been unsuccessful. For this reason, even if recording staff were in fact not using any automated system of dynamics capture, it still served them well to advance the idea that the system was instantaneous and exact.

---

[69] Lawson, *On the Right Track (Part Four)*, 19.
[70] Ibid., 20.
[71] Ibid.
[72] Holliday, *Reproducing Pianos Past and Present*, 102.
[73] Ibid., 103.

We know for certain that Stoddard did design a dynamics recording system in 1908, and applied for patents for it, but it seems that either this system was not regularly used when recording Ampico rolls, or else the rough lines marked by the electrical contacts were simply overlooked by editors who chose to rely instead on their ears, their scores, and their musical instincts. The studio master quoted anonymously by Holliday admitted that occasionally, Ampico staff would do a test run before a pianist arrived to record, marking the wavy line on the score based on what they could hear on a phonograph recording by the same artist. The pianist, of course, was not always told about this.[74] The roll was edited and produced with approximate dynamics encoding filled in, and this version of the roll would be played back for the recording pianist. The performer then would sometimes invest time and effort into going through several stages of editing, and sometimes he or she would sign his or her name to the rolls without even hearing them. [75]

Ampico's Editor-in-Chief reported that occasionally, the staff would obtain a first test run live from the pianists themselves in the Ampico recording room under the pretense of waiting for the equipment to be ready to use:

> On some such pretext as "timing the performance", or "killing time while they get the equipment ready", he [Milton Suskind, Ampico editor from 1917-25] would call for a complete run-through. During this performance the 'Cookie Chronograph' (Suskind himself) would 'record' the crescendo pattern by drawing a continuous line on the composition's music sheet – the bottom of the bass staff representing pianissimo; the top of the treble staff representing fortissimo….During the actual recorded performance, Cookie would again follow on the music sheet, this time marking the accents above the treble staff. A short line directly above the note indicated a soft accent only slightly above the basic volume; a long line denoted a heavy accent. That was the 'Cookie Chronograph'.[76]

[74] Holliday, *Reproducing Pianos Past and Present*, 102.
[75] Ibid.
[76] Lawson, *On the Right Track (Part Four)*, 21.

By 1918, Stoddard's early dynamics recorder was no longer used at all. Lawson suggests that this is due to the fact that highly practiced editors simply would have been able to do a better job of giving a convincing portrayal of a performance's overall effect than the early dynamics recorder would.[77] These staff members would have been intimately familiar with the nuances of the dynamic steps and crescendo function, as well as the time required for the pneumatics to enact large dynamic changes. This was an important factor in the creation of an effective final version of the roll.

The development of Ampico's new system of dynamics recording in 1926—a more precise mechanism which made use of an electrical system known as a spark chronograph—was one of the most thoroughly documented and publicized technological advances in reproducing piano history. Technological precision, automation, and high fidelity reproduction were among Ampico's most prominent marketing themes, and the company highlighted experiments undertaken by its staff by publicizing photos which documented research and development processes taking place in their facilities.

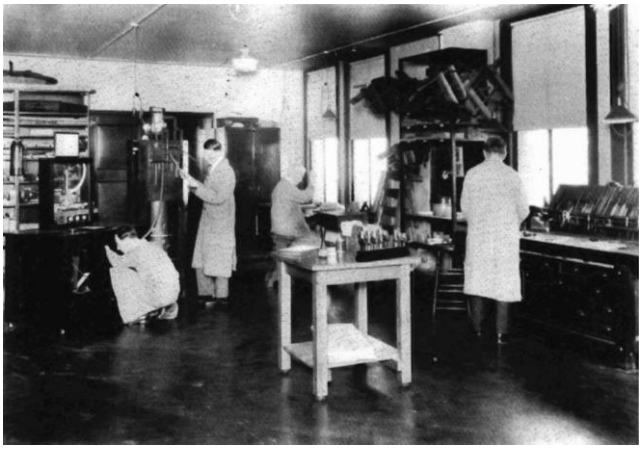


Figure 2-3: The Ampico research laboratory, Richard J. Howe, "The Ampico Research Laboratory and Recording Studio Photos," *The AMICA News Bulletin* 29, no. 2 (1992): 13.

[77] Ibid., 20.

A collection of laboratory and recording studio photos assembled by Richard J. Howe for *The AMICA* (Automatic Musical Instrument Collectors' Association) *News Bulletin* shows several men concentrating deeply on an array of precision tasks in a clean and sparsely furnished laboratory area (Figure 2-3).[78] A trio of these photos in a series show the progress of an experiment conducted by Charles Stoddard, in which the department head, clad in a white dress shirt, drives golf balls past a series of fine wires and through sheets of tin foil in order to measure the exact velocity of the balls (Figure 2-4). In the photos, Stoddard's two assistants, who sport long lab coats, kneel next to or stand over pieces of equipment which are presumably related to the experiment in some way.

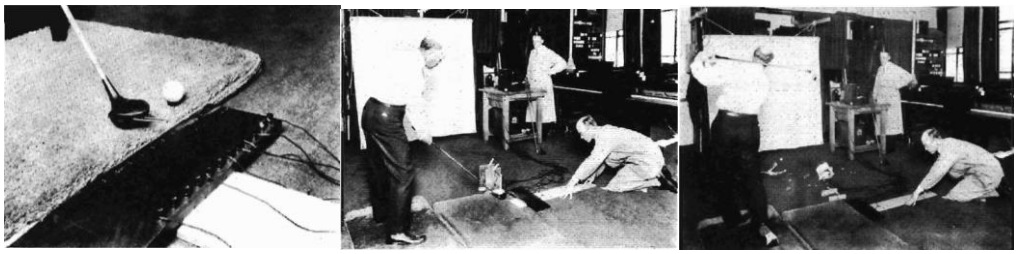


Figure 2-4: The Ampico golf club experiment, Richard J. Howe, "The Ampico Research Laboratory and Recording Studio Photos," *The AMICA News Bulletin* 29, no. 2 (1992): 13.

Whether the lab coats were just for the publicity photos, or Ampico researchers bustled around in them at all times, we cannot know, but the entire setup in these three photos, and the whole set in general, from the pristine lab coats to the unknown machinery the technicians are tinkering with, seems tailored to convey a sense of solemnity, importance, and attention to detail. In contrast with Welte's advertising techniques, which lent their instruments an air of mystery and elegance, and sought to convince readers of the Welte-Mignon's ability to reproduce the presence of an artist's "soul," Ampico's approach worked to foster confidence in the scientific exactness of their

[78] Richard J. Howe, "The Ampico Research Laboratory and Recording Studio Photos," *The AMICA News Bulletin* 29, no. 2 (1992): 10-14.

methods. Central to their ad campaigns was the idea that the essence of a performance could be accurately captured and recreated, if sufficient detail was obtained through technological processes.

The spark chronograph—the most famed fruit of the Ampico researchers' efforts—was introduced in early 1926, two years after Stoddard hired physicist Clarence Hickman to work on improvements to the Ampico.[79] The spark chronograph, as it was detailed by Hickman himself in a paper published in *The Journal of the Acoustical Society of America* in 1929, worked by means of a lightweight silver contactor which was attached to the shank of each hammer on the piano.[80] When a piano key was pressed and the hammer moved towards the piano strings, this electric contactor passed and touched two fine wires in turn. The chronograph measured the amount of time that elapsed between the silver contactor touching the first and second wires, by using a spark to punch a pair of holes in the roll of paper. These holes were then used to calculate the velocity of the piano hammer.[81] A roll that had been punched in this manner could be put through a development process wherein dark dye was spread across one side of the paper, which had been treated on the same side with a waterproof coating.[82] The dye would seep to the other side of the paper through the tiny holes left by the sparks passing through the paper, enabling an Ampico technician with a ruler to determine the dynamic levels of every single note as it was played by the performer.

Hickman's article summarizes the detailed experimentation that researchers undertook in the Ampico laboratory to determine the best type of dye solvent (alcohol mixed with water), the

---

[79] Givens, *Re-Enacting the Artist*, 25.
[80] C. N. Hickman, "A Spark Chronograph Developed for Measuring Loudness of Piano Tones," *The Journal of the Acoustical Society of America* 1, no. 35 (1929): 138-46.
[81] Lawson, "On the Right Track (Part Four)," 22.
[82] Hickman, "A Spark Chronograph," 141-2.

accuracy of piano hammer velocities given constant pneumatic pressure in the Ampico ("better than five parts in one thousand in playing a single note"), and the optimal distance between the two contact points (less than 12 mm from the string). [83] The question of whether the data obtained from the spark chronograph enabled technicians to cut better (however that was defined) reproducing piano rolls is of secondary importance to this discussion. What is more significant here is the way in which the promotion of this technological development adds to the discourse surrounding reproducing pianos. Companies had spent more than two decades working to sell the idea that reproducing pianos played back professional performances in perfect detail, but descriptions were problematically vague when it came to dynamics reproduction, and the process was shrouded in mysterious terms such as "secret process" and misleading descriptions like "actually photographed." With the spark chronograph, at last, Ampico could put their technology on display in order to convey a sense of complete openness and scientific rigour to the public. Publicizing the details of this mechanism served, in a sense, as proof of the claims to precision that Ampico had been making for years. Papers in academic journals were one channel for this message, and another will be seen in the types of advertisements placed in trade publications.

"The Microscope of the ear," runs a heading on a full-page advertisement by the American Piano Company in *The Tuners Journal* in 1929.[84] The ad introduces the spark chronograph, describing it as "an instrument which makes the finest split-second watch ever built take a back seat." Beneath a photo of what is likely the chronograph itself, or some part of it, the ad works to flatter the readership (piano tuners) and to link the chronograph to other scientific tools:

---

[83] Ibid., 142.

[84] American Piano Company, Advertisement, *The Tuners Journal* 8, no. 13 (June 1929).

> The ordinary microscope reveals marvels imperceptible to the unaided eye. The Chronograph does the same for the ear. The well-trained, sensitive ear of the tuner hears differences in sounds that are not apparent to the ordinary listener. Yet, were his ear 100 times more sensitive, this instrument could measure hammer blows more accurately than he could determine differences in the resulting sounds.[85]

Here, Ampico takes pains to compliment the tuners themselves before touting the company's own technology, linking the sensitivity and accuracy of the chronograph to that of the tuners' own hearing capabilities. Compared with the description published in *The Journal of the Acoustical Society of America*, however, this depiction of the spark chronograph offers almost nothing to explain how the machine works. The ad indicates that the chronograph is highly accurate—recording intervals of less than the thousandth part of a second—and that it measures hammer velocities, but descriptions end here.

Even the photograph itself, which occupies nearly half of the ad, is unlabelled and offers no assistance in comprehending the chronograph. A thin booklet of paper lies open on a table, in front of a dark case and shelves filled with dull wooden and glossy glass components. A pair of round gauges suggest the ability to measure something, but the reader knows neither what nor how. The purpose of this photograph—and of the ad as a whole—has little to do with improving readers' understanding of the spark chronograph, and more to do with conveying the same sense of complexity and elite precision that Ampico messaging communicates elsewhere. If the chronograph were a regularly shaped, simple box, devoid of mysterious dials and components, it's doubtful Ampico would have featured it in such a photograph! The mention of time intervals of less than a thousandth of a second, and description of precise measurements that revealed what the human eye could not see, also link the spark chronograph to developments in high-speed photography from the late nineteenth and early twentieth century. In 1889, Etienne

[85] Ibid.

Leopold Trouvelot captured photos of electric sparks using innovative photography methods that revealed fantastical shapes never seen before, and the Lumiere camera, developed in 1895, was able to capture up to eighteen frames per second, created the illusion of motion by stringing together series of images.[86] Scientists in the early twentieth century used film as "a sort of microscope" to observe the movements of cells, using images as a means of examining and theorizing life.[87] Labelling the spark chronograph as "the microscope of the ear" suggests that this technology, like split-second photography, is a tool for precise measurement that can provide access to previously unimaginable levels of detail.

Advertising for the Ampico that focused on this scientific approach to recording sought to appeal to potential customers who valued the fidelity promised by the reproducing piano. Although the spark chronograph did provide more comprehensive data from the recording process, did this method translate into significant improvements in the reproducing piano rolls that were punched after these recording sessions? To what extent did this increased reliance on automated data collection rather than the subjective ears of editors create a more accurate record of pianists' playing? There is still a crucial issue in play as we consider these questions: no matter how much detailed dynamics information was obtained from a recording session, and no matter how finely a technician differentiated the hammer velocity levels, at the end of the day, the reproducing piano itself was still incapable of playing back more than two levels of dynamics at any one time. No amount of technological wizardry on the recording end could circumvent this basic limitation on the reproducing end. Beyond this commonality shared by all makes of reproducing pianos, each brand had its own strengths and drawbacks, whether it was its ability to

[86] Jimena Canales, *A Tenth of a Second: A History* (Chicago: The University of Chicago Press, 2009), 140-5.
[87] Hannah Landecker, "Cellular Features: Microcinematography and Film Theory," *Critical Inquiry*, 31 (June 2005): 903-37.

effectively reproduce accents, its crescendos and diminuendos, or another aspect of the reproduction process.[88] Unlike the digital technologies of the twenty-first century, early-twentieth-century pneumatic systems simply could not keep pace with every split-second dynamics shift in a human pianist's playing. And even the best and most lifelike reproductions still relied on editorial compromises in order to work within the limitations of the two-level dynamics system of the reproducing piano.

In order to understand what these limitations meant in practice, consider the challenge human editors faced when presented with an enormous paper record containing the chronograph data for thousands of notes, each one with its own exact dynamic level, and each one slightly or significantly different than the notes that neighboured it. How could you convert these data points into any kind of overall dynamic level, applied across half the piano, that was both objectively faithful to the numerical data and musically coherent? Should you simply take the average of all of the dynamic levels of the notes at a given point in time? Tweak the numbers a little bit in order to preserve the effect of a melodic line in the treble that soared significantly above the middle voices? Compromise in order to balance a chord that had more notes in the bass than the treble? Considering these challenges, it may seem almost impossible for any technician to hope to render a pianist's performance accurately and musically. And yet, not only do the rolls we have of these pianists' playing sound nuanced, sensitive, and musical, but the pianists who listened to and commented on their rolls did sign off on them, saying they were satisfied that their playing was accurately reproduced. Clearly, these roll editors were skilled at working with the resources they had available to them—pneumatics, data, and their own ears and musicianship. The editors were experts at manipulating the systems they were familiar with, and

[88] Holliday, *Reproducing Pianos Past and Present*, 105-9.

their techniques for working around the challenges inherent to their proprietary systems do give us different musical results that are audible in playback. Rex Lawson whimsically suggests that Ampico dynamics are quite lifelike, while the Duo-Art system is most intellectually satisfying, and the Welte-Mignon's rolls have the most direct appeal to the listener's heart.[89]

In spite of what the reproducing piano companies worked relentlessly to portray to the public, these stories of technological challenges and editorial wizardry show that reproducing piano rolls were neither exact reproductions nor acoustic "photographs." Ultimately, they offered more of an edited impression than an exact reflection of a live performance, although the impression was one that, by the end of the reproducing piano's developmental history, was fairly compelling and did accurately recreate certain stylistic traits of a given pianist. One description that appears frequently across reproducing piano advertisements, testimonials, and literature refers to the reproducing roll as a "portrait" of an artist's playing. This term suits the process and the product much more accurately than "photograph" or even "reproduction" does. When someone sits to have their portrait painted, the artist seeks to capture important aspects of their appearance, but portrait-painting is not a quick process. Several sittings are usually required, and if the process needed to be expedited, artists could use popular stock poses. Furthermore, artists could use their discretion to make the portrait's subject appear more attractive, and to downplay any less-appealing features. In a similar way, roll editors would, sometimes with a performer's supervision, make edits to correct wrong notes, and enhance or clarify certain passages' dynamics or articulation.

[89] Rex Lawson, *On the Right Track (Part Four)*, 25-6.

Pianists Recommend the Reproducing Piano

Regardless of the exact workings of a certain system's crescendos and accents, reproducing piano rolls were faithful enough to the individual style of the early twentieth century's pianists that they were willing to attach their names and reputations to the rolls they recorded, as well as the testimonials and interviews they gave for representatives of these companies. Testimonials were a favourite advertising tool for reproducing piano companies. When an artist recorded for a particular system, a testimonial from the artist usually appeared in newspapers and magazines shortly thereafter.[90] Companies collected large catalogues of these endorsements from pianists, composers, and conductors, and certain themes consistently weave through the comments and responses: fidelity of reproduction, subtlety of expression, and educational value.

In a 1922 issue of *The Atlantic Monthly*, Aeolian printed an especially large, four-page collection of testimonial excerpts from seventeen pianists.[91] In this collection, Alfred Cortot covers both fidelity and education with his remarks: "I am entirely in accord with the opinion of all my eminent fellow pianists when they say that no instrument approaches the Duo-Art Piano in fidelity of musical reproduction. Further, I believe that your marvelous creation is of vital interest in the development of musical taste." Josef Hofmann states that "My Duo-Art rolls…are indeed my actual interpretation with all that implies." Myra Hess notes, "The Duo-Art's reproduction of my own work has been a complete revelation, in its faithful tone photography. Something more than the reproduction of sound is given to one through the Duo-Art—the illusion of actually hearing the original performance—so accurately does it register each subtle characteristic of the artist's interpretation." Many quotes use terminology similar to these three,

[90] Holliday, *Reproducing Pianos Past and Present*, 54.
[91] The Aeolian Company, Advertisement, *The Atlantic Monthly*, December 1922, 97-8.

and most of them give the impression that they are responding to the same set of prompts from Aeolian. Many pianists comment on how valuable it will be for the public to have the opportunity to hear stylistically accurate performances from great pianists, and most comment in some way on the accuracy of the Duo-Art's reproducing capabilities, especially with regards to rhythm and phrasing. These themes carry through to longer interviews with recording artists as well. One such interview with the Australian pianist and composer Percy Grainger was published in *The New York Times* in 1917, and the details in this extended conversation will shed more light on the nature of this testimonial acquisition process.

"The Duo-Art brings the playing of Percy Grainger to your home as realistically as if he were seated at your piano," reads the caption beneath a sketch of the pianist playing a grand piano for a small group of people seated in a cluster of armchairs.[92] Beneath the image, the majority of this advertisement is taken up with a transcription of an interview conducted with Percy Grainger by Aeolian. Much of the interview contains general praise for the Duo-Art as a means of providing people with more opportunities to listen to music, and as a home instrument that can serve as a hand-played instrument or a playback device. Grainger also suggests that the Duo-Art has given him the opportunity to hear what his playing would sound like from an audience's perspective. There is one section of this interview that is of particular interest in the context of this discussion of dynamics reproduction, automation, and human editing:

> [Grainger] "When I am *en tour*, my mother may have [the Duo-Art] to reproduce my records, and, for the time, I am with her in spirit—the Duo-Art reproductions are so vividly like my playing."
> "Altogether, the Duo-Art is quite wonderful indeed—one of the greatest marvels I have found in your remarkable America."
> [Aeolian] "You sincerely think that the Duo-Art reproduces from your records so accurately as to satisfy one so well qualified to judge critically as your own mother?"
> [Heading] *Duo-Art Reproductions Practically Perfect*

[92] The Aeolian Company, Advertisement, *New York Times*, May 23, 1917, 7.

> [Grainger] "Yes, surely. And when I myself hear the records which I have played at my best and then edited and corrected until they are my fullest musical expressions, I think to myself—'Ah, on the days when I play like that I am very well pleased'."
> [Aeolian] "This is a fine thing you are saying for the Duo-Art, Mr. Grainger—tell me, will you go on record with the statement that the Duo-Art actually reproduces your playing even in such subtle things as graduations of touch and tone quality?"
> [Grainger] "That is a very legal sounding query, if you understand what I mean," replied Grainger, smiling—"yes, I think the Duo-Art simulates every phase of my work, rhythm, tone, and all the rest. With reference to rhythm particularly, I am amazed at the absolute accuracy with which the instrument reproduces the artist's most personal characteristics."

Both the nature of Aeolian's focused questions, and the caution of Grainger's answers are significant in this exchange. Grainger begins by offering a compliment regarding the Duo-Art rolls, suggesting, along the same lines as many advertisements, that the playback of the reproducing rolls enables him to be present "in spirit" with his mother, or whoever else might listen to his rolls. The question posed next by the Aeolian representative does not seem too particular or invasive; it mainly addresses the accuracy of the Duo-Art reproducing piano in successfully reading from the perforations in the Duo-Art rolls. But Aeolian's italicized heading, which appears before Grainger's response is even provided, and which seems to summarize the response to come, takes a huge leap to get from Grainger's eventual answer to the claim that the Duo-Art's reproductions are "practically perfect"—something the pianist never said. Grainger has simply indicated that once the piano rolls have been edited and corrected, they sound to him to be much like the results of days on which he is pleased with his playing. This already seems to be quite a generous statement from Grainger, despite the somewhat indirect language. He has indicated that the reproductions are "vividly like his playing," and he has said that his Duo-Art rolls have been edited to a fine polish in order to satisfy his fullest musical intentions. But what has been left unsaid?

Grainger has, up until this point, avoided saying anything at all about the accuracy of Aeolian's recording methods, and whether the rolls actually reproduce the real details of his

original performances at the recording piano. His answers have not underscored the usual messages from reproducing piano advertising narratives: fidelity, nuance, touch, and the reassurance that every single detail of the performance is faithfully captured and reproduced. And so, in this interview, Aeolian proceeds to press Grainger even more intensely on this issue than his earlier comments allowed: "will you go on record with the statement that the Duo-Art actually reproduces your playing even in such subtle things as graduations of touch and tone quality?" Reading the transcription of this interview, Grainger's caution, and perhaps discomfort, are almost palpable. The pianist's smile as he states that this sounds almost like a legal inquiry seems to suggest that he is aware of exactly what Aeolian is seeking to obtain from him, and is considering how he ought to reply. His full response appears just as carefully worded as one might expect, given the loaded question from Aeolian. Aeolian asked Grainger whether the Duo-Art "reproduces [his] playing," including his touch and tone quality. Grainger provides the "yes" that Aeolian was looking for, but then qualifies his answer, and chooses to use slightly different terms. He specifies that the Duo-Art "simulates" his work, and here seems to avoid using the term "reproduce" which Aeolian has used consistently.

Throughout this advertisement, even outside of this excerpt, the discussion has revolved around "reproducing" and "reproductions." This is reasonable, given that the Duo-Art is a reproducing piano. Why would Grainger suddenly veer away from this term and choose to say instead that it "simulates"? In Grainger's final remark in response to Aeolian's leading question, we receive further confirmation that the pianist is being intentional with his choice of words. After first stating that the Duo-Art gives a simulation of his work, he then attempts to offer the interviewer something more to work with, and provides a generous remark about how rhythm in particular demonstrates "the absolute accuracy with which the instrument reproduces the artist's

most personal characteristics." Here, Grainger is willing to use Aeolian's "reproducing" terms to describe the Duo-Art after all, but only with regards to the accuracy of the rhythm. This is an important distinction because it suggests that perhaps—contrary to what the Ampico studio master suggested—Ampico recording artists did not actually have the wool pulled over their eyes with regards to the real details of the capture system and its process for capturing dynamics. After all, the pianists earned money from these rolls and testimonials, too, so it would not have served them well to have been disagreeable or to have criticized the company's processes and equipment. Perhaps, while the technicians were working their hardest to instill confidence in the artists that their every shade of dynamics was being accurately reproduced, the pianists themselves, already in the know that editorializing was an important part of the process, were simply, in their own way, playing along! Ultimately, the goal of the reproducing piano was not some type of altruistic archival recording—it was to make a profit, and pianists were not neutral parties in this business venture. The illusion of accurate reproduction sold instruments, and maintaining the illusion ensured that both the recording artist and the reproducing piano company could make money from the sale of the rolls in question.

One final interview excerpt, this one from the American pianist Ernest Schelling, will demonstrate that it was not only Percy Grainger who stuck to similar points when contending with Aeolian's leading questions. In this interview, Schelling had just commented on the fact that recording rolls for Duo-Art meant that he could reach people who may not have otherwise heard his performances.

> "Just what do you mean, Mr. Schelling, by reaching people through the Duo-Art? Do you feel that you are actually playing to them?"
> He was silent a moment. "Sincerely," he answered, "I think the Duo-Art reproduction of an artist's carefully prepared record will present that artist at his best. For example, I consider that my interpretation of the 10th Rhapsodie which we heard a few minutes ago

> upon the Duo-Art was played as well as I would play it in one of my best moods. That makes my position clear, doesn't it?"
> "You believe then," I queried, "that the Duo-Art reproductions retain the artist's personality?"
> "Oh yes indeed. Particularly in rhythmical peculiarities, in tempi and in individuality of phrasing, the reproduction is startlingly perfect."[93]

Here, Aeolian again asks pointed questions to obtain statements which line up well with their messaging. Schelling's first answer, given after a moment of silence in which the pianist seems to have contemplated his choice of words, does not even offer a direct response to Aeolian's somewhat disjunct question about whether Schelling is "actually playing to" people through his Duo-Art rolls. The pianist explains, somewhat vaguely, that he feels Duo-Art rolls offer playing that is of the same quality as he would play when in his best mood, and that the edited and polished records of other performers would do the same for them. Then, perhaps because his answer was in fact not very clear at all, and did not respond to Aeolian's original question, Schelling adds, "that makes my position clear, doesn't it?" Indeed it does give us more insight into his views, although it suggests that the pianist's position may not necessarily match his interviewer's.

In Schelling's final response, he mentions similar features to Grainger which he feels are accurately reproduced: rhythm, tempo, and phrasing. Both Grainger and Schelling focus on rhythm as one of the aspects they find to be most accurate on the reproducing piano, and the technical descriptions discussed above confirm that, compared with the elements related to dynamics, rhythm was reproduced with little alteration. But the two pianists can also be seen beating around the bush when it comes to fidelity of reproduction outside of rhythm and tempo. Aeolian's headings editorialize the pianists' responses, massaging their carefully chosen responses to suit broad statements about "perfection" and "ideals." Ultimately, in spite of the

[93] The Aeolian Company, Advertisement, *Cosmopolitan* 61, no. 5 (October 1916): 92-3.

ideas of living presence or scientific perfection that companies worked to convince the public of, reproducing piano technology relied just as much on a skilled human editor or interpreter as the pedal-powered player piano did, and these interviews suggest that pianists were not unaware of this. Staff editors were certainly very skilled in their work of interpreting numerical data into feasible dynamic levels, or listening to a live performance and marking down shorthand notes that would later give life to a monotone, hole-punched roll, but the bottom line is that these records were more of an impression than an exact reality.

These discrepancies between reproducing piano companies' lofty talking points and the working reality of recording piano systems does not mean that these rolls do not have great value and significance for listeners and researchers—a painted portrait is still a likeness that communicates a tidied-up and nicely posed perspective on an individual's actual appearance. In another sense, however, the recording process for reproducing rolls was more than a completely subjective impression of an artist's playing. The timings of the key strikes were not merely estimated by an editor working from a score or sitting near the piano with a pencil in hand, and the quotes we have from recording artists also suggest that they themselves genuinely found the rhythm and tempo of their rolls to be accurate.

Perhaps the 1926 Welte-Mignon advertisement discussed above that claimed the Welte recording process "actually photographed" the playing of the great pianists may have a reasonable parallel when we consider that the early twentieth century was the pinnacle of popularity for hand-coloured photographs. If black-and-white photographs can be compared with the automatically recorded notes on a reproducing piano roll, then perhaps the job of someone who dabbed coloured paint onto the photographs in order to replicate the original splendour of a landscape can be seen as similar to the editorial work of someone scribbling down a wavy line to

create a rough record of the dynamic colour of a piano performer's expression. In the end, creating a compelling musical representation of the pianist's work was more important than slavishly adhering to the quantified data spit out by the recording piano. This was particularly true in the early twentieth century, given the challenges of working within the confines of an early-twentieth-century pneumatic system, in which even the spark chronograph recorded data not from all 88 keys, but from groups of neighbouring keys, since the sheer bulk of a system that recorded information from each note would not have been feasible. Compared with systems from the past thirty years such as the Yamaha Disklavier, which captures performance data using electronic sensors and is able to play it back immediately on the same instrument using electromechanical solenoids, working with a pneumatic system necessitated far more creative workarounds for limitations of construction, capture, and conversion.

In the end, a detailed look at the player piano and the reproducing piano shows the extent to which both of these technologies relied on skilled human involvement, in spite of advertising claims to the contrary that focused on precision automation. This raises an additional question, then: were both technologies simply falling short of a fully automated ideal, or, do the messages around the player piano and reproducing piano hint at some hidden desires that these technologies also needed to fulfill? Recall the shift between early advertisements for piano-players, which focused exclusively on automation technology, and later advertisements, which successfully sold instruments by highlighting human involvement as a positive part of the playback process. With the reproducing piano, even though the playback process was fully automated, it was still important for companies to humanize the technology. Concerts involving the reproducing piano featured the instrument performing with a live orchestra, or playing back to back with the original pianist. Reproducing rolls were sold in large part by the name of the

artist on the roll, and the testimonials by these performers helped to assure customers that the reproductions they were hearing were just like hearing the artist in person. Recurring advertising themes of ghostly fingers and the "living presence" of concert artists in your living room created the impression that, although automation technology was at work to reproduce the performance, listeners were still hearing a human interpretation.

Ultimately, regardless of the exact specifications of the automation technology at work, customers were not looking for a soulless, automated rendition of a score. The player piano enabled its owners to create their own interpretations, and customers bought reproducing piano rolls in order to hear the interpretation of a professional artist (and, as these ads often concealed, they also heard the interpretative work of a professional editor!). At the beginning of this chapter, I highlighted a counterintuitive trend with player pianos and reproducing pianos, in which there was a correlation between increasingly automated performances and an increasing focus on attributing credit to human agents connected with these automated performances. Through this examination of how reproducing piano technology was marketed and how it functioned, I have shown that, much like in the case of the player piano, human involvement in musical performance was by no means erased by the presence of automation technology. In neither case were companies seeking to substitute soulless automation technology for human artistry—rather, the technology served to facilitate or transmit human performance. This fact does not change when we consider automation as it has been used in the later twentieth century and into the twenty-first century.

CHAPTER 3

Techno-Pop and Mechanization as Aesthetic

"We are not artists nor musicians. First of all we are workers."[1] This is a strange statement coming from Ralf Hütter, whose band, Kraftwerk, was recently honoured with a Grammy Lifetime Achievement Award for their pioneering work in the very art Hütter claims they do not practise. Short decades after advocates and aficionados of the player piano had spent years arguing that the use of automation technology did not disqualify player pianists from being considered as legitimate musicians, it is jarring to find a musician who uses another type of automation technology arguing the exact opposite point. And yet, this was Kraftwerk's aim: a rejection of the brand of artistic authenticity claimed by the transcendent virtuoso and the sweaty rock star, and the adoption of a new aesthetic that foregrounded artifice and automation. Kraftwerk—and other early techno-pop groups like them—were ground-breaking not only because of their pervasive use of synthesizers and sequencers, but because of their efforts to develop this aesthetic, which blurred the boundary between humans and machines.

This chapter bridges the gap between two case studies examining technological upheavals separated by nearly a century. Situated halfway between the decline of the player piano in the 1930s and the rise of holographic performance media in the 2010s, the 1970s were a defining decade in the adoption of synthesizers, sequencers, and drum machines as primary instrumental features in popular music. Wendy Carlos' *Switched-On Bach* thrust the Moog synthesizer into the limelight when the album clinched the number one slot on the *Billboard*

[1] Pascal Bussy, *Kraftwerk: Man, Machine, and Music* (Middlesex: SAF Publishing Ltd., 1993), 138.

Classical Albums chart for three years straight, from 1969 until 1972.[2] While Carlos' studio album was a runaway success, the synthesizer's incursion into the broader landscape of popular music performance initially met with reactions ranging from fascination to contempt—not unlike the responses to the introduction of player pianos and Vocaloid. In this interlude, I examine two prominent electronic bands in the late 1970s which originated on opposite sides of the globe: Germany's Kraftwerk and Japan's Yellow Magic Orchestra (YMO). Drawing primarily on journalism covering these bands' early international performances and recordings, as well as concert footage and interviews with the musicians, I trace the reception history of both groups, examining their role as harbingers of a musical era in which the visual link between a musician's physical actions on stage and the sounds heard by the audience was weakened, or even severed.

Scholars and music journalists have traced the cultural and musical factors that led to Kraftwerk's and YMO's inception, as well as the influence of the bands' work on the pop scene beyond their lifespans.[3] With musicians from British post-punk bands to Detroit techno artists to hip-hop pioneers looking to their work for inspiration, the legacies of YMO and Kraftwerk have extended far beyond techno-pop, as well as beyond their home countries. However, this study is the first scholarly work to consider Kraftwerk and YMO side by side. As two of the most influential techno-pop bands of the late 1970s, similarities between YMO's and Kraftwerk's instrumentation, reception, aesthetics, and the role of their national identities underscore

---

[2] Chris Morris, "Wendy Carlos Takes Her Moog Music To East Side Digital," *Billboard*, October 3, 1998, 69.

[3] For a general overview of the history of German electronic music and Kraftwerk's influence, see Sean Nye, "Minimal Understandings: The Berlin Decade, The Minimal Continuum, and Debates on the Legacy of German Techno," *Journal of Popular Music Studies* 25 (June 2013): 154-84. Mark Duffett, "Average White Band: Kraftwerk and the Politics of Race," in *Kraftwerk: Music Non-Stop*, ed. Sean Albiez and David Pattie (New York: Continuum, 2011), 194-213 looks back to the group's influences, from The Velvet Underground to James Brown. Michael K. Bourdaghs, "Happy End, Arai Yumi, and Yellow Magic Orchestra" in *Sayonara Amerika, Sayonara Nippon: A Geopolitical Prehistory of J-pop* (New York: Columbia University Press, 2012), 159-94 situates Yellow Magic Orchestra as a part of a diverse scene of popular "new music" in Japan in the 1970s, which would pave the way for much contemporary Japanese pop.

significant tensions in the crystallization of the synthesizer's meaning in popular music. Just as importantly, setting these two groups side by side, rather than focusing exclusively on the narrative of a single group, sheds light on different possible interpretations of synthesizer technology during its early years in popular music. In this chapter, I examine the late 1970s as a flashpoint in the history of automation technology in which mechanization became an aesthetic in its own right. This shift was part of a much larger upheaval in the 1970s, a symptom of a condition which futurist Alvin Toffler described as "future shock": a state of disorientation caused by an overwhelming rate of technological change.[4] The pressure to adapt to this new rate of change ultimately resulted in an all-encompassing focus on predicting what the future had in store, and this forward-thinking posture came to characterize much of the 1970s.[5] Techno-pop bands which featured futuristic-looking technology and intentionally fed the flames of automation anxiety were very much a part of the current in this stream.

Kraftwerk's International Success

The story of Kraftwerk's genesis as a band has been told in detail, and I am not seeking to add any new details to this existing narrative, but I will summarize a few of the important developments in Kraftwerk's early years that will remain relevant to the discussions in this chapter. The band's history begins with, and is underpinned by, the efforts of its two founding members: Ralf Hütter and Florian Schneider, who met as music students in an improvisation course at the Robert Schumann Conservatory.[6] The two musicians created Organisation zur

[4] Alvin Toffler, *Future Shock* (New York: Random House, 1970).
[5] Douglas Rushkoff, *Present Shock: When Everything Happens Now* (New York: Penguin Group, 2013), 14.
[6] Jon Savage, "Interview: Kraftwerk," *Red Bull Music Academy*, August 30, 2012, daily.redbullmusicacademy.com/2012/08/kraftwerk-interview, accessed May 28, 2019.

Verwirklichung gemeinsamer Musikkonzepte (Organization for the Realization of Common Music Concepts), an experimental music group with classical and electronic influences. Organisation released just one album with RCA Victor, and the commercial failure of this record contributed to the dissolution of the group. Hütter and Schneider continued to make music together from 1970-74 under the new name Kraftwerk, working briefly with a number of collaborators on three albums that tended towards free-form improvisation with experimental post-production effects.

In 1974, Kraftwerk released their first internationally successful album, *Autobahn.* It was with this record that the band established their new aesthetic and the trajectory that would come to define their music in the future. This aesthetic was decidedly modern, with a strong focus on themes of artifice and mechanization, from the futuristic appearance and timbre of the instruments the group used to the unemotional and satirical elements of their stage presence. The new Kraftwerk sound and image relied on heavy use of cutting-edge electronic technology; half-spoken, half-sung vocals; simple harmonies and lyrics that fit more in the realm of pop than experimentalism; and tidy, polished visuals on stage and in album artwork. Although *Autobahn* was the group's fourth album, Kraftwerk sought to establish the record as a reimagined "year zero," serving as a first release linked to the group's new aesthetic.[7] The radio edit of the album's title track cracked the top five on both sides of the Atlantic, and Kraftwerk arranged a twenty-one-stop tour of North America. The musicians cut their long hair short and purchased sharp-looking suits before departing for the U.S.—a decision that quickly set Kraftwerk apart visually. Their image was distinct not only from the long-haired, grungy look of many rock groups at the time, but from that of other experimental electronic groups in Germany, such as Tangerine

[7] Rob Johnstone, *Kraftwerk and the Electronic Revolution* (2008; New York: Films Media Group, 2013), eVideo.

Dream, who appeared in photos sporting jeans, hair past their shoulders, jewelry, casual shirts, and facial hair.

On tour, Kraftwerk stunned and fascinated audiences in the U.S. and Canada with their meticulous appearance, and their complex and pervasive use of synthesizers. [8] Although these instruments had been used previously in popular music, they used more for occasional effects, and not as the basis of an entire band. The synthesizer had spent the 1950s and '60s as an esoteric tool used by academic musicians such as Milton Babbitt, and had only begun to see use in popular music after Bob Moog gave his synthesizers a keyboard interface in the mid-1960s.

Recalling their first American show in New York's Beacon Theater, Kraftwerk percussionist Wolfgang Flür describes the impact of the contrast between the typical guitar bands who opened the concert and Kraftwerk's manicured appearance and futuristic synths: "When Ralf [Hütter] panned the thunderous sounds from left to right and back again over the whole stereo width of the stage during 'Autobahn', all I could see were open mouths and bewildered faces with wide-open eyes."[9] Kraftwerk's original twenty-one tour dates stretched longer and longer, turning into a three-month-long excursion, and headlines trickling back to Germany described how the band was "conquering" and "electrifying" America, with their electronic sound described as being "Like Air Conditioning" in a hot summer.[10]

Descriptions of the group that accompanied these headlines revealed a common underlying conception of the band's sound: in contrast to the warmer (i.e., more emotional) feel

---

[8] Wolfgang Flür, Janet Porteous, and Barbara Uhling, *Kraftwerk: I Was a Robot* (London: Omnibus Press, 2017), 76.

[9] Ibid.; It is worth noting that every account has its biases, and not all accounts of early Kraftwerk concerts were glowing reviews. Another journalist writing in 1975 reported that "at least half the people I took, in fact, fell asleep." Lester Bangs, "KRAFTWERKFEATURE, Or, How I Learned To Stop Worrying & Love the Bahn," *Creem*, September 1975, 30-1.

[10] Flür, Porteous, and Uhling, *Kraftwerk*, 80-90.

and sound of rock groups, Kraftwerk's futuristic equipment, tightly buttoned appearance, and motoric beats came across as cold and unemotional, prompting comparisons not only to air conditioning, but also puppets, robots, and stereotypically stoic and disciplined Germans. In 1978, the release of *The Man-Machine* prompted *Rolling Stone* to describe the album as "so antiseptic that germs would die there."[11] Many of these descriptors underscore facets of Kraftwerk's carefully sculpted aesthetic of mechanization and modernism. Theo Cateforis has argued that by the early 1980s, the synthesizer had become the defining symbol of musical modern identity.[12] In examining Kraftwerk's reception, we are able to glimpse early discourse around the crystallization of this symbol and its relationship to anxieties around automation and mechanization. There is an important contrast here between the perception and use of synthesizers and those of player piano technology: although the player piano, 75 years prior, had similarly relied on mechanization to produce music, both the physical cabinet of the player or reproducing piano and the advertising messaging around the device worked to conceal the mechanical, automated aspects of the technology. Kraftwerk, in shaping their sound and image in the manner described above, were working to do exactly the opposite, foregrounding the mechanical elements of their performances. By the time this group appeared in the popular music scene, mechanization had moved from a means of musical production to an intentional aesthetic choice.

---

[11] Mitchell Schneider, "The Man-Machine," *Rolling Stone*, May 18, 1978, rollingstone.com/music/music-album-reviews/the-man-machine-96960, accessed May 27, 2019. Given that many of the synths Kraftwerk used, such as the Minimoog, are perceived now as having a "warm" sound, this initial "cold" reception provides an example of changing perceptions of musical technologies.

[12] Theo Cateforis, *Are We Not New Wave? Modern Pop at the Turn of the 1980s* (Ann Arbor, MI: University of Michigan Press, 2011), 151.

German Automata: Two Themes in Kraftwerk Reception History

Both the focus on mechanization and the connection to German cultural clichés proved to be important factors in Kraftwerk's reception. Many interviews with group members and reviews of the band centre on one or both of these issues, as does the scholarly literature examining Kraftwerk. Recollections from the group's members, as well as early journalism on the band, show that this two-pronged approach to Kraftwerk's reception was in immediately in play from the moment they set foot in North America to tour *Autobahn*. In an interview with band member Karl Bartos, who worked with the group from 1975-1991, the percussionist recalls an early encounter with stereotypes upon their arrival in the U.S. for their 1975 tour, during which "everyone" was greeting the band with "heil Hitler" salutes. "They were just making fun and jokes and not being very serious but we'd had enough of this idea," Bartos said.[13] Kraftwerk had adopted their stiff, stoic image at the outset of their North American tour, and while the new aesthetic created a striking contrast with the appearance of long-haired rock groups and complemented the tidy appearance of their sparse stage and electronic equipment, it also fed directly into hackneyed American stereotypes of Germans.

Kraftwerk's relationship with postwar national identity is a complex issue that extends well beyond a simple matter of taking advantage of clichés. Sean Albiez and Kyrre Tromm Lindvig have argued that Kraftwerk's gestures to stereotypes of the stoic German in the 1970s were ironic critiques, and argue for the importance of viewing Kraftwerk's performances through the lens of this intentional and self-aware satire, both abroad and at home.[14] Kraftwerk was

---

[13] John Doran, "Karl Bartos Interviewed: Kraftwerk And The Birth Of The Modern," *The Quietus*, March 11, 2009, thequietus.com/articles/01282-karl-bartos-interviewed-kraftwerk-and-the-birth-of-the-modern, accessed May 27, 2019.

[14] Sean Albiez and Kyrre Tromm Lindvig, "*Autobahn* and Heimatklange: Soundtracking the FRG," in *Kraftwerk: Music Nonstop*, ed. Sean Albiez and David Pattie (New York: Continuum, 2011), 15.

certainly aware of their reception both in Germany and internationally. Often, however, journalists' habits of labelling Kraftwerk as robotic scientists and efficient Germans stemmed from comments made by the musicians themselves. In interviews from the late 1970s, the band's founding members Ralf Hütter and Florian Schneider can be seen playing along with repetitive questions from journalists regarding their alignment with cultural clichés, but while these interviews sometimes reveal their efforts to problematize simplistic national stereotypes, other conversations with music journalists in the U.S. seem to exacerbate them. Ulrich Adelt has argued that Ralf Hütter's interviews in German tend to focus less on German identity, and offer more balanced views than his interviews in English, likely because of Hütter's limited English abilities.[15] In interviews with English-speaking journalists, however, Hütter and Schneider can still be seen intentionally curating their group's image, and repeatedly sticking to particular talking points that helped to underscore the key aspects of the philosophy and image they wanted to create.

In 1975, the notoriously provocative music journalist Lester Bangs interviewed Hütter and Schneider for an article in *Creem* magazine. Bangs opened his article with a freewheeling essay that linked subjects including the German invention of methamphetamine, the Third Reich, and the idea of a machine revolution. In his typically unapologetic and edgy style, Bangs asserted, "[Rock is] being taken over by the Germans and the machines….The stupnagling success of Kraftwerk's 'Autobahn' is more than just the latest evidence in support of the case for Teutonic raillery, more than just a record, it is an indictment. An indictment of all those who would resist the bloodless iron will and order of the ineluctable dawn of the Machine Age."[16]

---

[15] Ulrich Adelt, *Krautrock: German Music in the Seventies* (Ann Arbor: University of Michigan Press, 2016), 27.
[16] Lester Bangs, "KRAFTWERKFEATURE, Or, How I Learned To Stop Worrying & Love the Bahn," *Creem*, September 1975, 30-1.

Here, Bangs invokes both the anxiety of a German takeover and a technological takeover for a readership consisting of American rock fans who would have already viewed electronic music and its associated automation technologies with suspicion. Bangs unpacks both German identity and technological dread in detail in his interview, and I will explore both in turn here.

One of the more startling moments in this interview, even given Lester Bangs' reputation for irreverence, comes in the context of Bangs asking whether, given Kraftwerk's penchant for machines, the musicians might be pleased with the development of electrodes implanted in the brain that were capable of translating thoughts directly into sound. When Ralf Hütter expressed enthusiasm for the idea, Bangs, closing the jaws on the trap, suggests that this would be "the final solution for the music problem." The transcription of this interview prevents the reader from learning whether Bangs succeeded in provoking any kind of visible reaction from Hütter or Schneider. On paper, Hütter seems to respond calmly without any acknowledgement of the Nazi reference, when he replies, "No, not the solution. The next step." Regardless of whether Hütter intentionally avoided reacting to the "final solution" jab for the sake of the interview, Bangs was not the only participant in this exchange who was making carefully targeted statements to provoke a response or build up an image for readers. Lester Bangs' tactics, aimed at reinforcing certain connections to technological and cultural anxieties, are matched by those of the German interviewees, even if the latter were seemingly more polite.

By far the longest uninterrupted quote in Bangs' interview comes from Ralf Hütter, whom Bangs gives ample room for an extended explanation of the German cultural situation after the war. Hütter describes how German music and entertainment was replaced with American imports, and names his generation, and Kraftwerk in particular, as the first to create space for a new cultural identity. Comparing Tangerine Dream with his group, Hütter points out

Tangerine Dream's English name, and claims that they created an Anglo-American identity onstage. Kraftwerk, Hütter states, emphatically rejected this concealment of their German background: "We cannot deny we are from Germany, because the German mentality, which is more advanced, will always be part of our behavior. We create out of the German language, the mother language, which is very mechanical, we use as the basic structure of our music. Also the machines, from the industries of Germany." Here, the provocative nature of Hütter's statements about the German mentality and language does not seem to stem, as Adelt has argued, from any fumbling related to a lack of facility in English. In this interview, we see Hütter and Schneider making intentional statements that help to solidify Kraftwerk's modern, mechanized aesthetic, and link it to their identity as a German group who think like Germans and sing in German and use German technology (unlike Tangerine Dream, who are painted here as sell-outs).

Both sides of this interview seem engaged in a drawn-out posturing contest, seeking to manipulate the flow of the conversation, while avoiding direct engagement with the other party's points. At the conclusion of the interview, both parties have simply exhausted their agendas, and the conversation reaches a stalemate. Hütter and Schneider are the ones to wrap up the conversation, and cease their smilingly tolerant pretenses in doing so. Bangs describes how "Florian abruptly stood up, opened the window to let the smoke out, then walked to the door and opened it, explaining with curious polite curtness that 'we had also an interview with Rolling Stone, but it was not so long as this one. Now it is time to retire. You must excuse us.'" Both Lester Bangs and Kraftwerk intentionally employed German stereotypes to underscore their messages throughout this interview, but they each do so with different goals in mind. While Kraftwerk's generalizations are just as sweeping as Bangs', they are attempting to lay the

groundwork for an aesthetic niche which the band could occupy in the minds of American readers and listeners.

For many rock readers in 1975, who valued music that upheld values such as personal expression and visible technical mastery, Kraftwerk represented a next step in an inevitable and dreaded process of dehumanization in music. Bangs plays directly to these fears of a loss of humanity, painting an unsettling image of electronic music past and future for his readers in the prose leading up to his interview with Kraftwerk:

> In the beginning there was feedback: the machines speaking on their own, answering their supposed masters with shrieks of misalliance. Gradually the humans learned to control the feedback, or thought they did, and the next step was the introduction of more highly refined forms of distortion and artificial sound, in the form of the synthesizer, which the human beings sought also to control. In the music of Kraftwerk, and bands like them present and to come, we see at last the fitting culmination of this revolution, as the machines not merely overpower and play the human beings but absorb them, until the scientist and his technology, having developed a higher consciousness of its own, are one and the same.[17]

Bangs' opening intonation of "in the beginning" lends his narrative the gravity of a Genesis-like account of chaos into order, but here, the eventual arrival of order and control are hollow, and the order is not man-made but imposed by machines. Humanity's loss of control is subtle and gradual in Bangs' narrative: first, they think they have successfully controlled feedback; later, they merely seek to control the synthesizer; and finally, the machines have revolted, overpowering and absorbing human beings.

Bangs' description of scientist and technology becoming one and the same, however ominous it was meant to sound, appears at first blush to be not altogether different from Hütter and Schneider's own descriptions of their group's concept. "Kraftwerk – Die Mensch Maschine" first appeared on tour posters in 1975, and the band's 1978 album took this same slogan as its

[17] Ibid.

title. The idea of "the man-machine" is pervasive in Hütter's and Schneider's interviews, but neither musician intends the term to reflect an erasure of the "man" in their music. Ralf Hütter emphasized this distinction repeatedly in his interviews. Of the group's adoption of "the man-machine" as a descriptor, Hütter said, "we call ourselves 'the man machine', which means the machines are not subservient to us and we are not the sounds of the machine, but it's some kind of equal relationship, or you might even say friendship between man and machine, and not opposed."[18] David Pattie argues that although these remarks were used as fuel for negative press concerning the band's robotic image, read from a different angle, Hütter was really only describing the integration of artist and instrument.[19] Just as playing a guitar does not dehumanize the guitarist, Kraftwerk's mastery of technologically advanced instruments did not represent an escape from reality, but a meaningful interaction with technologies that were becoming an unavoidable element of everyday life. It has largely been due to the nature of this relationship between technology and the ordinary world that Kraftwerk has historically been viewed as one of the most influential groups in the development of techno, and also a reason why sampling the group continues to confer a sense of credibility on contemporary artists. It is important to note that Bangs' framing of dehumanization as a fearful process for rock readers was only one perspective on these aesthetic choices.

The Spanish philosopher José Ortega y Gasset approached this issue from a different angle in 1925, arguing that while the music of the Romantic era focused on the expression of personal feelings, modern music required a certain impersonal distance to appreciate fully:

---

[18] Ralf Hütter, "Interview," *WSKU (Kent – Ohio),* first broadcast June 19, 1978, cited in David Pattie, "Introduction: The (Ger)Man Machines," in *Kraftwerk: Music Non-stop*, ed. Sean Albiez and David Pattie (New York: Continuum: 2011), 2.

[19] David Pattie, "Introduction: The (Ger)Man Machines," in *Kraftwerk: Music Non-stop*, ed. Sean Albiez and David Pattie (New York: Continuum, 2011), 9.

"Instead of paying attention to the sentimental echo of the music in ourselves…this music is something external to ourselves: it is a distant object, perfectly localized outside of ourselves and in front of it we feel like pure contemplators. We enjoy the new music concentrating towards the exterior. It is the music that interests us, not its resonance within ourselves."[20] Ortega y Gasset labelled this focus on objectivity over private feelings as "dehumanization." The term was not intended to suggest a fearful loss of human agency in musical performance, but a form of contemplation stripped of an individual's inner emotions and anxieties. Kraftwerk's aesthetics mirror certain aspects of Ortega's philosophy, opting to visibly separate personal feeling from musical performance, and serve as contemplators and mediators of electronic music.

The line of reasoning which contends that the use of technology does not correspond with dehumanization is highly reminiscent of the logic which player piano companies wielded in their promotional material in the early twentieth century. Advertisements and sales pitches sought to convince potential customers that the assistance a player piano provided did not strip them of their ability to express their own interpretations. Since the piano itself was already an "incessant piling up of mechanism" which assisted musicians in quickly and accurately striking strings with hammers, the player piano was simply a small step that included the technologies of the day but did not dehumanize users or compromise their self-expression.[21] For Kraftwerk, the synthesizer, too, was part of the everyday technological landscape which they depicted in their music: songs by this group took European cars and trains as their subject matter, rather than spaceships and otherworldly experiences.

---

[20] Jose Ortega y Gasset, *El Espectador III*, 12, quoted in M. J. Neves, "The Dehumanization of Art: Ortega y Gasset's Vision of New Music," *International Review of the Aesthetics and Sociology of Music* 43 (December 2012): 369.

[21] Ernest Newman, *The Piano-Player and Its Music* (Edinburgh: Riverside Press, 1920), 18.

There was one important difference, however, between the player piano as a tool, and Kraftwerk's electronic instruments as tools: the synthesizers, claimed Hütter and Schneider, contributed back to their users in an individual way, becoming more like creative, intelligent partners than instruments such as pianos or guitars could have been. By speaking of the use of technology as a "cooperation" between men and machines, Kraftwerk also gave significant agency to the equipment. In a radio interview, Hütter described this reciprocal relationship in greater detail, and this careful explanation is worth reproducing at length:

> We always had this strong relationship between ourselves and our music machines. We are always plugged into our electrical systems, and we're always attached to our machinery. We produce sounds with musical machines….To us it was quite direct to speak of The Man Machine because that's what we really are. It's the connection and cooperation of men and machines, because sometimes we play our machines, and sometimes they play us. It's like a dialogue: sometimes we switch on certain automatic machines and…they play very nice music…and we listen. We spend a lot of time listening to our machines, and then we change the programs and reset them. So it's like an exchange of ideas between us two. That's what "The Man Machine" is about, and also certain aspects in society where people are mechanically reproduced, or bought and marketed, or robots: the original Russian word "robotnik" means "worker." That's really our identity, what we are.[22]

Hütter's description has some important areas of overlap with Bangs' description of a future in which a "scientist and his technology, having developed a higher consciousness of its own, are one and the same." Rather than stating that Kraftwerk's machines are always plugged in, Hütter states that Kraftwerk's human musicians are always plugged into their electrical systems and attached to their machines, conjuring an image of the band members themselves as electronic terminals hooked into a technological system. Sometimes the musicians of Kraftwerk play their instruments, and, quite unlike a guitar, sometimes the instruments play the musicians of Kraftwerk. Automation technology permitted the group to figuratively and literally take a step

[22] Ralf Hütter, "Interview," *Beacon Radio, Birmingham, UK*, June 14, 1981, retrieved from archive.org/web/20081202043525/http://kraftwerk.technopop.com.br/interview_122.php, accessed May 30, 2019.

back and listen from a distance to a pattern looping on a sequencer in order to consider new layering effects or new beats. While the group's working relationship with these machines was a valuable element of their creative process, for some listeners, placing automated technology on an equal footing with musical artists also sparked some anxiety.

Returning to Lester Bangs' 1975 interview, it is not only Kraftwerk who are making significant statements about automation technology and music. In his introductory write-up, Bangs offers an insightful commentary on automation anxiety in music, beginning with a rhetorical question: "if any idiot can play [Chuck Berry's guitar lines], why not eliminate…mistakes altogether, punch 'Johnny B. Goode' into a computer printout and let the machines do it in total passive acquiescence to the Cybernetic Inevitable?" Bangs' question, although here it is delivered tongue in cheek, is one of the same questions that was central to the reception of player piano technology, and is part of the discussion around singing synthesis technology in the twenty-first century. It was not a new idea in 1975, nor were the anxieties that came with it. Bangs explained, "People used to complain about groups like the Monkees and the Archies like voters complain about 'political machines,' and just recently a friend of mine recoiled in revulsion at his first exposure to Kiss, whom he termed 'everything that has left me disgusted with rock 'n' roll nowadays—they're automatons!'"

Automatons, the very same mechanical reproductions that had provoked fascination and fear for centuries, reappear here in 1975 as a knee-jerk criticism of a rock band that, from one listener's perspective, failed to display sufficient authenticity. The Monkees and The Archies are understandable targets of censure at this time for listeners who were focused on preserving their concept of musical authenticity, since both were fictional bands that were assembled specifically for television shows. But why would Kiss, with their dramatic and aggressive stage antics, be

compared with automata? One possible explanation could be that this person perceived Kiss' pyrotechnic, stunt-filled performances as lacking the same human sincerity or expressivity that others would find missing from the music of electronic bands such as Kraftwerk and Yellow Magic Orchestra. Ultimately, however, we cannot speak for Bangs' friend, and furthermore, the more significant observation here is not from this friend, but from the journalist himself. At this point, Lester Bangs could have wrapped up his preamble, slapped a similar accusation of robotic insincerity on Kraftwerk, and proceed to the interview. Bangs did not do this. He first followed up on his friend's comment, not with an affirmation, but with a more profound insight: "What he failed to suss was that sometimes automatons deliver the very finest specimens of a mass-produced, disposable commodity like rock." Authenticity, Bangs was suggesting, isn't always the point. Sometimes rock, as a commercial product, is better served by precision in live performance than it is by spectacles of performed emotion. Kraftwerk was not attempting to meet the expectations of the 1970s rock aesthetic and coming up short; they were rejecting the myth of authenticity altogether. Although Bangs' article drips with cynicism, this insight aligns him more closely with Kraftwerk's aesthetic philosophy than perhaps either party would care to admit.

As with their statements regarding German identity, Kraftwerk's input into the discussions of technological themes in this interview has its own goals. A comment from Hütter later in the interview suggests not only a link between Kraftwerk's ideals and those of the advocates of the player piano decades earlier, but a different perspective from Bangs on the role of automation:

> We use tapes, prerecorded, and we play tapes, also in our performance. When we recorded on TV we were not allowed to play the tape as part of the performance, because the musicians' union felt that they would be put out of work. But I think just the opposite:

> with better machines, you will be able to do better work, and you will be able to spend your time and energies on a higher level.

Within this quote, there are two themes that recur in every new instance of automation technology discussed in this dissertation. The first is automation anxiety: the fear that automation will replace human beings, especially in their jobs. Musicians' unions seeking to limit the use of automation technology in live performance was not a new problem in 1975, and it is an issue that still persists in the twenty-first century, causing labour disputes and raising questions about the importance of creative labour.[23] When automation technology directly replaces a human musician's role—as when "canned" music replaces a live guitarist, or a "virtual" orchestra replaces a group of human orchestral musicians—the cause for concern (and the potential value of union protection) is far more clear-cut than when a human musician records his or her own tape, uses a loop pedal, or programs a sequencer in order to perform more complex works.

Hütter's last point regarding "doing better work" is significant: in some cases, working with automation technology offers musicians more than the ability to avoid collaboration—using a machine to handle certain musical elements can free up mental or physical resources for other tasks. With the player piano, this same concept was taken to new extremes in music. What if automation technology could completely obviate the need to acquire keyboard technique? Hütter's argument—that using better machines enables better work, and permits more time and energy to be spent on a higher level—was exactly what advertisers for player pianos were offering: buyers could skip the scales and arpeggios, and focus all of their attention on crafting their ideal interpretation.

---

[23] Michael M. Kennedy, "The 'Death' of Live Musical Theater? 'Virtual Orchestras' and the 2003 Broadway Musicians' Strike," paper presented at the Annual Meeting of the American Musicological Society, Rochester, New York, November 9-12, 2017.

The new type of symbiotic relationship between performers and technology modelled by Kraftwerk drew a great deal of attention, but also raised misgivings about the increasingly technological nature of music. In an interview for *Electronics & Music Maker*, Hütter confirmed that Kraftwerk's performance aesthetic was more than a natural relationship between musician and instrument and was meant to evoke the robotic and mechanical: "So many people move or even jump around on stage these days and it's important for our music that we do not do this - our rather static performance is also necessary for emphasising the 'robotic' aspect of our music."[24] In the late 1970s, many saw this robotic style of composition and performance as the beginnings of the dehumanization of music-making. Kraftwerk lacked a relatable and engaging frontman, and in most performances, the four performers barely glanced at the audience. They were not the only group, electronic or otherwise, to deliver seemingly cold or stiff performances, however and there was often a musical rationale for this posture.

Gary Numan, frontman of the electronic band Tubeway Army, explained: "The boys have their machines, and they have [to] stand there and play them, they very rarely look up and they never smile, because they've got to concentrate. They've got an awful lot to do, no time to stand around smiling and carrying on."[25] Later in the 1980s, shoegaze bands such as My Bloody Valentine earned their genre its myopic label with their focus on guitar pedals and introspection. But for music journalists such as David Buxton, Kraftwerk embodied the ultimate end of the gradual erasure of the pop performer as the star of the show—a claim that would recur years later in discussions of holographic performances.[26] These recurring anxieties around dehumanization

[24] Mike Beecher, "Kraftwerk Revealed: An Interview with Ralf Hütter," *Electronics & Music Maker,* September 1981, 62-3.
[25] Quoted in Steven Grant, "Is Gary Numan Eclectic?" *Trouser Press*, May 1980, 6.
[26] David Buxton, "Music, the Star System, and the Rise of Consumerism," in *On Record: Rock, Pop and the Written Word*, ed. Simon Frith and Andrew Goodwin (New York: Routledge, 2006), 427-40.

and the erasure of the performer largely stem from Kraftwerk's emphatic rejection of 1970s rock ideals, and the refinement of their own aesthetic. Kraftwerk's music and stage presence ran counter to the values of rock authenticity, which were rooted in hard-won instrumental skills, and sincerity of feelings demonstrated in sweaty physicality. By contrast, Kraftwerk's stiff posture and downturned gazes shifted focus from the human labour onstage to the mechanized labour carried out by the sequencers and synths. Their simple harmonic progressions and repetitive melodic fragments were a target for critics, who argued that their music did little to convey a sense of virtuosic skill or to communicate emotions of any sort.

Music journalists in the 1970s frequently positioned Kraftwerk as the polar opposite of the pop and rock performers typical of the time, and Kraftwerk did nothing to dissuade them. Of their carefully curated reputation and tidy shirts and ties, Karl Bartos recalls, "[Ralf Hütter] wanted to make it clear that Kraftwerk were different from any other pop or rock group and he wanted this image of a string ensemble. I didn't like it that much, I thought I always looked like a banker." [27] Bartos wasn't the only techno-pop musician who would go on the record complaining about his group's stuffy outfits. A member of the British group Orchestral Manoeuvres in the Dark, which, in 1982, also sported short haircuts and shirts and ties not unlike Kraftwerk's, felt that his group resembled "bank clerks" onstage.[28] In his work on new wave music in the 1980s, Cateforis describes the performance aesthetic of Tubeway Army several years after Kraftwerk had adopted their robotic postures and impassive stage presence in concert, and the many similarities are striking:

> Caked in a sheen of ghostly white makeup (applied at the show's behest to hide his acne) and black mascara, [Gary] Numan presented an emotionally detached, unsmiling visage that would set a striking precedent for his future stage shows. Taken as a whole, the players' stiff postures, black uniforms, and "concentrated" approach to their instruments

[27] Pascal Bussy, *Kraftwerk: Man, Machine and Music* (Sarajevo: SAF Publishing Ltd., 2004), 64.
[28] Bob Doerschuk, "Orchestral Manoeuvres in the Dark," *Keyboard*, April 1982, 30.

> made them appear as if they were technicians in a work cubicle rather than musical performers….They undertook their musical roles in a dispassionate, robotic manner. The presumably separate realms of humans and machines had bled over into one another in Tubeway Army's presentation. In many ways the band had left behind rock's normal expressive domain, and was closer in spirit to the performing automata of the eighteenth century or Frederick Winslow Taylor's early twentieth-century conception of "scientific management," which equated industrial human labor with mechanical efficiency.[29]

Many of these same aesthetic elements permeated Kraftwerk's stage presence as well as their music, from the emotional detachment and concentration onstage to the automata comparisons and overlap between humans and machines. David Pattie's description of a Kraftwerk concert, although the performance in question was given in the twenty-first century, describes performance practices that the band already adhered to in the late 1970s: "We have reached an apotheosis of sorts; not the typical kind one might expect in a live event, where the musician's investment in the music is complete, but one in which all the obvious signs of investment have been erased. This is tidy: all clutter discarded, no sweat, no effort."[30] Pattie argues that this type of performance runs completely counter to the prevailing notion of performances as public demonstrations of the investment of the musicians. Performers, then, typically proved their investment in their performances by engaging in and displaying the things that Kraftwerk lacked: dramatic physical gestures, interaction with the audience, and visible evidence of emotion.

By these criteria, none of the case studies in this dissertation qualify as performances, but Kraftwerk perhaps run afoul of this definition by the largest margin. These performers are not simply machines or holograms that can be excused for falling short of a performance that demonstrates investment. They are human performers exerting effort to suppress expressive

[29] Cateforis, *Are We Not New Wave?*, 169.
[30] David Pattie, "Kraftwerk: Playing the Machines," in *Kraftwerk: Music Non-Stop*, ed. Sean Albiez and David Pattie (New York: Continuum: 2011), 119.

performance gestures and appear machine-like.[31] For some, this hybridity between humans and technology in the man-machine concept was always uneasy, and Kraftwerk was never successful in making a coherent and significant statement about either technology or German identity.[32] John T. Littlejohn, in his analysis of Kraftwerk's lyrics, contends that after the success of *Autobahn*, the group "sold out" in order to maintain their international prestige.[33] In examining the lyrics for songs such as "The Robots," "The Model," and "The Hall of Mirrors," Littlejohn argues that many of Kraftwerk's hits hint at a loss of identity, rather than undertaking any kind of meaningful identity construction.[34]

"The Robots" has a particularly interesting performance history in Kraftwerk's concerts. In 1977, the group invested in a set of lookalike dummies which had specially crafted faces made to resemble each band member. These mannequins, which were sometimes referred to by the band and the press as robots, were outfitted with Kraftwerk's trademark red and black outfits, and had moveable mouths. On May 19, 1978, Kraftwerk released *The Man-Machine*, and just over a week later, the robot-mannequins were presented for the first time on the TV show *19.30*, and were used in the music video for the new album's first track, "The Robots."[35] At a launch party for *The Man-Machine* held in Paris, Kraftwerk set up their new robots and required the invited journalists to pose their questions to the lookalikes, which were equipped with pre-recorded answers. Kraftwerk were pleased with the results of their setup ("Robots are patient; they don't object to anything or protest," noted Wolfgang Flür); the journalists, less so.[36]

---

[31] Gronholm notes that Flür and Bartos were hired mostly on the basis of their ability to control their movements in performance and refrain from playing dramatically (Gronholm, "Kraftwerk," 77.)
[32] Adelt, *Krautrock*, 27.
[33] John T. Littlejohn, "Kraftwerk: Language, Lucre, and Loss of Identity," *Popular Music and Society* 32 (2009): 635-53.
[34] Ibid., 639-41.
[35] Flür, *Kraftwerk*, 139-40.
[36] Ibid., 141.

"The Robots" become one of Kraftwerk's best-known songs, and the lookalike robots went on to become fixtures in the group's photos and performances, placed in front row seats at concerts, and intercut with footage of the human musicians in a music video. In the early 1990s, the mannequins were replaced by actual robots whose arms moved in synchronized choreography, and these machines took the spotlight for performances of "The Robots," standing in for their human counterparts at centre stage. These figures, despite their new movement capabilities, appeared less lifelike than the mannequins they replaced, however, and intentionally exposed their mechanical workings. The four automatons retained the moulded heads of the musicians, but no longer wore their signature red shirts and black ties. Below their detailed faces, the robots had only a featureless grey torso and hands connected by metallic arms with exposed rods and wiring. In place of the legs that had once sported sharp dress pants, a pole supported the severed torsos. For nearly thirty years, these robots delivered nearly identical performances at Kraftwerk's shows. Their slow, sweeping arm movements—ironically more dramatic than those of the human performers—and the projected visuals on the screen behind them have remained fairly consistent over the years. Perhaps the biggest change has also been the most gradual: the rubbery faces on each robot, replaced and kept up to date over time, have gradually aged alongside those of their human counterparts.

When "The Robots" is performed in concert using these pre-programmed figures, there is no real live performance taking place on stage, if "live" requires the active involvement of human musicians. And yet, across decades of concert footage showing performances this song, audiences continue to cheer throughout the performance, as though the robotic stand-ins were capable of hearing and responding. The awkwardness which sometimes caused audiences at reproducing piano performances to hesitate and consider whether they ought to applaud a

mechanical performance is absent here, perhaps because the original artists themselves are still nearby, and still able to receive the cheers and applause, even if it is only from backstage.

During performances of "The Robots" in the 1970s, before the automatons were visually engaging enough to hold an audience's attention for several minutes, the lookalike mannequins were sometimes seated in the front row, where the camera could occasionally show them seemingly watching the concert, while Kraftwerk themselves delivered an extra-stiff performance, standing as still as possible, jerkily moving their hands and arms to play their instruments, and barely moving their lips when singing. But in Kraftwerk's artistic and technological vision, the ultimate goal was never to deliver human performances that looked or sounded artificially stiff, and, as such, these early performances of "The Robots," as well as the original mannequins, did not fully realize the group's ideals. Nor was Kraftwerk working towards a musical aesthetic in which human musicians no longer had a creative role to play. During the past few decades, technology has caught up with Kraftwerk's philosophy, enabling them to physically walk off of the stage and leave the performance of "The Robots" in the automated hands of four mechanical dummies. And yet, the lookalike robots have never been tasked with delivering an entire concert. Their role is only relevant—and only meaningful—during a song that is specifically about robots.

Of course, it is important to note that the robots' arm-waving is not actually producing any music, and the four figures serve only as moving bodies to which the audience can anchor their gaze. But these human-faced machines are important because they serve as a visual representation of Kraftwerk's "man-machine" concept. These robots, which are given featureless torsos and poles instead of legs, are also intentionally given detailed human faces. Visually, the robots are hybrids, a synthesis of expressive human facial features and smooth metallic structural

components. The concept of "the man-machine," too, is that of a hybrid—a synthesis of technology and expressive communication. In 1978, the best Kraftwerk could do was to deliver a stilted performance in which they behaved like robots—humans taking on stereotypical mechanical mannerisms. With sequencers and mechanized robots, Kraftwerk was capable of delivering a performance entirely devoid of any representation of humanity. However, they chose not to, opting instead for a performance with human faces and expressive mechanical bodies that showed the relationship between man and machine, and also gestured to the relationship which Lester Bangs forecasted, in which the musicians and their technology become one. When Kraftwerk steps off the stage during performances of this song, and the rubber-faced robots begin their synchronized choreography, the performance may be automated, but it still wears the face of human creativity.

If early criticism of Kraftwerk's music played up fears of automation technology, warning that "the robots are coming," then with this song, the robots are here, but the legless automated bodies onstage haven't taken over human musicianship; they have been built to represent the nature of a new type of music born of a symbiotic collaboration with human musicians. "It's…no longer you and I, it's It," explained Hütter and Schneider in 1975, "It's feedback. You can jam with an automatic machine, sometimes just you and it alone in the studio."[37] Ultimately, "the man-machine" was another way of labelling an already-familiar concept that connects each case in this study: the way in which technology and automation can provide access to new forms of music-making, and, rather than stifling or replacing human artistry, can amplify creativity.

[37] Bangs, "KRAFTWERKFEATURE," 30-1.

Yellow Magic Orchestra: Technology and Identity in Eastern Techno-Pop

Kraftwerk was not the only electronic group turning heads with a stoic image and synthesized sound in the late 1970s, and they were also not the only such band to receive recognition in their home country only after they had successfully toured and had hit songs overseas. After releasing their first album in 1978, the Japanese electronic trio Yellow Magic Orchestra (YMO) crossed the Pacific rather than the Atlantic to reach American performance halls in 1979, four years after Kraftwerk's *Autobahn* tour. YMO was and still is frequently described in relation to Kraftwerk. Although the Japanese band can also be categorized as a techno-pop group and there are notable similarities between the two ensembles, these two groups navigated issues of cultural identity and the use of technology in different ways, offering a different take on a modern, mechanized performance aesthetic. By overlaying YMO's different approaches on these same issues, I offer a more complete picture of these musical technologies and related aesthetic strategies in the 1970s.

Beginning in 1976, Haruomi Hosono, Yukihiro Takahashi, and Ryuichi Sakamoto, three Japanese musicians with established careers, connected as collaborators on a number of projects initiated by individual group members, ranging from Hosono's electro-exotica album, *Cochin Moon* to Sakamoto's electronic fusion album, *The Thousand Knives of Ryuichi Sakamoto*. The trio recorded their first album as a band in 1978, calling themselves *Yellow Magic Orchestra*—a play on the group's Asian origins as well as Japan's recent interest in black magic.[38]

YMO's self-titled first record was quickly followed by a second album in 1979 titled *Solid State Survivor,* released the same year in which the trio undertook their first international tour. After the band's initially tepid reception in Japan, the timely pairing of *Solid State Survivor*'s release and positive reviews from their tour overseas quickly shot them to stardom at

[38] John Lewis, "Back to the Future," *The Guardian*, July 4, 2008.

home as well as abroad. YMO scored hits in Japan and the West, and *Solid State Survivor* became Japan's best-selling album of the year in 1980—the year after its initial release. This success secured their position as fixtures in the Japanese musical landscape in the early 1980s. Drawing on the modern appeal of their synthesizer-heavy, futuristic sound, YMO was able to forge mutually beneficial alliances in the 1980s with electronics and tech retailers such as Seiko and Sony, the latter of which used a YMO song in a prominent cassette tape advertisement, creating a link that enhanced the group's high-tech image.[39]

YMO's early history as a band contains several parallels with Kraftwerk's initial challenges and reception. Much like Kraftwerk's unremarkable reputation early on in Germany, initial reviews of YMO's performances in Japan were lukewarm, and it wasn't until the group gained international popularity that they drew acclaim in their home country. Additionally, and perhaps most notably, both groups were formed in countries that had suffered defeats in World War II and had subsequently been occupied by Allied countries, which meant that during the decades leading up to both bands' creation, their respective home countries had been flooded with Anglo-American pop culture. As in Germany, Japan's music scene was dominated by American music, and most local musicians tried to recreate the popular styles originating across the Pacific. The successes of YMO and Kraftwerk overseas went a long way towards legitimizing these musicians in the eyes of people in their home countries, particularly when it contributed to the development of a musical style that departed from Anglo-American genres. Both of these countries were beginning to develop a reputation as exporters of mechanical and technological merchandise, and, as such, techno-pop, with its similar aesthetics of mechanization

[39] Michael K. Bourdaghs, *Sayonara Amerika, Sayonara Nippon: A Geopolitical Prehistory of J-Pop* (New York: Columbia University Press, 2012), 143.

and high-tech automation was able to underscore these connections in the minds of international audiences.

Much like Kraftwerk's musicians, YMO was seeking to develop a unique style and sound that was distinctively Japanese but would also have appeal both inside and outside of Japan. "We needed something really powerful, something really new in the music scene," Haruomi Hosono explained to *Rolling Stone*'s James Henke in 1980. "We needed something that would be a bridge to the next pop form and that could be really powerful anywhere – in Japan, in the United States, in England, in Europe. I also wanted something that would be original to come from Japan. All the other musicians are following and listening to the music of the West and trying to do what they are doing."[40] Statements like Hosono's show a desire to innovate, and to create something uniquely Japanese against a backdrop of widespread musical imitation. YMO began to record and tour a few years after Kraftwerk had already gained an international reputation as electronic artists, and the newer group sometimes fell into the long shadow cast by the German band, with reviewers linking YMO to Kraftwerk in order to describe their sound. While YMO acknowledged their respect and admiration for the German group, YMO's musical style was still distinct, even if they used similar technologies. Compared with Kraftwerk's sparser sound in the late 1970s, YMO wove dense, rich textures with colourful harmonic palettes and stylistic traces of jazz, classical, and disco. Part of the reason for this difference stemmed from the experiences of the musicians in each band. YMO's members were seasoned studio musicians with years of experience under their belts, and their capability on their instruments is apparent in performance, elevating concerts from what could have been little more than an exercise in programming to a skillful musical performance.

---

[40] James Henke, "Yellow Magic Orchestra: Japanese Technopop is Poised to Invade America," *Rolling Stone* 319, June 12, 1980.

Although YMO would go on to become one of the most popular and influential bands to emerge from the 1970s after their hit song "Firecracker" shot up the charts, initial reactions to the group and their electronic music was mixed. Japanese stereotypes, technological anxiety, language barriers in live concerts, and even Kraftwerk's stoic reputation factored into their reception. *Washington Post* performing arts reviewer Mike Joyce scorned a 1979 performance, writing:

> They call their music "Technopops," but other words also come to mind. Transistorized Tchaikovsky. Diode Disco. Robot Rock. Their songs…were reduced to a dreary, mechanical mush. The musicians never added a human touch to their playing. They preferred to let their gadgets do their work for them and, at times, it wasn't clear whether the men were playing the machines or vice versa. The result was an incessant drone which blurred any musical thought or substance.[41]

Joyce's criticism reflects similar concerns to Kraftwerk's critics regarding the separation of the roles of man and machine, or the lack thereof. However, the suggestion that YMO "never added a human touch" to their performance is more surprising than similar comments directed towards the German group were. Although both bands made heavy use of synthesizers, their physical configuration and their decisions regarding the use of non-electronic rock instruments reveal significant differences between the two groups. Kraftwerk arranged themselves in a semicircle around a grouping of completely electronic instruments, which they played with minimal movement. Although YMO were still significantly less physically expressive than most rock groups at the time, especially in the group's earlier years, Hosono was a skilled bassist and Takahashi was an experienced drummer, and YMO chose to build their synth-heavy sound around this drum and bass foundation. Even visually, YMO made less of an effort to eradicate physical displays of human musicianship from their concerts. The band's drum kit—easily the

[41] Mike Joyce, "Yellow Magic," *The Washington Post*, November 6, 1979, B7.

most visually engaging instrument onstage—was positioned front and centre, unlike Kraftwerk, who eschewed drum kits and developed electronic drum pads for their percussionists to play.

Still, this puzzlement and unfamiliarity extended to some of YMO's early audiences as well. A reviewer for *Variety* commented:

> As symbolized by the headsets each member wears in performance, Japan's Yellow Magic Orchestra brings an entirely new level of electronic existentialism to the icy German techno-rock school….Things got off to an extremely remote start that night, via a series of seamless and ultimately tedious instrumentals which bore little if any traces of recognizable melodic warmth….Crowd reaction was generally muted throughout, although the large audience complement of Japanese, who traditionally save their applause for the end of a concert, may have contributed to that.[42]

YMO's bulky headphones, which remained over their ears throughout their concerts, did contribute to the suggestion that they were separating themselves from their audience. The fact that the group members were not fluent in English and could carry on little dialogue with their audience added to this perception. But YMO's music itself occasionally rubbed critics the wrong way. Remarking on a comment from YMO's Hosono in which the bassist explained, "We wanted to create music that can sound exciting to us, and can thrill our brains and hearts," *Globe and Mail* columnist Paul McGrath quipped, "How easily this bunch can be thrilled is all too evident in this mediocre collection of electronic pop."[43]

Although McGrath's comments seem misplaced four decades later, when the legacy and value of YMO's music has been firmly established in electronic music history, his deprecating comments can be partially attributed to their timing, as they were penned around the same time as the tides of musical opinion had just begun to turn in YMO's favour. Two of the group's albums seized the number one and number two places on Japan's Oricon charts for seven

---

[42] "Yellow Magic Orch," *Variety*, December 17, 1980, 72.

[43] Paul McGrath, "Multiplies Yellow Magic Orchestra," *The Globe and Mail*, August 30, 1980, F6.

consecutive weeks.[44] An article in an American newspaper from late 1980 sums up their growing popularity in both the East and the West:

> Its claims on the future aside, the mechanical be-bop of the YMO has definitely clicked with a generation of Japanese teen-agers weaned on the beepings of TV computer games. A recent YMO concert in Tokyo had more than 180,000 fans writing for tickets to an arena that seated 10,000. The recent announcement of the group's fourth album, "Multiplies," in early June sent 200,000 people to their local record shops to order the disc, sight unseen. The YMO is currently the hottest and most popular group among the musically wired-in Japanese. The third and latest album, "Public Pressure," sold 250,000 copies in only two weeks and quickly charged to the top of the charts. A spokesman for the YMO said a single disc, "Computer Game," sold 400,000 copies in the United States. The Japanese group performed before sellout crowds during a recent tour of the United States and Europe.[45]

Although their "mechanical be-bop" was still puzzling to some listeners, the band's popularity was unmistakable, and YMO received an invitation to appear on the famed American music-dance TV show *Soul Train* in November 1980. Hosted by Don Cornelius between 1971 and 1993, *Soul Train* typically showcased African-American R&B, soul, and funk artists. YMO became the first and only Japanese band to appear on the show. The group chose to perform a cover of the 1968 funk hit, "Tighten Up," as well as their hit song, "Firecracker." Although the audience in the studio danced along energetically, and applauded the Japanese band's performance, when Don Cornelius joined YMO onstage, the typically smooth-talking host seemed uncharacteristically at a loss for words. After an uncomfortable chuckle, a long silence, and then another confused laugh, Cornelius cleared his throat and said, "In case you folks out there in television land are wondering what's going on…I haven't the slightest idea." Cornelius' awkward puzzlement, and lack of knowledge of YMO's music persisted throughout his short interview with the band. After each group member gave their name, the host, grinning, admitted,

---

[44] "YMO 以来!?ポルノが 24 年ぶりの快挙達成!," oricon.co.jp/news/5122/full, August 17, 2004, accessed June 16, 2019.

[45] Minoru Inaba, "Computer rock music gaining fans," *Sarasota Journal* August 18, 1980, 11A.

"Yeah…if somebody offered me a million dollars to tell you somebody's name up here, you know I couldn't collect it, right?" After acknowledging the language barrier between them, Cornelius spoke briefly with Takahashi.

> "Do you think your sound…which we like very much also…which of the current sounds do you think Yellow Magic Orchestra is close to?"
> "Ah, it's difficult…" the drummer trailed off.
> "You kinda have your own sound…is that…more or less…?" Cornelius prompted.
> "Someone said, ah, like Kraftwerk…do you know Kraftwerk?"
> "Of course! Hey, this is Big Don here, bro!" Cornelius paused to permit the audience a laugh. "Nah, I'm not familiar with the record, and I'm sorry…but we're awfully glad to have you with us."

Cornelius' obvious awkwardness might seem puzzling. YMO had turned out an energetic, danceable performance, and pleased their audience with a fresh take on a familiar hit. In the context of the show's usual lineup of performers, however, YMO were definitely unusual. The *Soul Train* crowd were typically dancing to songs by Donna Summer, Stevie Wonder, and Kool & the Gang. Amidst this collection of soul superstars, this group of rather shy Japanese musicians took the stage to deliver a performance that blended funk music with new electronic instruments and a generous twist of Japanese humour.

After being introduced by Don Cornelius, YMO started up the opening vamp of "Tighten Up," and then offered a screeched introduction in an exaggerated Japanese accent: "Hi everybody! We are YMO! From Tokyo, Japan! We don't sightsee, we dance! You understand?" YMO took their parody of Japanese stereotypes further still, planting Youichi Ito, the band's manager, in the audience. Surrounded by fashionable young people dancing along to the music, Ito sported a clichéd Japanese salaryman's business suit, thick-rimmed glasses, a bulky camera around his neck, and a handheld sign that said "WOW!" This type of self-aware humour, which played up and poked fun at Western expectations of Japaneseness, was present throughout YMO's career, but their audiences were not always quick to pick up on it. Describing their

reception on their first forays abroad in 1979 and 1980, Hosono recalls the clueless misconceptions the band contended with:

> When [YMO] did interviews, we were constantly getting asked the same questions. It was always things like, 'Does your music have a Zen influence?' or 'Are you influenced by traditional Japanese instruments?' This was 1980, so everyone still had a lot of misconceptions about what kind of place Tokyo was. YMO went global at the same time as the Walkman, so there was this image of technological progress, but it would get framed in a negative way—like, people would think that was why everyone in Tokyo walked around wearing face masks.[46]

The parallel here between YMO and Kraftwerk is significant. These threads of cultural stereotyping and technological progress were two of the biggest factors in both groups' reception outside of their home countries, and both groups folded these associations into the development of their aesthetic.

For YMO, these themes of mechanization and cultural otherness are visually melded in the album art for the U.S. version of the band's self-titled album. Whereas the Japanese release used a simple graphic that assembled the letters of YMO into a cube shape on a white background, the American release depicted a woman in a Japanese kimono and sunglasses, holding a fan. Instead of hair, however, a tangle of multicoloured wires swirl outwards from the woman's head. Like the cover art, the tracks on this version of the album drape innovative synthesizer technology in self-aware exotica (the album includes a cover of Martin Denny's Orientalist number "Firecracker," as well as tracks such as "La Femme Chinoise"), and this pairing sold well overseas. Like Kraftwerk, YMO also chose to adopt matching outfits and a relatively unexpressive stage presence. Although this image also served to underscore both groups' negation of the 1970s rock aesthetic, in the case of both YMO and Kraftwerk, these

[46] James Hadfield, "YMO's Yukihiro Takahashi celebrates a pair of 40th anniversaries," *The Japan Times*, November 23, 2018, japantimes.co.jp/culture/2018/11/23/music/ymos-yukihiro-takahashi-celebrates-pair-40th-anniversaries/#.XQhczBZKhaQ, accessed June 17, 2018.

choices were intentionally ironic and sought to parody similar stereotypes associated with Japan and Germany. Bourdaghs argues that for YMO, the performers' deadpan expressions were intentional caricatures of Western stereotypes of taciturn "Orientals," and serve as an example of YMO's incorporation of parody across their discography as a tool to undermine cultural stereotypes.[47] Similarly, Kraftwerk's ties, hairstyles, and rigid posture were caricatures of the disciplined, stoic German. This aesthetic stood out from the surrounding cultural wash of imports and imitations of American and British pop culture that dominated the youth music scene in both countries.

While YMO took on a technologically focused image as a part of their aesthetic strategy and identity construction, their attitude towards synthesizers and technological advances differed significantly from Kraftwerk's, and these values transferred to the music they created. Of YMO's contrast with other synthesizer-focused groups, John Lewis wrote, "While their peers in Düsseldorf and Detroit were using synthesiser technology to create a bleak, dystopian vision of the future—a world of faceless robots and brutal post-industrial landscapes—the YMO saw technology as something joyous and liberating. In their hands, the synthesiser was a cuddly, slightly whimsical instrument."[48] Not only were their arrangements more harmonically dense, their sound was more exuberant, their rhythms were more syncopated, and the group performed a number of cover songs, offering new takes on hits by artists from Martin Denny to The Beatles. YMO never took themselves too seriously. The humour they showed during their *Soul Train* appearance turned up everywhere from song titles like "Bridge Over Troubled Music" to the

[47] Bourdaghs, *Sayonara Amerika, Sayonara Nippon*, 147.
[48] John Lewis, "Back to the Future," *The Guardian*, July 4, 2008, theguardian.com/music/2008/jul/04/electronicmusic.filmandmusic11, accessed June 18, 2019.

comedy skits interposed between the musical tracks on the Japanese version of their album *X∞ Multiplies.*

YMO's self-titled debut album also explored unconventional new materials in pop and electronic music, and incorporated sounds effects from video games from the late 1970s including the popular game *Space Invaders.* By including these sounds, YMO was employing an aesthetic strategy similar to that of Kraftwerk, who incorporated the auditory experiences of everyday modern life into their music, such as car horns and the sound of the Doppler effect as cars sped past on the Autobahn. The video game sound effects sampled by YMO were drawn from arcade games that would have been a new and notable element of urban soundscapes in the late 1970s, and as such, they achieved a similar effect in establishing this album as decidedly modern. Bringing electronic games into electronic music advanced the band's identity as a hip, contemporary group. Including tunes that automatically played at certain points in a gaming experience was also an aesthetic move that called into question typical assumptions about what constituted authentic musical materials, or authentic musical expression.

The album opens with a track called "Computer Game 'Theme from The Circus,'" which comprises just under two minutes of beeps and bloops, which are sometimes rhythmic, and sometimes less than—the same sounds a player would encounter in Exidy's 1977 arcade game, *Circus.* Across the entirety of the track, only three melodic fragments emerge from the chaotic texture of arcade sound effects. The first is the simple start-up melody which players would hear at the beginning of each game of *Circus*. The second is the "funeral march" theme from Chopin's Second Piano Sonata, which played when a character died, not only in *Circus,* but in other early video games such as the earlier 1975 arcade game, *Gun Fight.* This motif would have been familiar even to listeners who had never played video games, owing to its long history as

death music in early-twentieth-century film.[49] Finally, YMO includes *Circus*' "success" melody—the ubiquitous "Ta-ra-ra Boom-de-ay" tune from music halls in the late nineteenth and early twentieth centuries. The final thirty seconds of the track incorporate muffled popping sounds that become more and more frequent as the track draws to a close, depositing the listener directly into the album's second track, the title of which explains the sound effects: "Firecracker." "Computer Game: 'Theme from The Circus'" was an unconventional opener for a pop album. Although there is an underlying beat included in some sections of the track, which gives listeners something to which they can anchor their sense of rhythm, other lengthy segments contain nothing but arrhythmic sound effects, creating the sense that this could be nothing more than a recording of an unknown gamer playing a round of *Circus*. As a track on an album, this was highly unusual, both in terms of its musical materials (or the relative absence of them) and its structure.

East Asian studies scholar Michael K. Bourdaghs has argued along similar lines, suggesting that one of YMO's most radical moves was to undermine the opposition between authenticity and inauthenticity in music by proposing that in late-twentieth-century media culture, that which is fake may be more real than the real itself.[50] Bourdaughs reads the use of Chopin's funeral march theme in "Computer Game: 'Theme from The Circus'" as an announcement of "the death of a certain model of rock music authenticity" in which sounds are visibly coupled with a performer's body.[51] Brian Currid has articulated this separation in techno-

[49] Neil Lerner, "Mario's Dynamic Leaps: Musical Innovations (and the Specter of Early Cinema) in *Donkey Kong* and *Super Mario Bros.*" in *Music in Video Games: Studying Play*, ed. K.J. Donnelly, William Gibbons, and Neil Lerner (New York: Routledge, 2014), 1.
[50] Bourdaghs, *Sayonara Amerika, Sayonara Nippon*, 144. This idea was not new, however; Hugh Kenner has explored the relationship between personal and counterfeit, reality and simulation, in examples ranging from the eighteenth-century defecating duck automaton considered in chapter 2, to modern computer systems (Hugh Kenner, *The Counterfeiters: An Historical Comedy* [London: Dalkey Archive Press, 2005]).
[51] Ibid.

pop as "transmut[ing] the performance-centered traditions of rock by refusing any direct connection between performers' bodies and the production of sound."[52]

This issue was not unique to electronic music in the 1970s, and continues to be a consideration in performances of today's electronic music genres. For music in which sounds are electronically produced, the main issue is less a matter of refusing to foreground an existing connection between sound and human bodies, and more a matter of to what extent an artist wishes to play up the illusion that there is, in fact, a connection between their gestures and the sounds being digitally generated by the equipment onstage. In twenty-first-century EDM performances in the West, laptop performers frequently contend with the anxiety that they appear to be doing nothing more onstage than checking their email.[53] Work by Mark Butler has detailed the way in which DJs and laptop performers will often perform expressive engagement by exaggerating the physical movements necessary to adjust controls on pieces of equipment, sometimes seeming to turn small knobs with their entire body, communicating with their facial expressions, or dancing along with the music.[54] Butler's interviews show that it requires thought and effort to consider the audience's perspective and feelings of live engagement and to shape a performance accordingly. However, in early live concerts by YMO from the late 1970s, the group appears not only to be opting not to intentionally play up the performative aspects of their movements, but even making an effort to do exactly the opposite. The DJs and laptop performers in Butler's study show that, even for twenty-first-century electronic musicians, the idea persists that physical displays of skill and emotion are markers of authenticity.

---

[52] Brian Currid, "'Finally, I Reach to Africa': Ryuichi Sakamoto and Sounding Japan(ese)," in *Contemporary Japan and Popular Culture*, ed. John Whittier Treat (Honolulu: University of Hawaii Press, 1996), 75.
[53] Mark Butler, *Playing with Something That Runs: Technology, Improvisation, and Composition in DJ and Laptop Performance* (New York: Oxford University Press, 2014), 95-6.
[54] Ibid., 101-2.

While YMO was, as Bourdaghs argued, intentionally disrupting the relationship between the authentic and inauthentic with their stage presence, much as Kraftwerk was, these groups were just two early examples of a longer-lasting trend in techno-pop. In the early 1980s, some electronic musicians took to the stage with all of their music preprogrammed, or even pre-recorded, and forewent any efforts at even pretending to provide evidence of musical labour in their concerts. Cateforis has shown how techno-pop artists occasionally highlighted this lack of effort in their interviews, poking fun at the pretentions of rock and its anxieties around providing evidence of musicians' work ethic.[55] This subversion of rock's expectations of authenticity reveals different priorities in techno-pop. These artists were underscoring a commitment to an intentional use of mechanization as an aesthetic, as I explored earlier with Kraftwerk. Restraining the performer's physical movements and facial expressions meant that the human labour going into the musical performance was visually minimized, while the machine labour was foregrounded. In the late 1970s, this mechanized look and sound was a new and intentional aesthetic tactic. In the twenty-first century, this approach has been rejected by DJs who are working to make a name for themselves as musical artists, and not just manipulators of machines.

Although the band is noticeably looser in later years, in footage from YMO's 1979 Trans Atlantic Tour, significant aspects of the performance, from the stage setup, to the equipment, to the techno-pop group's movements onstage intentionally draw attention away from the performers and tone down the band's interaction with the audience. In concerts on this early tour, at the start of each show, group members all slipped on sets of conspicuous headphones before sounding the first notes of their set. Eyes downturned and expressions blank, with their

[55] Cateforis, *Are We Not New Wave?*, 180.

headphones appearing to block out auditory input from the world around them, YMO stoically interacts with their equipment, and pays little attention to their audience. One performer is even positioned with his back squarely to the audience, spending the show manipulating a large modular synthesizer with minimal hand movements and no showy performance gestures or even a slight bob of his head to the beat of the music to which the audience is dancing energetically behind him. Rather than showing the back of the modular synth and the performer's face, the setup inverts the typical priorities of a concert, showing the back of the performer's head and the synthesizer's face, prioritizing a good view of the technology involved in the performance over the performer himself. Bourdaghs' description of the band, standing stock still with their trailing headphone cables giving the impression that the performers are merely "terminals in an interconnected network" also underscores an important departure from the flashy, expressive performances in 1970s rock.[56]

For YMO, music generated by synthesizers, even when performed live, did not need to be paired with a physical performance that emphasized embodied expressions of artistic intention. Unlike the DJs and laptop performers studied by Butler, whose onstage presence was intentionally choreographed to maintain the link between the performer's body and the electronic sounds playing out into the venue, YMO did not force exaggerated attempts at demonstrative gestures into performance, even in later years when their performances include more physical movement. Letting the crowd dance away to the music they created, the band appeared to stay detached from both their music and their audience, with no improvisational flourishes, eye contact, or dramatic motions. YMO's live performances advance the idea that in this new world

[56] Bourdaghs, *Sayonara Amerika, Sayonara Nippon*, 144.

of synthesized music, authenticity did not require sweaty demonstrations of emotion, but it also did not require forced solemnity or humourlessness.

The importance of YMO's popularity will link into the discussion of Vocaloid in the remaining chapters in this study in two main areas. First of all, YMO's massive success in Japan helped to generate momentum for the rich desktop music (DTM) scene that would flourish in the 1980s. It was this culture of creative amateur music-making in the DTM community that would lay the groundwork for Vocaloid culture more than two decades later. Secondly, the absence of spontaneity and performative emotion from live performances by YMO was an important precursor to the pre-programmed Vocaloid concerts that puzzled Western journalists in the early 2010s. Descriptions of YMO in the press during the group's early years bear striking similarities to descriptions of Vocaloid performances. An article from 1980 describes how YMO "has ushered in the age of the computer programmer as rock star…in which the computer does everything but wiggle its hips."[57] The article goes on to explain, "Most of the music [is] stored in computer memory cells and automatically reproduced by synthesizers. When the group performs, the three musicians accompany the bank of synthesizers. 'We closely follow the computer. No ad libs whatsoever,' [Yukihiro] Takahashi said."[58] The language used in this description is reminiscent not only of live Vocaloid concerts, but also of concerts involving reproducing pianos in the early 1900s—the performances of concert pianists, too, were "automatically reproduced," not from computer memory cells, but from a paper record.

Orchestras accompanying a concerto on a reproducing piano, techno-pop band members playing along with a sequencer, and instrumentalists serving as a backing band for a pre-programmed Vocaloid hologram are all participating in similar activities using automation

[57] Minoru Inaba, "Computer rock music gaining fans," *Sarasota Journal* August 18, 1980, 11A.
[58] Ibid.

technology, spread across a century of music-making. Both of the bands examined in this chapter show that, despite the comments from interviewers and reporters about "dehumanization," and even when a group like Kraftwerk played up the mechanical aspect of their creative process, the fears about a loss of human creativity in music only increased the group's popularity. The anxieties triggered by Kraftwerk's discussions of machine hybrids, and YMO's stiff, unsmiling performances were very much core parts of their aesthetic strategy. By prompting questions and worries through seemingly inauthentic performances, Kraftwerk, YMO, and many later techno-pop bands who took cues from these early groups, were essentially holding a mirror to the exaggerated practices thought to confer authenticity on musicians in other popular music genres—even if this mirror was, in its own way, a distorted one. Automation technology was not new, but it had shifted from a means of producing music, as with the player piano, to a foregrounded aesthetic of mechanization. The remaining section, which addresses Vocaloid, explores one additional upheaval in this history, in which fans and amateurs gain control of both the automated means of production and the aesthetic choices.

CHAPTER 4

Vocaloid's Online Culture: Community and Creativity

In 2003, Yamaha Corporation released Vocaloid, a computer application that could synthesize human singing. Developed in collaboration with researchers at Pompeu Fabra University in Spain, the program was designed to enable studio professionals to produce vocal tracks that could serve as background vocals or rough mock-ups of new arrangements.[1] With Vocaloid, users can input a melody and lyrics on an interface that resembles a horizontally scrolling piano roll, and the software will generate a sung vocal line. The program permits the manipulation of pitch, rhythm, dynamics, timbre, breathing, and vibrato, enabling users to fine-tune the vocals and produce a more realistic result. Although the application was created for professional use, in the years following its release, amateur use of Vocaloid unexpectedly skyrocketed, and a dedicated community of creative users coalesced online, collaborating on lyrics, musical arrangements, dance routines, and animations, collectively producing highly polished musical and visual works, the popularity of which further snowballed Vocaloid's userbase.

In order to use Vocaloid, individuals purchase third-party software packages which contain vocal banks with distinct vocal timbres and a fictional character image on the box. While many voice banks and characters, referred to simply as "Vocaloids," have been created for use with this application, and are capable of singing in English, Japanese, Spanish, Korean, and Chinese, the character whose fictional appearance and stylized voice garnered the most attention was the teal-haired girl named Hatsune Miku. Miku's software debuted in 2007, and took

[1] Scott Wilkinson, "HUMANOID OR VOCALOID?," *Electronic Musician,* August 1, 2003, emusician.com/mag/emusic_humanoid_vocaloid/index.html.

advantage of the significant improvements offered by the new Vocaloid 2 synthesis engine, released in the same year. With her distinctively high-pitched and innocent-sounding voice, and her long, teal pigtails, Miku immediately became the number-one fan favourite among Vocaloid users and listeners—a spot she has not relinquished in more than a decade.

While Vocaloid continued to gain mainstream attention, as the Vocaloid 2 engine made synthesized Vocaloid singing even more similar to human singing, it was only a matter of time before an attempt was made to usher an automated singer into the spotlight in a live concert. Early efforts to include Vocaloid singers in live performances starting in 2009 were little more than brief experiments, but in the years since then, projection techniques have improved and interest in live Vocaloid concerts has increased as Vocaloid's popularity has grown.

In this chapter, I will explore the technological and cultural history of Vocaloid, in order to examine questions surrounding the use and meaning of this application. Looking back to several key moments in the history of this technology, I will examine the growth of Hatsune Miku's fan community, the tools that were taken up and adapted or developed specifically to amplify the creative work done in this subculture, and the reception history of this emerging performance format. I will first provide a brief overview of the concept and history of the Vocaloid application, followed by a closer look at the collaborative creative community behind Hatsune Miku, discussing its cultural development alongside work by scholars who have explored similar online or fan cultures. I will then explore the historical and cultural context that has contributed to Vocaloid's growing popularity, bringing recent scholarship on Vocaloid and virtual idols into dialogue with larger discussions of pop music stars and the meaning of the acousmatic voice. These subjects and methods will serve as a foundation for an examination of live Vocaloid performances in the following chapter, in which I will analyze live concerts

featuring Vocaloids, study the role of the audience in this new type of automated performance, and trace advances in the technology used to bring the virtual star to life. Taken together, this work will examine the changing meaning of virtual performance in the twenty-first century, and connect Vocaloid to past histories of automation-related anxieties in music performance. Ultimately, studying the Vocaloid community and holographic performance media highlights the common threads between this new automation narrative and those in the past, while underscoring new and unique elements of Vocaloid's story that reveal a shift in the way amateurs in the 21st century use technology to create music and build community.

Vocal Synthesis and Computer Music Before Vocaloid

Two decades into the twenty-first century, synthesized voices are a regular part of our everyday world. We listen impatiently as they slowly list far too many options in automated answering systems for our utility companies and banks. We chuckle when they pronounce local street names incorrectly in our GPS systems. And sometimes we are the ones who are forced to speak slowly when we try to interact with virtual assistants like Siri and Cortana. Occasionally, we might hear an automated announcement, perhaps on public transit, and if we stop to think about it, we may actually be unsure whether the voice we hear is a human voice or a computer-synthesized voice. The experimentation and incremental advances that have led up to these experiences—which for us, now seem hardly noteworthy—have taken place on a 250-year timeline, beginning in 1769, when Wolfgang von Kempelen hooked bagpipe components and bellows together to concoct a crude speaking machine.[2] The Austro-Hungarian inventor's device

[2] Thomas L. Hankins and Robert J. Silverman, *Instruments and Imagination* (Princeton: Princeton University Press, 2014), 193.

took twenty-two years to develop, and the completed version, finished in 1791, incorporated reeds, resonators, and swishing channels that helped to simulate sounds from vowels to nasal consonants. A trained user could produce strings of complex words.[3] An untrained user could produce sounds that resembled an upset goat.[4] Kempelen's speaking machine was part of the same Enlightenment interest in automata that I have discussed previously, in which inventors worked to break down human actions into mechanical actions and construct automated devices to re-enact them. Modern efforts in vocal synthesis, and the steadily improving systems they have produced, have accelerated over the past century, with significant milestones including Homer Dudley's Voder (short for voice operation demonstrator), first showcased in 1939, and Noriko Umeda's early computer-based text-to-speech system, developed in 1968.[5]

Singing synthesis naturally posed a greater challenge than speech. IBM's John Kelly and Carol Lockbaum were the first to program a computer to warble a tune, using the IBM 7094 to sing "Daisy Bell" in 1961. Kelly and Lockbaum's achievement became well known as a key moment in singing synthesis history, and "Daisy Bell" would later be sung by other computers, including the murderous supercomputer HAL in *2001: A Space Odyssey*, and by Apple's virtual assistant, Siri, when a user asked her to sing a song. The IBM's 1961 rendition of "Daisy Bell" was endearing, but it wasn't going to steal the spotlight onstage in a live concert setting. Given this, the timeline after the IBM 7094 is all the more striking: less than fifty years passed from when Kelly and Lockbaum programmed the first melody, to the date when a computer-generated

---

[3] Wolfgang von Kempelen, *Mechanismus der menschlichen Sprache nebst der Beschreibung einer sprechenden Machine* (Vienna: J.B. Degen, 1791), cited in Willem Levelt, *A History of Psycholinguistics: The Pre-Chomskyan Era* (Oxford: Oxford University Press, 2013), 129-31.

[4] Fabian Brackhane, "Kempelen's Speaking Machine," YouTube, youtube.com/watch?v=k_YUB_S6Gpo (accessed May 19, 2019).

[5] Dennis H. Klatt, "Review of Text-to-Speech Conversion for English," *The Journal of the Acoustical Society of America* 82 (1987): 737-93.

singing voice actually was the focus of a live concert in 2009, when a Vocaloid singer performed with instrumental backing from human musicians in front of an enthusiastic live audience.

There are two technologies in play at Vocaloid concerts: one is so-called holographic projection technology and the other is vocal synthesis technology. Discussion of holographic projection technologies will be reserved for a later examination of live concerts, and so I will first examine a pivot point that contributed to computer-generated music's move from multi-million-dollar labs to home computers and the musical mainstream, and brought amateurs into the world of computer music. Tracing this path will establish important context for the discussion of Vocaloid technology to follow.

Amateurs and Computer Music

In the 1980s, the success of professional groups such as YMO and Kraftwerk caused a spike in the popularity of electronic music as a genre, and this in turn led to a surge in amateur synthesizer use. It was in this decade that MIDI was introduced, and this key development made desktop music (DTM) culture and amateur computer music creation even more affordable and accessible to amateurs. Although DTM culture preceded Vocaloid culture by more than 20 years, these communities and amateur musical efforts did a considerable amount of work towards hammering out a framework of meaning and culture around which Vocaloid technologies and collaborations would be built in the future. Work by Keisuke Yamada has highlighted important links between 1980s DTM in Japan and the Vocaloid phenomenon, focusing especially on the connection between Vocaloid and earlier Yamaha technologies.[6] In 1983, Yamaha introduced

[6] Keisuke Yamada, *Supercell Featuring Hatsune Miku* (New York: Bloomsbury Academic, 2017), 13-14.

the DX synthesizer series, including the extremely popular DX7 synthesizer. This instrument became the first commercially successful digital synthesizer in a market dominated by analog synths, and went on to sell more than 200 000 units. The DX series alleviated many of the functional restrictions that had posed difficulties for synthesizer users. These new synths were versatile, compact, affordable, and, most importantly, had MIDI ports, allowing users to connect them to sequencers and computers. The DX7 was marketed to a broad spectrum of musicians, including educators, amateur home users, and professionals across a range of genres, with prominent users including Kraftwerk, Brian Eno, Enya, and U2.[7] The instrument and its sound came to define synthesized sounds and synthesizer functionality for both professionals and amateurs during the 80s. During this decade, another technology that offered increased access to music production for amateur musicians was the multitrack recorder (MTR), which gave home users the ability to record recordings with four tracks outside of professional studios.

The DX series were such pivotal instruments in synthesizer history that many of its features and functions influenced the development of later instruments for years to come. Yamada notes that even Hatsune Miku's design draws heavily on colour schemes and motifs from the DX7 and the DX100—a cheaper version of the DX7. The panel on Miku's sleeve is a clear reference to the panel on the DX100, and the teal colour of Miku's pigtails is the same as an indicator on the DX7.[8] Miku's skirt also features a MIDI terminal design, suggesting, perhaps, that although Miku is designed to seem human-like, she is still a musical instrument, and a synthesizer. One of the many amateur synth users who participated in the DTM scene in Japan was Itou Hiroyuki, whose involvement in the DTM subculture had a strong influence on his career path. In his twenties, Itou owned a DX7, created his own music as a hobby, and sold a few

[7] Peter Manning, *Electronic and Computer Music* (New York: Oxford University Press, 2013), 82.
[8] Yamada, *Supercell Featuring Hatsune Miku*, 14.

demo tapes on the shelves of record shops.[9] These formative experiences shaped the course of Itou's career, and in 1995, the former DTM hobbyist went on to become the founder of Crypton Future Media—the media company which would eventually be responsible for Hatsune Miku. Because Yamaha was the company behind both Vocaloid and the DX7/DX100 synthesizer, these visual links underscore the relationship between Yamaha technology, DTM culture, and Vocaloid.[10]

In the 1990s, digital music-making in Japan continued to grow and develop. Technology continued to become more affordable and accessible, enabling greater numbers of amateurs to acquire equipment and participate. The commercial availability of affordable hard drives led to the development of hard disc multitrack recorders in the late 1990s such as the Akai DPS12, which cost about $1450—not a small purchase, but much more affordable for amateur music-makers than previous technology.[11] One of the most important shifts during this decade was the transition from storing musical data locally on computers, to uploading and sharing creations on the internet. The development of online music collaboration in its early years, as connection speeds increased and new software and operating systems were released, has been described by Peter Manning.[12] Manning's work connects software and operating system releases to details of instruments and notable musicians, covering the 1990s and early 2000s in detail. An important part of Vocaloid's history picks up where Manning's narrative leaves off, with the launch of video-sharing websites in the mid-2000s. The availability of platforms that allowed users to

[9] Tomonori Shiba, *Hatsune Miku wa naze sekai o kaetanoka? [Why Did Hatsune Miku Change the World?]*, Tokyo: Outa Shuppan, 2014), 43.
[10] Yamada, *Supercell Featuring Hatsune Miku*, 16.
[11] Ibid.
[12] Manning, *Electronic and Computer Music*, 471-82.

share creative content meant that amateur musicians had a new place to encounter new work, upload their own, and connect with likeminded users in new ways.

Virtual Singers Find a Virtual Home: NicoNico Douga and Amateur Users

The story of Vocaloid's amateur community brings together three components: vocal synthesis technology, a fan community, and a video upload website. All three of these elements were essential for Vocaloid to become the global music phenomenon it is today. Having examined Vocaloid synthesis technology and its precursors, I will turn to a consideration of the video website. Following the same trajectory as Stephen J. Sansweet, who wrote that "fandom may start with the property, but it ends up being all about the people," the elements of technology and platform will serve as a foundation for an exploration of the Vocaloid fanbase, which is at the heart of this phenomenon and this chapter.[13]

Much as DTM culture was able to develop once technology and instruments became more accessible and affordable, with Vocaloid, songwriters who could never have paid to produce demo tapes with professional singers could now circulate their music. Vocaloid's online history begins in 2006, when the now-popular Japanese video-sharing website Nico Nico Douga was first launched, since it was this platform that would ultimately provide a space for this circulation to take place, and for the nascent Vocaloid community to mature and expand. NicoNico resembles other video-sharing platforms such as YouTube in its basic function—hosting videos uploaded by users—but with several key differences which were particularly well-suited to fostering the development of a user-focused creative culture.

[13] Stephen J. Sansweet, "Foreword," in *Fan CULTure: Essays on Participatory Fandom in the 21st Century,* ed. Kristin M. Barton and Jonathan Malcolm Lampley (Jefferson, NC: McFarland & Company, Inc., 2014).

First of all, unlike YouTube, with its comment trees located in a section below the video, comments from NicoNico's users appear directly on top of the video itself, with each comment scrolling across the video at the exact moment in time during the video's playback at which the original poster made their comment. If a user comments on an event occurring at the two-minute mark in a video, then as subsequent users view the video, the first viewer's comment appears once the same moment in playback is reached. This results in what can sometimes appear to be a jumble of distracting text that partially obscures the video, particularly on popular uploads that have received many comments, but this feature enables a group of users separated by both temporal and spatial distance to react and interact collectively in a format that simulates real-time interaction. Unlike other major video-sharing platforms, on which comments cannot be viewed at the same time as the video, on NicoNico, climactic moments in a song will often arrive accompanied by a wave of excited "oooohhhhhhhh!" reactions pouring across the screen; moments of comedy see users laughing together, or mimicking short phrases they found humorous. Sometimes, users will nonvocally "sing" together to favourite lyrics by typing along with them, or engage with a song using symbols and abbreviations. Users also interact with content on NicoNico through the use of "tagging," a feature that enables users to categorize videos. While uploaders can permanently assign up to five tags to their own videos, the remainder of the tags (up to a total of ten) are assigned and altered by viewers, and cannot be controlled by the original uploader. Originally intended for categorization, users frequently repurpose the feature for commentary purposes, including humour, criticism, and satire.

One of NicoNico's defining characteristics is its emphasis on sharing and collaboration in the production of creative content. Popular categories for video uploads that have persisted throughout NicoNico's history include "Tried Singing" (歌ってみた) and "Tried Dancing" (踊

ってみた), and a significant amount of the website's content is user-created artistic content. Frequently, popular uploads to NicoNico will be shared and developed in ways far beyond the original creators' means. A group of human musicians may arrange and perform a popular tune, while another user might choreograph a dance routine to accompany the new performance, and an artist may sketch a storyboard, which an animator may turn into a music video.

In 2007, just a year after this video-sharing website launched, Hatsune Miku's voice bank was released for use with the Vocaloid 2 synthesis engine, and this fortuitous timing provided a home for the creative community that would eventually produce some of the most well-known Vocaloid songs. NicoNico was the primary platform for collaboration on these complex fan-made creations, and the site continues to be a prominent hub for Vocaloid contributors and their work today. In 2013, approximately 30% of all uploads to NicoNico were Vocaloid-related, [14] a substantial share in the traffic of one of Japan's top ten most-visited sites. The rise of NicoNico went hand in hand with the rise of Vocaloid, and the collaborative, creative bent of the NicoNico community mirrored the development of similar traits in Vocaloid culture.

In the years since NicoNico's launch, other media-sharing platforms have adopted systems for linking audience reactions to specific moments in time. SoundCloud, an audio distribution platform launched in 2008, allows users to tie comments to a specific time in an audio track, enabling subsequent listeners to note the particular moment that prompted previous commenters' responses when reading their comments. In 2016, Facebook Live incorporated a feature similar to NicoNico's comment system when it added floating emoji, which viewers can use to indicate their reactions to real-time content being streamed on Facebook Live. Just like

[14] "Bokaro 2013-nen tsukibetsu toukoushasuu gurafu" 「ボカロ 2013 年 月別投稿者数グラフ」 (Graph of 2013 Monthly Vocaloid Uploader Counts), NicoNico, ch.nicovideo.jp/kadotanimitsuru/blomaga/ar428894, accessed 2015/10/26.

NicoNico, these emoji flow across the screen from right to left before disappearing, collectively providing real-time emotional feedback from the video's audience. Unlike Facebook Live, however, NicoNico's text-based commenting system affords audiences the flexibility to express themselves in full thoughts or creative ASCII art (or, just as frequently, gratuitous "wooooooooooow"s and one-word interjections), rather than limiting these contributions to a small selection of emoji. NicoNico comments are an organic part of the video, with their appearance taking visual precedence over the video's actual content, emphasizing viewer participation and response.

From this constant flow of viewer input, and owing to the extraordinary freedom users have to express themselves, memes and participatory responses unique to the NicoNico community have developed over time and become fixtures in the Vocaloid community, both online and offline. In 2007, a simple, fan-made parody video[15] of a roughly animated Hatsune Miku waving a green onion ("negi" in Japanese) to the beat of a Finnish folk song went viral (Figure 4-1). Users began typing a series of green-coloured letter Ys during certain parts of the song, to virtually join in a collective show of negi-waving participation. A comment placed early in the video's playback provided helpful instructions for the uninitiated: "Y=negi." As more and more users joined in, the group delineated the moments in which the negi should be used, and during these portions of the song, the screen would sometimes be flooded with strings of Ys. The practice caught on and spread, first to other videos on NicoNico featuring the teal-haired Vocaloid, although these videos had nothing to do with the negi image, and gradually to physical Hatsune Miku merchandise including figurines, art, keychains, and plush toys, irrevocably pairing Miku with the unlikely vegetable.

[15] The animation was a parody of a popular meme derived from the anime *Bleach*, in which a character was depicted spinning a green onion while the Finnish song "Ievan Polkka" played in the background.

Figure 4-1: Screencap of NicoNico scrolling comments over video of Ievan Polkka, Otomania, "I was allowed to cover「Ievan Polkka」with VOCALOID2 Hatsune Miku," NicoNico, nicovideo.jp/watch/sm982882, accessed July 8, 2019.

At live concerts, fans attend with green-coloured glowsticks, sometimes wielding two in one hand to form a Y shape, evoking this connection and participating in a real-life version of the negi inside joke and the NicoNico "YYYY" comment. Compared with the floating emoji of Facebook Live, or the detached comment trees of YouTube, the combination of expressive flexibility and time-specific linking in the NicoNico comment system creates a greater sense of communal viewership, which has given rise to unique forms of cultural expression that became an integral part of the developing Vocaloid community.

Why do glowstick rituals and scrolling comments appended by online viewers matter? With Vocaloid, audience participation is part of the performance, and the cultural practices propagated by users are an important part of the meaning of Vocaloid technology. A growing body of scholarship focusing on users and their relationship to technological development has underscored the fact that users and technologies are two sides of the same coin. Bicycles,

telephones, video-sharing platforms, and virtual divas do not emerge from a vacuum, but are built to meet an existing need, or create a new one. Often, however, the purpose for which a technology was originally designed is supplanted by a new purpose developed as the technology is used.

Science and technology scholars Trevor Pinch and Wiebe Bijker, the pioneers of the approach referred to as the social construction of technology (SCOT), were among the earliest to focus on the role of the user in this process of development.[16] Their work focuses on the interpretive flexibility of technology, in which users could cultivate radically different purposes and uses for a technology, particularly in the early stages of its development. In *Analog Days: The Invention and Impact of the Moog Synthesizer*, Trevor Pinch and Frank Trocco detail the evolution of Robert Moog's approach to constructing the modular synthesizer in the early days of the instrument's history, when several major instrument builders with differing philosophies were still in competition with one another.[17] Pinch and Trocco emphasize musicians' involvement in this process, showing how Moog's developmental trajectory relied heavily on input from artists who were actively using the instruments, and tracing the ways in which this dialogue altered the finalized form of the synthesizer. In studies such as *Analog Days*, the SCOT approach highlights the blurred boundaries between the roles of producer and consumer, designer and user. Similarly, in a study of Vocaloid—a creative community with high fan involvement in which the roles of producers and consumers have a considerable amount of

[16] Trevor J. Pinch and Wiebe E. Bijker, "The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *Social Studies of Science* 14 (August 1984): 399-441.

[17] Trevor Pinch and Frank Trocco, *Analog Days: The Invention and Impact of the Moog Synthesizer* (Cambridge, MA: Harvard University Press, 2002).

overlap—attention to user activities will provide insights into how fan communities engage with music, and how users make use of new technologies.

In an effort to provide new insight into the cooperative artistic work taking place in the Vocaloid community, a five-year music research project called OngaCREST (Core Research for Evolutional Science and Technology)—undertaken at Japan's National Institute of Advanced Industrial Science and Technology (AIST) and led by media interaction researcher Masataka Goto—has tracked and modelled the networks of collaboration through which Vocaloid works are created and refined. The project has produced a number of applications which process massive amounts of data from the NicoNico community and generate visualizations depicting the evolution of original Vocaloid works on an ongoing basis as users develop them. Goto and his colleagues envision the applications as a part of the long-term development of creative communities such as NicoNico, helping to facilitate productive and collaborative work-sharing by reducing anxieties about intellectual property and plagiarism in an open-source culture, and by helping to improve the visibility of new, high-quality derivative works that might otherwise be overlooked by the community due to the overwhelming volume of content being created.[18]

Of the project and the type of culture the OngaCREST team seeks to promote, Goto writes:

> We call a society in which relationships between humans and content and between past content and future content are rich and capable of sustained development a '*content-symbiotic society*.' To realize such a society, this project aims to build a similarity-aware information environment…among a huge amount of media content. If a content-symbiotic society can be realized, media content can be richly and soundly created and used.…people will be able to continue to create and share content with peace of mind. Anyone will be able to actively encounter and appreciate content and, furthermore, enjoy creating content easily.[19]

[18] Masataka Goto, "OngaCREST Project: Building a Similarity-Aware Information Environment for a Content-Symbiotic Society," in *Human-Harmonized Information Technology, Volume 2: Horizontal* Expansion, ed. Toyoaki Nishida (Tokyo: Springer Japan, 2017), 1-2.
[19] Ibid., 3.

Goto's choice of terminology here reveals a shift in the meaning of user contributions in this content-symbiotic society. Rather than discussing the production of unique artistic works, Goto focuses on the accumulation of vast amounts of content that exists to be used in the creation of even more content. In a model such as this, where creativity is part of a process of neverending growth and accumulation, tools for navigating this content are necessary.

To this end, in order to foster the continued growth of the content-symbiotic society that gave rise to the Vocaloid community, OngaCREST has developed technologies that support both content appreciation and content creation, including the music-browsing assistance service called Songrium. Songrium was created with the Vocaloid community specifically in mind, and has focused its analytical efforts thus far on music videos on NicoNico featuring Vocaloids. The application has analyzed more than 750 000 videos, the results of which have shed light on the processes behind the highly collaborative online culture, providing new insight into the role of derivative works, and of the small, individual contributions each video makes in the evolution of highly polished works. Songrium found that, among the Vocaloid videos analyzed, approximately 19 percent could be considered completely original songs, while approximately 81 percent were derivative works, such as instrumental covers performed by humans, and animated dance music videos, meaning that on average, for every original work uploaded to NicoNico, users will add four derivative works that interpret or develop the original in a new way. [20]

This data generated by Songrium underscores the strong focus within the NicoNico Vocaloid community on collaborative artistic development through the contribution of derivative works. Additionally, by linking these derivative works back to their originals, Songrium strives

[20] Ibid., 18.

to highlight new contributions that otherwise might have been overlooked. When an original song rises in popularity, the number of derivative works being uploaded (such as drawings providing a storyboard for a potential music video, or human dancers performing choreography that may turn up later in a 3D animation) increases dramatically. This means that works that may have made important contributions to the development of the original might go unnoticed, simply because they were uploaded at a later date. Songrium's visualizations seek to ameliorate this issue. The OngaCREST researchers and developers are working to enable users to make connections between various contributions, building an audience for new content creators, and facilitating collaboration on developing works.

Songrium is constantly updating itself, collecting information from NicoNico, using algorithms to detect similarities between new and existing works, and linking them in an easy-to-use visual interface. Two-dimensional viewing modes such as Music Star Map assign each original song a position in 2D space, with arrows providing visual links to other songs that are musically similar, while its proximity to these other original songs is determined by how similar they are to one another (Figure 4-2). Songs with many musical features in common will be closer to one another in 2D space than those with fewer commonalities. Clicking on an original song brings up a detailed visualization of all derivative works associated with the original, in a format that resembles colour-coded planets in orbit. The colour of the circle representing each derivative work identifies the type of contribution as singing, playing, a music video, dancing, etc., while the size and speed of the circle as it revolves in its orbit indicate its popularity. The radius of each derivative work's orbit marks the date on which it was uploaded, with works created closer to the original orbiting closer to the centre.

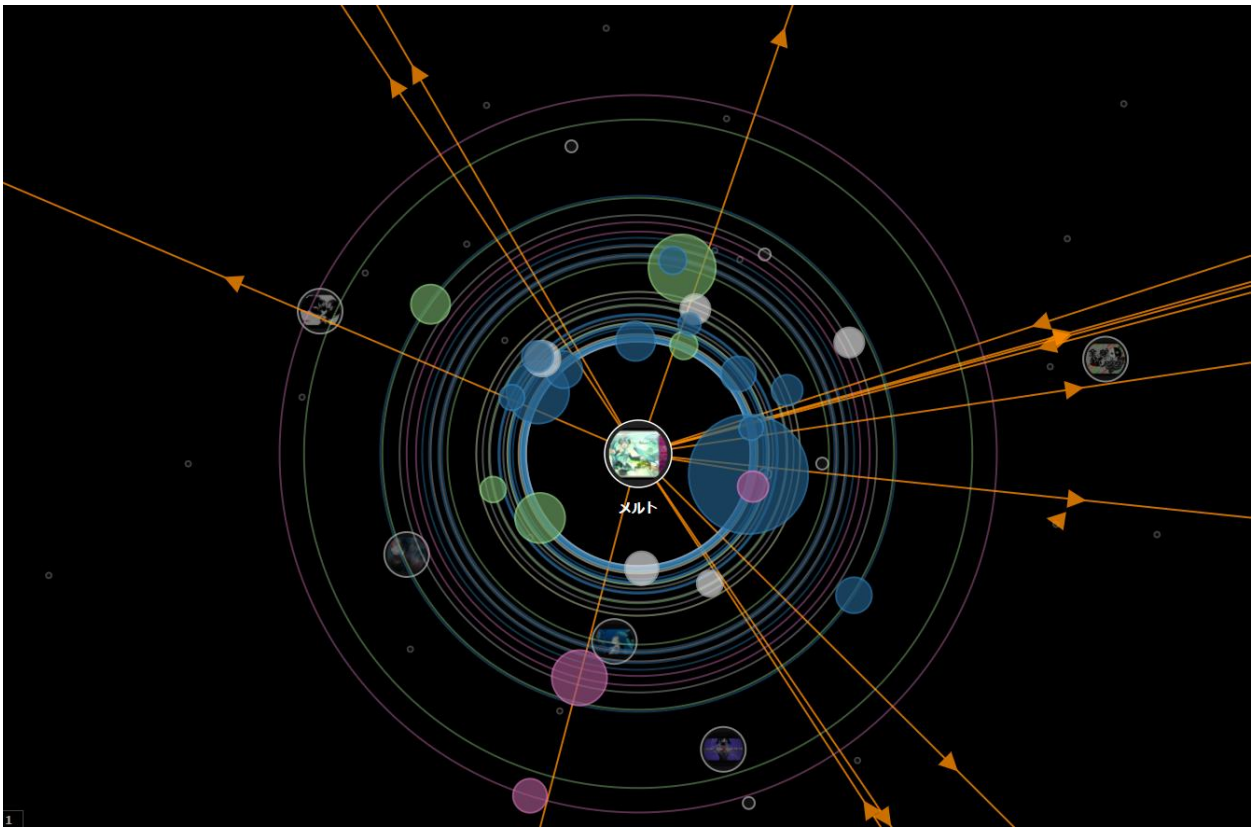


Figure 4-2: Songrium's Music Star Map, AIST, "Songrium: A Planetarium of Music," songrium.jp/map, accessed July 8, 2019.

Frequently, the derivative works orbiting farthest from the centre are videos from live Vocaloid shows—appropriately, performances that are the culmination of the composing, arranging, choreographing, and animating efforts of the community after an original work has been developed and polished through the integration of derivative works.

What Goto calls a "content-symbiotic society," Henry Jenkins has referred to as a "participatory culture." Both proposed terms emphasize user-fuelled collaborative creation, and while Goto's term focuses on the continued development of the community and its work along several axes, Jenkins' definition places more focus on accessibility. According to Jenkins' criteria, participatory cultures possess two key attributes: "relatively low barriers to artistic expression and civic engagement," and "strong support for creating and sharing creations with

others."[21] The NicoNico community, as well as tools like Songrium, have contributed to the development of a community characterized by these very qualities, promoting ease of access (Songrium's role in linking related and derivative works to help promote their discovery by interested users), and simplifying the ways in which participants can contribute to the community (NicoNico's simple comment, tagging, and upload systems). Jenkins emphasizes that in examining these technologies, our focus should not be on the technology itself, but on the relationship between the technology and its users, as well as between different technologies developing alongside one another:

> Rather than dealing with each technology in isolation, we would do better to take an ecological approach, thinking about the interrelationship among different communication technologies, the cultural communities that grow up around them, and the activities they support. Media systems consist of communication technologies and the social, cultural, legal, political, and economic institutions, practices, and protocols that shape and surround them.[22]

The type of interactions that take place on NicoNico differ significantly from those on YouTube, as does the type of content uploaded, the types of communities which populate each video-hosting service, and the different technologies that are used in conjunction with each. Understanding these differences in ecology is crucial to understanding the unique nature of the creative communities on these platforms. One additional criterion that has been underscored by Jenkins is the importance of a participatory culture being "one in which members believe their contributions matter, and feel some degree of social connections with one another (at least they care what other people think about what they have created)."[23] NicoNico has proven particularly successful in fostering and supporting this type of interconnected user engagement. The visibility

---

[21] Henry Jenkins, *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century* (Cambridge, MA: The MIT Press, 2009), 5.
[22] Ibid., 7.
[23] Ibid.

of community-contributed comments and tags, and the clear chains of collaboration involved in collective works reinforce the feelings Jenkins identifies as necessary to establish a participatory culture. But while certain aspects of the website's interface make this type of interaction easier than on other websites, it was the Vocaloid community that adopted NicoNico as its home platform—the video-sharing website was not designed specifically for use by the creative community. As Jenkins notes, certain technologies can "inspire certain uses," but these uses will only be adopted on a larger scale when they meet a recurring need at a particular historical juncture. In other words, as the works produced on NicoNico demonstrate, what culture chooses to do with the tools available to them matters far more than the tools themselves.[24]

Building on Jenkins' theories, in her explorations of the online music cultures on SoundCloud, YouTube, and Vine, Grace Y. Choi has emphasized the fact that in participatory creative cultures, simplicity and accessibility are key. "Because uploading a video on YouTube is relatively simple, people can participate in video production without sophisticated software," writes Choi. "The ease of making videos has helped female musicians to showcase their talents online without professional help."[25] Choi's interviews with women who produce music on these platforms reveal that many video uploaders feel they can better focus on producing quality content when the software and hardware requirements are kept to a minimum.

Simplicity and ease of access for transmedia publishing platforms are defining features of a new phase in the development of participatory cultures which, according to Aaron Delwiche and Jennifer Jacobs Henderson, began in 2005.[26] The fourth such phase to have taken place since

---

[24] Ibid., 8.

[25] Grace Y. Choi, "Who Run the Music? Girls!" Examining the Construction of Female Digital Musicians' Online Presence," *Popular Music and Society* 40 (2017): 477.

[26] Aaron Delwiche and Jennifer Jacobs Henderson, "Introduction: What is Participatory Culture?" in *The Participatory Cultures Handbook*, ed. Jennifer Jacobs Henderson and Aaron Alan Delwiche (New York: Routledge, 2013), 7.

the 1980s, following on the heels of a five-year "Push-button Publishing" phase which saw an explosion of online content on user-friendly web publishing systems, "Ubiquitous Connections," a phase in which online interactions are no longer limited to print and audio, has been enabled by widespread access to broadband Internet. According to Delwiche and Henderson, researchers have recently moderated their optimistic predictions regarding this phase of participatory culture and its potential for positive cultural impact, citing the challenges around intellectual property, draconian regulations, and laws and institutions that stifle the digital environment.[27] Further doubt has been expressed by Sherry Turkle, who argues that as technology saturates every aspect of day-to-day life, the people who use it are becoming increasingly apathetic and isolated.[28] However, work by scholars studying fan culture has shown that not only are fans in participatory cultures staying connected and engaged, they are also producing new narratives and artifacts for their fan subjects, maintaining and building their communities, and influencing professionally produced content, through the additive impact of small contributions.[29]

Many of these contributions to the Vocaloid community on NicoNico are quite simple: "tried dancing" contributors often upload videos shot in their bedrooms on their personal computers' webcams, while artists' contributions are sometimes simply a series of rough storyboard sketches an animator may later pick up and incorporate into a music video. Like the ease of access the musicians in Choi's study enjoy, the NicoNico platform has emphasized

---

[27] Ibid.

[28] Sherry Turkle, *Alone Together: Why We Expect More from Technology and Less from Each Other* (New York: Basic Books, 2011).

[29] See Alison Slade, Amber J. Narro, and Dedria Givens-Carroll, eds., *Television, Social Media, and Fan Culture* (Lanham, MD: Lexington Books, 2015) and Kristin M. Barton and Jonathan Malcolm Lampley, eds., *Fan CULTure: Essays on Participatory Fandom in the 21st Century* (Jefferson, NC: McFarland & Company, Inc., 2014).

simplicity and collaborative feedback, creating an environment that supports and amplifies the smaller contributions of amateurs.

Animated music videos featuring dancing 3D models of Hatsune Miku began popping up on NicoNico shortly after the release of her voicebank in 2007. These fan-made creations quickly became popular, but they were also more difficult to produce than other types of content, since most fans had no experience with—or even access to— expensive and complex 3D animation software. In response to this emerging need, a community member named Yu Higuchi developed an easy-to-use animation application called MikuMikuDance and released it as freeware in February 2008. Compared with pricier professional programs, MikuMikuDance was simpler to work with, and its features were streamlined to meet the needs of users hoping to create their own Vocaloid music videos. The software was initially released with a single character model, Hatsune Miku. In the years since its 2008 release, many other users have contributed to MikuMikuDance, adding other Vocaloid character models, plugins, and companion editing programs. As in Choi's case studies, the simplicity and accessibility of MikuMikuDance encouraged many fans to learn the software, and videos produced with the application became fixtures in the Vocaloid community—so much so that Songrium flags MikuMikuDance submissions with their own unique colour.

Interviews conducted by media scholar Rafal Zaborowski have shown that for Vocaloid's users and listeners, the collaborative nature of the NicoNico culture, its transparency, and the unique tools that facilitate quick and simple contributions to the community help to create a deeper connection with Vocaloid music. Transcriptions of Zaborowski's interviews reveal an appreciation for the unlimited access to and real-time participation in the creative process which Vocaloid's online culture offers to fans. "It's just a bunch of talented people, using [the software]

for everyone to enjoy," explained one of Zaborowski's interview participants. "They don't have to go through [the industry], they just upload."[30] Zaborowski's work touches on the notion that, in spite of the fact that Hatsune Miku's voice is computer generated, Vocaloid fans perceive her songs as possessing "real freedom of expression," in contrast with the hyper-produced images and music of major pop idol groups popular in Japan, which they described as "all fake."[31]

Zaborowski notes that many of his participants were quick to emphasize that they felt Vocaloid music possessed superior authenticity and reality, compared with idol groups working under major labels. This sense of authentic, free expression fans feel when listening to Vocaloid music is one of the core elements of fandom identified by Kristin M. Barton, who explains that "being a fan allows us to express ourselves, it helps us connect to like minded people, and it allows us to escape into a world devoid of the pressures of life, even if only for 30 minutes at a time."[32] The irony, of course, lies in the fact that Vocaloid's detractors invert these descriptions in their criticism of holographic stars. If a listener defines "real freedom of expression" as the human ability to experience emotional reactions to real-time events and improvise based on those feelings, then a pre-programmed singer with a synthesized voice would indeed seem "all fake." While Vocaloids' flawless singing will never contain what many audiences consider to be key humanizing elements, for Vocaloid fans, the authenticity of a track comes from the fact that it was not a manufactured hit produced by a team of professional songwriters looking to make a profit. Fans feel a sense of agency and ownership in the bottom-up production process through which anyone can create and upload a song that expresses their feelings, and the way in which

---

[30] Rafal Zaborowski, "Hatsune Miku and Japanese Virtual Idols," in *The Oxford Handbook of Music and Virtuality*, ed. Sheila Whiteley and Shara Rambarran (New York: Oxford University Press, 2016), 121.
[31] Ibid., 124.
[32] Kristin M. Barton, "Introduction," *Fan CULTure: Essays on Participatory Fandom in the 21st Century*, eds. Kristin M. Barton and Jonathan Malcolm Lampley (Jefferson, NC: McFarland & Company, Inc., 2014), 6.

amateur works can be developed through the contributions of other amateurs who feel an emotional connection to the music and respond in an artistic way.

Supercell: A NicoNico Success Story

One of the most well-known success stories to emerge from the Vocaloid community had its genesis on NicoNico. Today, Supercell is known as a popular music group in Japan with three studio albums to their name, two of which have received the Gold Disc award from the Recording Industry Association of Japan.[33] In 2007, however, the eleven artists who would come together to form the creative supergroup were scattered across the NicoNico community, separately creating Vocaloid-themed works. The story of this group's origins and rise to mainstream popularity is a favourite tale for the online community, and an example of the potential within a content-symbiotic society for users spread across a community to coalesce into collaborative groups capable of producing works that exceed the abilities of its individual contributors. In December 2007, a musician who went only by his given name of Ryo uploaded his first solo submission, "Melt" （メルト）. Since he didn't know any singers who could record the vocals, the young songwriter chose to use Hatsune Miku's voice over a synthesized drum and keyboard track, despite having had nothing to do with Vocaloid or its fan community prior to the composition of "Melt."[34] The song was a hit on NicoNico, and as of 2017, the upload has accrued more than eleven million views, situating it as the second most popular Vocaloid video of all time.[35]

---

[33] Supercell, "Discography," supercell.jp/discography.html, accessed July 8, 2019.
[34] Oricon News, "supercell のメンバーにインタビュー" ("Interview with Supercell Members"), oricon.co.jp/trend/hayari/20080805_02.html, accessed December 11, 2018.
[35] Ryo, "Hatsune Miku sang original song「Melt」," nicovideo.jp/watch/sm1715919, accessed March 23, 2017.

The success of "Melt" eventually led to the formation of Supercell, but rather than the music attracting other talented contributors, it was actually the art that drew attention, and not for positive reasons. Ryo, lacking visual art to upload with his video, used an image of Hatsune Miku created by illustrator 119 without obtaining permission to include it. When a NicoNico user commented to inquire as to whether Ryo had approval from 119 to use the image, Ryo wrote the artist to apologize and request permission after the fact. Not only did 119 consent, but the visual artist was impressed with Ryo's music, and the two began to collaborate. Eventually, Ryo and 119 added a number of visual artists to their collective from 119's circle of friends and colleagues, and Supercell was born.[36]

Ryo continued to produce and upload Vocaloid submissions in 2008, collaborating with visual artists on three more videos, all of which quickly became popular on NicoNico. In August of the same year, Supercell—by this time comprised of eleven members, ten of whom were visual artists—self-released an album containing twelve tracks, all of which featured Hatsune Miku's vocals. Shortly after the independent release, however, the group signed a deal with Sony Music, one of Japan's most prominent labels, and the album was remastered and rereleased in 2009, charting at no. 4 on the Oricon weekly albums ranking.[37] The timeline of Supercell's success story is remarkable: only two years had elapsed between Ryo's amateur upload of "Melt" and Sony Music's release of Supercell's self-named album. From this point onward, Supercell continued to write music, but largely left Vocaloid in the past. In 2009, after the release of their first album, Supercell brought vocalist Nagi Yanagi—a NicoNico contributor herself—on board to provide human vocals, replacing Hatsune Miku's synthesized singing in the

[36] Yamada, *Supercell Featuring Hatsune Miku*, 51.
[37] Supercell, "Biography," supercell.jp/biography.html, accessed July 8, 2019.

majority of the band's songs from 2009 until 2011, when a singer known as Koeda was selected to assume the role after Yanagi's departure.

In 2012, Supercell released a track titled "ODDS&ENDS," which saw the return of Hatsune Miku as the featured vocalist for one song, much to the delight of Vocaloid fans. But the unusually self-aware lyrics Ryo wrote for the Vocaloid singer in this song made it a unique standout which quickly secured an important place in the Vocaloid community. Whereas Ryo's previous songs had mostly framed Miku as a teenage girl singing about youthful love, in "ODDS&ENDS," Miku speaks as a sentient Vocaloid program, confined to a digital existence in which she can do nothing but sing the words given to her by her human users. The song narrates her relationship with one particular user through their artistic ups and downs. Unflinchingly referencing popular criticisms of Vocaloid music, the lyrics cite negative comments on Miku's vocal timbre ("My voice is a terrible offense to the ear" 「なんて耳障り、ひどい声だって」) and accusations levelled at Vocaloid producers ("He's just a nobody who has to rely on a program"/"He's nothing but a fox borrowing a tiger's power" 「虎の威を借る狐のくせに」)

The lyrics follow the story of a struggling musician who feels scorned by the world. In the first chorus, Miku offers him the use of her voice to communicate his ideas and feelings:

> So I'll lend you my voice! Some simply don't get it
> My voice is a terrible offense to the ear, or so they say
> But it'll surely become your strength! Let me sing and you'll see
> Let me sing your very own words.
> Compose them and join them together, I'll cry out those words and feelings

Eventually, the musician in the song's narrative finds success, gaining fame and a large following. He then decides to set aside the Vocaloid program, stating, "There are already many machine voices; I am my own person!" (もう機械の声なんてたくさんだ　僕は僕自身なんだよ), and comes to resent his association with Vocaloid. The song's conclusion, however, sees

the musician trying to return to his collaborations with Miku, recognizing the value and impact of the music they made together, but to his dismay, he finds that he is unable to make the program sing in the same way as before. The final lines deliver a snapshot of the impact of Miku's songs on the musical community, reflecting on all the sadness and happiness that Vocaloid tracks have expressed and shared with the world, through the partnership between humans and a machine.

The official music video for "ODDS&ENDS" is set in a large, dimly lit room cluttered with out-of-date technology. CRT television sets, old computer components, and bulky phone handsets lie discarded among heaps of nuts and bolts—odds and ends, as per the song's title. The opening moments consist of a series of close-up shots of various devices as they blink and spin, accompanied only by a gentle drum beat and a repetitive rising melodic figure. The camera then focuses on a spark of light, which is descending quietly and gently among the piles of castoff technology, casting a warm glow on the dim greys of the surrounding objects. At the exact moment it reaches the ground, the music comes to a halt, save for a single, crystalline dominant note struck in the uppermost register of the piano. The music video's main character is introduced a few moments later: a tiny, retro-styled robot who ventures to the site where the spark touched down, and discovers a handheld screen displaying Hatsune Miku's face. Startled at first as the image of Miku abruptly begins singing, the robot then watches with curiosity, and eventually seeks to pull Miku's screen to a location where the robot can work to prevent Miku's display from running out of power, continuing to labour at this task as the narrative in the song's lyrics unfolds.

The viewer frequently sees the two-dimensional image of Miku lip-sync to some of the lyrics of the song as her screen is pulled around the room by the tiny robot, which positions the

image on the handheld screen as the singer in the music video, while the human instrumentalists perform in the background, oblivious to the miniature narrative unfolding amidst the piles of odds and ends. However, for the vast majority of the music video, the viewer only sees the bottom half of Miku's face, and often just her mouth. The fact that Miku is singing in first person seems, on one hand, to confer human agency on her, enabling her to willingly offer her voice to the discouraged musician. On the other hand, throughout the song's lyrics, Miku is merely an observer, watching from within her virtual world, feeling pride, joy, and loss only in relation to the musician who composes words and melodies for her to sing, positioning her as a tool, or a blank canvas onto which any number of software users can project their own emotions and ideas through creative control of this idealized, fictional girl. Even within the world of the music video, Miku has no capacity to act on her own, and is carried passively about the room by the robot. The computer-generated singer here remains boxed in by the four edges of the handheld screen, unable to interact with the band members she is ostensibly performing with, unable to prevent herself from being powered down, unable to cooperate with the robot seeking to help her. Throughout the video, Miku's expressionless face on the screen continues to impassively articulate her pre-programmed lyrics, irrespective of everything taking place around her. Even though her voice is passionately and sometimes almost breathlessly belting out the lyrics of this song, our view of Miku is a view of a girl in a box, or rather, just the mouth of a girl in a box, with the rest of her body invisible, inactive, and irrelevant.

In the final scenes of the music video, as the musician in the lyrics cries out in disbelief and regret at his inability to bring Miku to life again, the robot also stumbles and fails in its frantic quest to keep Miku's digital display powered. Suddenly, the driving rhythm guitar that had been emotionally propelling the desperation of the scene cuts out completely as the handheld

screen flashes a final warning, and Miku's image vanishes. The Vocaloid continues to sing, however, her disembodied voice continuing to narrate from somewhere beyond the cluttered room. Describing the musician's tears and regrets, she quotes his words: "I'm powerless, I can't even save a single one of these odds and ends" （僕は無力だ。ガラクターつだって救えやしない）

After this quiet and emotionally vulnerable bridge, the final few lines of the song take an abrupt turn. A triumphant musical backing suddenly starts up to accompany optimistic lyrics that narrate an ambiguous transformation as the song races to its finish:

> And at that very moment, the world's colors began to change
> Sadness, happiness: One person and these odds and ends came to know it all
> Lyrics become songs, and once again they pulse around the world for you
> Entrust your will to that voice, now your emotions resound

While the song's audio alone leaves this transition sounding rather abrupt and inexplicable, moving from the grief of the musician to a triumphant but vague conclusion, the music video adds an additional layer of meaning to these final moments.

Just before the return of the energetic theme, as the musician tearfully bemoans his inability to reconstitute his partnership with Miku, a change begins to occur in the room. Bolts and cogs slowly start to rise from the ground, and the tiny robot is lifted off its feet as well, gently turning head over heels as it joins a growing cloud of scrap metal gathering in the centre of the room. Moments before the sudden and jubilant return of the theme, as Miku tenderly intones the final words of the musician's expressions of regret, a familiar musical cue sneaks into the accompaniment, at the same moment as a growing light, shining up from the formerly blank handheld screen, begins to envelop the floating cluster of metallic odds and ends. Tucked behind Miku's vocals, an optimistic dominant note, struck again in the upper end of the piano's range, suggests a link to the anticipation and mystery of the opening moments of the video, and hints

that something special is about to transpire. The assertive downbeat of the next measure is accompanied by a brilliant flash of light, out of which a three-dimensional figure of Hatsune Miku materializes, her body given form by the mass of odds and ends suspended in the air. The song drives to its climactic conclusion as the camera pans around the hovering form of Miku, illuminated dramatically by the coloured light from the tiny screen on the ground. She slowly raises shining hands made of cogs and screws until, in the final bars of the song, the light fades and the jumble of pieces falls back to the ground.

In the Vocaloid community, small contributions—from scrolling comments that catch on and create a new trend, to uploaders offering up amateur choreography recorded on a webcam in their bedroom—are all part of the collective effort that gives rise to the Vocaloid phenomenon. Although the official English translation of the lyrics uses a passive construction to describe how "the world's colours began to change," in the original Japanese lyrics, the use of the transitive verb 変える indicates that, rather than undergoing a passive colour shift, the world is directly acting to cause that change. The appearance of the life-sized image of Miku, composed of countless tiny odds and ends, which had little significance on their own and previously lay discarded about the room, is a compelling and deeply moving moment precisely because of the way in which it evokes the unified efforts of the diverse community that gave rise to the virtual star.

Vocaloid is still being defined by its continued use today, and its community is also continuing to evolve. Examining their trajectory thus far, however, shows that the technology has developed along a vastly different course than its university-based creators originally imagined. An online community of amateurs transformed a studio application, only expected to sell a handful of copies, into a mainstream success on a scale that would have been inconceivable a

little over a decade ago. User involvement has created this unique artistic community in which amateur collaborators are able to produce high-quality music and visuals on a large scale. Media researcher Masataka Goto has predicted that Vocaloid's story is far from over, and argues that singing synthesis will become as indispensable to the music industry as other synthesizers have.[38] Vocaloid music matters in the music world today because the evolution of this genre developed by amateurs offers us a new insight into the changing musical priorities of popular music in the twenty-first century. In a culture characterized by "ubiquitous connections," creative amateurs can easily connect and collaborate online, and popular songs no longer need to come exclusively from major labels. Perhaps what is most unique about this musical culture is the reversal in which, unlike amateur bands who gain a reputation first through numerous live performances and only then sign on to record an album, the development of a format for live Vocaloid concerts was prompted due to the overwhelming popularity of digitally-created audio tracks that were never "recordings" in the sense of having an original performance to which they correspond. Regardless of whether or not there is an original live performance behind these musical works, today, they have made their way onto concert stages around the world. Now that I have established its technological and cultural history, this new format for live performances is worth examining much more closely.

[38] Masataka Goto, "Frontiers of Music Technologies: Singing Synthesis and Active Music Listening" (presentation, CIRMMT Distinguished Lecture, Montreal, QC, September 24, 2015).

CHAPTER 5

Holograms Take the Stage: Automation and Performative Fandom

Hatsune Miku first appeared on the concert stage in Saitama, Japan in 2009, in the form of an image on a screen, backed by a band of live instrumentalists. The brief performance paved the way for lengthier and more complicated attempts at bringing the fictional singer to life in a realistic way, and the ensuing holographic spectacles served to boost Miku's popularity outside of her home country. The technique behind Miku's projected performances is closer to a nineteenth-century theatre trick than any Star Trek holographic technologies. Known as "Pepper's Ghost," the technique reflects the image of an actor who is located below or to the side of the stage onto a sheet of glass positioned onstage. From the audience's perspective, the ghostly apparition appears to interact with other cast members onstage. Holographic singers in the twenty-first century still use a similar technique, with laser projections on a transparent screen. The lit portions of the singer's body look reasonably opaque to the audience, but the screen around them is transparent, creating the illusion that the hologram is bodily present in the midst of the objects and people farther back on the stage.

This method has been used for other musical artists, including the famous posthumous appearance of a holographic Tupac Shakur at Coachella in 2012, and performances by Gorillaz which have used similar projection technology beginning in 2006. More recently, bands such as Studio Killers have used holographic versions of singers for artistic purposes, creating dynamic visual displays for use at music festivals. In 2018, a new generation of holographic performers began to take to the stage in live concerts, and the number of these performances rose sharply. Holograms of Maria Callas and Roy Orbison started tours of Europe and the Americas,

performing their greatest hits with the backing of live orchestras. Based on the success of these productions, the company behind the Callas and Orbison holograms is in the process of preparing shows featuring Amy Winehouse and Whitney Houston. Even the legendary Swedish pop group ABBA announced in 2018 that work was underway for a holographic tour in 2019 or 2020.

When encountering a new performance format that substitutes holograms for humans, puzzlement and awkwardness are typical reactions for journalists and attendees. These performances tend to raise questions about the nature of live concerts. Why have lasers on a screen instead of living performers? Should the audience applaud a hologram? For different types of holographic concerts, the answer to these questions differ. In the case of the Tupac, Callas, and Orbison performances, all of these holograms are recreations of performances by dead people. Concerts like these are put together by production companies who create holographic visualizations of these deceased stars based on historical video footage. BASE Hologram, which produced the Callas hologram, spent nearly a year putting together the virtual performance. BASE hired the Metropolitan Opera's Stephen Wadsworth to spend twelve weeks coaching an actor to imitate Callas' gestures and movements as she sang or walked across the stage in a gown.[1] The final motion-captured performance then served as a foundation for the final holographic projection of Callas. Technicians matched the newly created visual elements with audio extracted from actual past recordings of Callas. After adding in a live conductor and orchestra, the illusion was complete—or, at least, complete enough to sell tickets. These types of holographic concerts draw audiences based on nostalgia. Audiences include large numbers of

[1] Catherine Womack, "With 'Callas in Concert,' an Opera Diva Makes a Holographic Encore," *Los Angeles Times*, April 8, 2019, latimes.com/books/la-ca-jc-fob-mini-callas-hologram-concert-20190408-story.html, accessed June 28, 2019.

long-time Callas fans who are willing to pay money, suspend their disbelief, and play along with an illusion that there is a live vocal performance onstage.

For many, the substitution is convincing. "It's pretty powerful," said one attendee at Paris' Salle Pleyel, "You feel like she's really there. I don't know how it's possible."[2] Other responses at the same performance were more lukewarm, stating that the holographic recreation failed to move them, or voicing the uncomfortable questions that the event raised for the audience. "She comes on like a diva, waiting for everyone to stand up and scream…and there's some timid applause. People are wondering, 'is this art? Is it serious? Do I get on board or not?' And we're captivated. It's scary."[3] According to L.A. Opera president and chief executive Christopher Koelsch, for most viewers, this discomfort was short-lived. Koelsch observed a shift in a California audience's behaviour towards the Callas hologram as the performance progressed. "After a few numbers, the technology started to disappear for [the audience] and they were acting as if this mirage was Callas herself….I would say within 10 to 15 minutes people were reacting to her performance in the same way that they would react to a vocal recital at [the Dorothy Chandler Pavilion]. That was the part that was quite astonishing to me."[4]

Despite what Koelsch has said, the technology isn't quite able to completely "disappear" just yet. The holographic performer's laser-projected body still appears slightly translucent when it passes in front of solid objects (such as members of the orchestra) which gives the singer a rather ghostly appearance—perhaps a rather apt look for performers who passed away decades ago. In spite of imperfections in the holograms' image or sound, the illusion sells. With more shows in the works that will seek to cater to nostalgic fans, this newest category of virtual

---

[2] AFP News Agency, "Astonishment as Hologram, Live Orchestra Put Callas Back Onstage," YouTube video, youtube.com/watch?v=ieTsKYg1_Qo, accessed June 28, 2019.
[3] Ibid.
[4] Womack, "Callas in Concert."

concert has room to explore different genres and styles, but is ultimately bound by an important limitation: the performances are restricted to these deceased stars' recorded output. The holographic version of Maria Callas will not be recording and touring new music, and, as such, while a "greatest hits" show may be an appealing novelty for now, these projects' inability to generate new musical material ultimately makes them little more than a rehash of fans' record collections. Once Roy Orbison's hologram has worked its way through his biggest hits, there is little more to be said or done.

As early as 2006, bands such as Gorillaz, Dethklok, and Studio Killers have also begun to use holographic visuals in live performances, and for entirely different purposes than the "zombie" holograms considered above. All three of these bands are examples of musical groups in which the band members are fictional characters with fictional identities. This one small complication makes it impossible for the human musicians who write and record the band's songs to appear onstage as themselves. For these types of groups, live concerts are still performed by live musicians, but each fictional band member has a fictional avatar which appears in holographic form onstage or as an animation in music videos. British virtual rock band Gorillaz has served as a vehicle for dark satire and commentary from creators Damon Albarn and Jamie Hewlett on topics including politics, the environment, and the vapidity of MTV. With Gorillaz, while the masks of the cartoon Gorillaz' melancholy visages provides room for freer commentary, Albarn and Hewlett's names are still publicly connected with the virtual band, and still conduct interviews regarding the group's music.

More recently, European electronic group Studio Killers have circumvented this relationship with their fictional band altogether, going to great lengths to conceal their true identities from the public. The band members collaborate almost exclusively online, and

maintain their fictional alter-egos as "real." According to Studio Killers' YouTube channel, their origin story suggests that "[n]o one knows where they came from; one day they were just here staring back at us through our high definition flat screens."[5] The virtual ensemble self-released their first album in 2013. The self-titled record credits Goldie Foxx and Dyna Mink with the music and Chubby Cherry with the vocal performances and lyrics, but the band's human artists are three individuals located in the U.K., Finland, and Denmark. Responding to an interviewer's inquiry about her virtual existence, Cherry, whose vocal performances and interviews are recorded by a human man who creates Cherry's voice by pitch shifting his own voice into a woman's vocal range, responded, "Sir, I am a real girl. Let's not give me a Pinocchio complex."[6]

Reviewers speculated that Studio Killers could only remain anonymous until they took to the live concert stage, but when the group co-headlined a pair of European music festivals in 2015, the performers maintained their cover. Goldie Foxx and Dyna Mink arrived on stage wearing animal masks, which concealed their faces while still allowing them to perform. Cherry's situation was more complicated. A mask wouldn't enable her male performer to become a convincing stand-in, and so Cherry participated in the performance as an artistically rendered hologram positioned between her bandmates. All of her vocal lines, sung and spoken, were pre-programmed. Groups like these are not attempting to draw on the past fame of deceased artists in their use of holographic performance technology. Instead, the use of fictional characters allows these groups a different type of artistic freedom. For Studio Killers, Cherry's gender-flipped fictional identity allows the man who voices and animates her to take on a completely different persona than if he were onstage as himself. If the holograms of dead celebrities are

[5] Studio Killers, "About," Studio Killers YouTube Channel, youtube.com/user/StudioKillers/about, accessed July 3, 2019.
[6] Contact Music, "Studio Killers – Interview," contactmusic.com/studio-killers/studio-killers-interview-2014-june, accessed July 3, 2019.

about maintaining and reanimating old expectations, then these groups aim for the opposite, pushing boundaries and taking chances with expanded artistic freedom.

Vocaloids comprise a third category of virtual performers, and again, they are different in purpose and execution than the previous two categories. Performances featuring Vocaloids are neither based on past recordings by real singers, nor are they the brainchild of a fixed group of professional artists. As I previously discussed, Vocaloid music is synthesized from scratch using computer software, most often by amateurs. Each Vocaloid has a unique voice bank, a name, and an image of a fictional character. Even as the frequency and variety of all types of holographic performances continue to increase, Vocaloid concerts featuring Hatsune Miku and other fictional characters continue to outnumber the sum of concerts featuring every other holographic singer put together, with Vocaloid performances taking place in a growing list of cities around the globe.

Vocaloid can no longer be considered a niche musical technology fad. But Hatsune Miku has become a polarizing figure for music journalists in the west, with concert reviews ranging from the effusive ("If You Don't Go See Virtual Pop Star Hatsune Miku in Concert You're Insane"[7]) to the cynical ("The Virtual Pop Star Hatsune Miku Is So Good She Makes Me Want to Throw Up"[8]). Most fall somewhere between these extremes, but common themes include feelings of detached bemusement, descriptions of disorienting sensory overload, and predictions of a dehumanized musical future. Many view Vocaloid performances as just another passing novelty, and point to a lack of live interaction between performer and audience as a fatal shortcoming that will prevent holographic concerts from staking a permanent claim in the

[7] Daniel Robson, "If You Don't Go See Virtual Pop Star Hatsune Miku in Concert You're Insane," *Noisey*, October 1, 2014, noisey.vice.com/en_ca/article/if-you-dont-go-see-virtual-pop-star-hatsune-miku-in-concert-youre-insane
[8] Drew Millard, "The Virtual Pop Star Hatsune Miku Is So Good She Makes Me Want to Throw Up," *Noisey*, May 7, 2016, noisey.vice.com/en_us/article/hatsune-miku-show-review-2016.

musical landscape. One reviewer expressed boredom with a 2016 performance, writing, "While Miku's performance was flawless, it was flat as hell. There was no story. She never lost her breath, or flubbed a dance move…. There was no payoff for me in the audience because there was no risk being taken by the performer."[9] This emphasis on the lack of risk and failure has been echoed by many other writers. Another reviewer recounting a concert experience in Toronto explains, "It's live in the sense that a throng of people watching a music video together would be. There's a crowd, but the show would be identical with or without their attendance. There's no interaction, no banter, nothing to encourage a unique experience…. There's a humanity lacking that makes it less of a concert and more of a public screening."[10]

If Vocaloid is little more than a holographic imitation of a live performance, lacking any of the organic interactions that make live shows meaningful, then how can we account for the exponential fanbase growth over the past decade for what ought to be a niche technological fad? What of the sold-out Vocaloid concerts in a list of countries that grows longer each year, and the adoption of similar holographic performance formats by other bands in the wake of Miku's success? The Vocaloid star has served as the opening act for Lady Gaga on her 2014 tour, and recently made the jump to the classical music world, singing the lead role in an opera composed specifically for her, premiering in Paris and Tokyo in 2014 and since staged at opera houses in the Netherlands, Denmark, Germany, and Australia Vocaloid's popularity shows no signs of waning, and the technologies used to produce holographic concerts continue to be improved upon, and adopted for performances by musicians in other countries and musical genres.

---

[9] Mary Lucus-Flannery, "What I learned from a vocaloid and 1500 screaming millennials," *Medium*, May 5, 2016, medium.com/@marylucusflannery/what-i-learned-from-a-vocaloid-and-1500-screaming-millennials-d181a26d5ce6.
[10] Leon Weinstein, "Hatsune Miku at the Sony Centre for the Performing Arts," Live in Limbo, May 23, 2016, liveinlimbo.com/2016/05/23/concert-reviews/hatsune-at-the-sony-centre-for-the-performing-arts.html.

This continued growth in popularity and influence suggests that there is more to Vocaloid performance than risk-free replay. Taking Hatsune Miku's virtual career trajectory as a case study enables us to isolate and examine questions that challenge twentieth-century ideals of authenticity in live performance and of the nature of the performance event itself. What does it mean for an automated, holographic singer with a synthesized voice to take the place of a human onstage? What does the rise of this new concert format reveal about our priorities in 21st-century musical performance? And is this phenomenon a frightening step, as some say, in a gradual sterilization of live musical performance and the devaluation of the human voice, or does Hatsune Miku's popularity point to a larger creative trend that goes beyond a new type of clinical perfectionism in live performance? In addressing these issues, I will first be examining Vocaloid performance in settings that have positioned the new medium as a successor to human concert performances by directly substituting a Vocaloid for a live singer. This section will focus on Vocaloid performances in Canada, the U.S., and Mexico, in which the Vocaloid performer is backed by a band of human instrumentalists, in a format similar to a typical pop concert. I will then contrast these performances with events in Japan that forego key elements of human concert conventions in order to explore Vocaloid as a medium that foregrounds its own forms of competency without relying on the framework and standard practices of human performance to be understood. In this chapter, I offer a response to the anxieties surrounding this new performance format, situate Vocaloid as a user-driven medium that enables amateurs to develop new musical proficiencies, and critique notions of fidelity, representation, and liveness that rely on socially produced concepts of the performance event from the twentieth century.

Vocaloid: Puppet, Superstar, Idol?

Recent scholarship has positioned Vocaloid performances within the context of Japanese theatrical and artistic traditions, while also noting that this new technology plays into recurring fears about a loss of authenticity and the "death of the artist."[11] Performing arts scholars Louise Jackson and Mike Dines argue that the virtual avatars and their producers can be better understood in the context of the 400-year legacy of bunraku theatre. In this traditional style of Japanese puppetry, three puppeteers work together to operate a single puppet, remaining in view themselves, while one or more chanters voice the puppets from a seat to the side of the stage. Jackson and Dines observe that in bunraku, unlike in other puppetry traditions, the "illusion of totality" is absent – meaning that the audience can easily see that one puppeteer is operating the puppet's left arm while another controls the right. In both bunraku and Vocaloid performances, according to Jackson and Dines, this can create a feeling of shattered immersion, especially for Western viewers, whom they note have a "rather Western fixation on the authenticity of the human voice."[12]

This particular "Western fixation" has been dissected with increasing frequency in recent years, as scholars in film studies, sound studies, and performance studies consider the location and meaning of the voice when it is separated temporally and spatially from its original source, transmitted through a different medium, or visually coupled with a different body than the one that originally produced it. Film scholars have been examining this issue as it relates to performances on cinema screens in the years since sound synchronization was developed, and

[11] Louise H. Jackson and Mike Dines, "Vocaloids and Japanese Virtual Vocal Performance: The Cultural Heritage and Technological Futures of Vocal Puppetry" in *The Oxford Handbook of Music and Virtuality*, ed. Sheila Whiteley and Shara Rambarran (New York: Oxford University Press. 2016), 101.
[12] Ibid.

the new technology enabled actors to record their parts in a studio rather than on location, opening up the potential for innovative postproduction audio techniques to heighten the sensory links between image and sound. Michel Chion has written of the "audiovisual contract," in which a film's viewers consent to considering the images they see on the screen and the sounds they hear through the speakers as belonging to the same unified world, despite being aware of the grafting and splicing that takes place in the studio as actors, foley artists, and sound engineers work together to build the fictional world playing out on the screen.[13] Chion demonstrates that hearing and seeing mutually influence one another, ultimately transforming our perception, and linking sequences of events or actions and emotions that would otherwise remain disconnected. The audience, however, must suspend their disbelief, and entering into the audiovisual contract is a voluntary act. Rick Altman describes these relationships in less consensual terms, instead framing the audiovisual contract as a deception which shields "[t]he sound film's fundamental lie: the implication that sound is produced by the image when in fact it remains independent of it."[14]

Both Chion and Altman write of voices that are recorded separately by film actors, and then visually reattached to the actors' bodies by the film's editors. In an overdubbing, although the sound the viewer hears was performed at a different point in time, it was usually still performed by the same individual. With Vocaloid, however, the body that is animated in dance videos or projected on a huge screen at a concert has nothing to do with the vocal performance the audience hears. Hatsune Miku's voice bank is based on samples of voice actress Saki Fujita's speech, but when listeners enjoy Miku's music, it is not Saki Fujita they connect the performance back to, but a fictional avatar with long, teal pigtails which has taken on a unique identity and

[13] Michel Chion, *Audio-Vision: Sound on Screen* (New York: Columbia University Press, 1994).
[14] Rick Altman, "Introduction," *Yale French Studies* 60 (1980): 6.

personality through the accrual of thousands of small contributions. Considering a Vocaloid concert experience through the lens of Chion's contractual concept, we can see that in order to engage with the concert, the viewer must agree to temporarily accept that a computer-generated holographic projection is delivering the performance. Projection technology is not nearly sophisticated enough for concert-goers to ever be duped into believing that the figure on the screen is a living person. Unlike bunraku or post-production vocal dubbing, however, the songs and spoken words heard in the concert venue do not originate from a human performance at all, unless we trace the sounds used back to Saki Fujita, sitting in a studio, reading strings of nonsense words and syllables containing every possible combination of phonemes in the Japanese language.

While Jackson and Dines' argument that Vocaloid's heritage can be traced back to the ancient tradition of bunraku does effectively highlight the disconnect between vocalist, puppeteers, and puppet—or synthesized voice, animators, and hologram—it falls short on two counts. First, while bunraku performances are indeed visually divisible, since we can watch the puppeteers at work and see how their actions produce the puppets' actions, in a Vocaloid concert, the efforts of the animators, motion-captured dancers, and Vocaloid producers are completely invisible, with the focus resting exclusively on the holographic singer. In this way, Vocaloid has more in common with the puppetry traditions in which the puppeteers remain hidden behind a curtain—the traditions with which Jackson and Dines contrast bunraku. Secondly, Jackson and Dines' focus on a centuries-old performance tradition neglects important links between Vocaloid and recent cultural practices that not only bear more relevant similarities to the online community and its virtual star, but are much stronger forces in the culture of today's tech- and media-savvy young Japanese, who make up the bulk of the Vocaloid fanbase. If

Chion's and Altman's discussions of the suspended disbelief and auditory deception involved in film sound mirror the tacit understanding that governs fans' interactions with Vocaloids, then the traditions of vocal dubbing in film industries outside of North America are particularly relevant to a discussion of incongruent voices and on-screen bodies. Furthermore, within the Vocaloid community, Hatsune Miku is rarely linked to traditional, government-sponsored arts such as bunraku, or any other style of puppetry. Rather, she is most frequently described as a virtual "idol"—a label which positions her squarely within a current and clearly defined world of pop culture performance that comes with its own set of expectations and customs.

Many fan practices linked to Vocaloid bear strong connections to idol culture, and there is an important distinction created by calling Miku a "virtual idol" rather than simply a "virtual singer." The "idol" label establishes a set of expectations and standards regarding her relationship to fans. In order to understand the dynamics between Vocaloids and their fan communities, as well as the meaning of live concerts staged by a holographic idol, it is essential to appreciate the unique function of the idol in Japanese popular culture.

Idol culture, and the particularly intense brand of fandom surrounding it, has already received a great deal of scholarly attention. Hiroshi Aoyagi's oft-cited chapter in Timothy J. Craig's 2000 edited collection, discusses the cross-cultural, historical, and socio-economic roots of idols' widespread popularity in Asia, while his 2005 monograph, *Islands of Eight Million Smiles: Idol Performance and Symbolic Production in Contemporary Japan,* takes a closer look at the idol-manufacturing industry and its system of commercializing image and personality.[15] Patrick W. Galbraith and Jason G. Karlin's 2012 collection focuses exclusively on issues relating

[15] Hiroshi Aoyagi, "Pop Idols and the Asian Identity" in *Japan Pop!: Inside the World of Japanese Pop Culture,* ed. Timothy J. Craig (Armonk, NY: M.E. Sharpe, 2000); Hiroshi Aoyagi, *Islands of Eight Million Smiles: Idol Performance and Symbolic Production in Contemporary Japan* (Cambridge, MA: Harvard University Press, 2005).

to idols and celebrity in Japan, exploring the systems of production behind the high-powered media giants producing the country's steady stream of youthful idols, and analyzing the role of gender stereotypes in the economy of desire and availability that fuels the industry.[16]

As Aoyagi has noted, idols typically act and sing at a level that could be seen as quite amateurish, and it can be difficult to understand the appeal of these rather average individuals and their status as cultural icons, especially for those who do not live and move in a culture in which idols' personalities and images are as ubiquitous as they are in their home countries.[17] The relationships between Japanese idols and their fans are characterized by a dynamic in which the stars are positioned not as inaccessible or superhuman, as film actors sometimes are, but as servants who toil for their fans.[18] Reciprocally, fans toil for their favourite idols as well, and are viewed as active participants in idol-fan relationships, rather than distant admirers. The media furor surrounding idol elections (which have sometimes received more coverage than federal elections[19]), handshake events, and exclusive events which encourage fans to purchase large numbers of CDs for a chance to attend constitute a different type of fan interaction that is far more personal and interactive than the type of distant admiration accorded to celebrities such as film actors. In these types of idol events, fans are able to feel that they have some level of influence on or personal connection with the idols' world.

---

[16] Patrick W. Galbraith and Jason G. Karlin, eds., *Idols and Celebrity in Japanese Media Culture* (New York: Palgrave Macmillan, 2012).

[17] "Pop Idols and the Asian Identity" Hiroshi Aoyagi, 214.

[18] Christine R. Yano, "Letters from the Heart: Negotiating Fan-Star Relationships in Japanese Popular Music" in *Fanning the Flames: Fans and Consumer Culture in Contemporary Japan*, ed. William W. Kelly (New York: SUNY Press, 2004), 41-58.

[19] Minoru Matsutani, "Voting for Idols is Bigger than Politics," *the Japan Times*, July 1, 2013, japantimes.co.jp/life/2013/07/01/language/voting-for-idols-is-bigger-than-politics/#.WTwmTWjyvIU, accessed July 4, 2019.

Igor Prusa has noted that this type of relationship offers increased intimacy between performer and audience, and also gives rise to a prescribed form of "celebrity conscience."[20] Prusa writes that "[idols] are assigned significant cultural authority connected with huge symbolic influence, but simultaneously tend to be approached as public property with certain obligations, duties, and socially created values that are ideologically designated as 'virtues.'"[21] These virtues, and the strict contracts that ensure that idols adhere to them, maintain an image of purity, averageness, innocence, youthful energy, and cuteness. Idols offer fans an appearance of accessible femininity (Daniel Black also underscores the focus on "compliant femininity"[22]), and the opportunity to participate in experiences with the idols that provide a sense of familiarity and intimacy as a reward for their devotion.

Musically, idol groups are regarded as the ultimate in interchangeable, prefabricated performances. With few exceptions, idols do not write their own music, and, as mentioned above, they often lack any exceptional vocal abilities. Black has written of these performing groups and their music as "highly constructed and controlled confection[s] for the delectation of the consuming public."[23] Supergroups such as Tokyo's famed AKB48 are constantly in a state of flux. The group is often split into subgroups, enabling them to perform in multiple locations at once. Older members quietly leave, and younger members join on a regular basis. In a process that Yuya Kiuchi describes as "seemingly more democratic," fans continually evaluate group members through popularity votes, with the winners earning TV commercial spots or better on-

---

[20] Igor Prusa, "Megaspectacle and Celebrity Transgression in Japan: The Sakai Noriko Media Scandal," in *Idols and Celebrity in Japanese Media Culture*, eds. Patrick W. Galbraith and Jason G. Karlin (New York: Palgrave Macmillan, 2012), 57-8.
[21] Ibid., 58
[22] Daniel Black, "The Virtual Ideal: Virtual Idols, Cute Technology and Unclean Biology," *Continuum: Journal of Media & Cultural Studies* 22 (February 2008): 37–50.
[23] Ibid., 37

stage positions in future performances.[24] Despite the fact that idols must adhere to extremely strict contracts that govern their behaviour, appearance, and relationships (idols are expressly forbidden from dating, in order to preserve their image of availability), eventually an idol's career will come to an end, whether gradually as she ages and cedes the spotlight to newer idols, or through a behavioural contract breach, as in the highly publicized scandal that erupted in 2013 when AKB48 member Minami Minegishi was spotted by a tabloid journalist leaving her boyfriend's apartment. In a startling act of public contrition that attracted international media attention, Minegishi shaved her head and issued a video apology to her fans, but was still demoted from her role in the idol supergroup.

What's an idol manager to do in order to protect the substantial investment the company has made in training performers, if human idols inevitably are considered unfit to perform? For some companies, the answer lies in the virtual realm. The history of virtual idols currently spans just over twenty years, starting with Kyoko Date, launched in 1996 and considered to be the first virtual idol. Date's creators used computer-generated graphics and a human voice actor to release a CD and two music videos, and make a number of TV appearances, but her virtual career quickly stalled. While her technology was impressive for 1996, viewers still found her dance moves "unnatural" and slightly "creepy," slipping too far into the uncanny valley—the unsettling feelings caused by robots or animated simulations almost, but not exactly like humans— for viewers' comfort.

Companies in several countries created virtual idols of their own in the years that followed, and while some saw modest success, the vast majority rapidly fell from favour. Daniel Black's analysis of virtual female idols, as well as mascots and characters designed to fit the

[24] Yuya Kiuchi, "Idols You Can Meet: AKB48 and a New Trend in Japan's Music Industry," *The Journal of Popular Culture* 50 (February 2017): 30.

kawaii, or "cute" aesthetic conceptualizes them as "sanitized" figures, whose biology is erased or painted over in order to lessen the feelings of discomfort caused by excessive realism.[25] Black points to cute characters that lack mouths and other undesirable bodily openings, such as Hello Kitty, and to the "skinning" (meaning the addition of a skin, not the removal of one) of both virtual and robotic figures, as examples of techniques used to create smooth and reassuring exteriors for potentially troubling digital or mechanical bodies. While singing idols such as Kyoko Date and Hatsune Miku do require mouths, the "smooth and reassuring" nature of these particular idols' exteriors extends past skin that will never wrinkle, to their unchangeable and perfectly controllable behaviour, ensuring that they are never accused of the crime of being romantically involved, or of disappointing a fan in any way. Although Hatsune Miku's career has now extended past the ten-year mark, she remains sixteen years old, the same age she was when she debuted.

Hatsune Miku and Live Concerts in North America

In 2009, Hatsune Miku made her first jump from screen to stage, although she had a long way to go before her idol performances at centre stage—in 2009, it is perhaps more accurate to say that she moved from smaller computer screens to a larger screen suspended above a stage. In a concert that would come to be known as Hatsune Miku's first live performance, still images and animated sequences featuring the virtual singer played out on an LCD screen positioned behind a human band while Miku's vocals sang over the speakers for two songs. At this concert, the LCD screen essentially served as a super-sized version of the personal computer screen that viewers

[25] Black, "The Virtual Ideal," 37-50.

could have watched at home. The song titles appeared on the screen before the animations played, lending the performance of the two songs a feeling not unlike watching a music video with live musical accompaniment. This performance was in fact not staged specifically to feature Miku; immediately following the second song, "Black Rock Shooter," a promotional video for the anime series by the same name began to play on the screen.

Presentation techniques used at Vocaloid concerts (as well as other concerts with holographic elements) have come a long way since 2009. More recent performances use projection technology to cast the virtual singer's image onto a transparent band of plastic in such a way that she or he appears as a three-dimensional, life-sized performer. The screen is positioned front and centre on the stage, occupying the same space as a human lead singer, and creating the illusion that the Vocaloid (or other hologram) is singing and dancing independently. With the transparent screen enabling the audience to continue to see the physical space behind the singer, and the width of the setup enabling the hologram free rein of the stage, it's quite possible to forget now and then that the figure on stage is purely a projection of light.

One of the most fascinating aspects of a Hatsune Miku concert is the dynamic between the virtual star and her fans in a live setting. The audience responds to Miku as though she were a living person, chanting her name or screaming for encores, and the hologram gives the appearance of responding to their cries by wiping away a virtual tear and thanking them before performing one more song. The participatory nature of the online culture that fostered the Vocaloid phenomenon also extends to these stadium performances. Cosplay—wearing costumes and accessories that represent a fictional character—is popular at Vocaloid events, and some fans who bear not even a passing resemblance to the diminutive teenage girl will arrive sporting teal-coloured wigs or costumes. Most fans attend equipped with green-tinted glowsticks—a visual

reference to the green onions which they themselves determined would become associated with the singer. Unlike music events to which western audiences are more accustomed, glowsticks are not waved about haphazardly at Vocaloid concerts. One reviewer at a 2016 performance wrote, "the audience were armed with venue-supplied glow sticks that added an unexpected element to the performance. They chanted 'Hey! Hey! Hey!' in rigid time along to the songs, waving their glow sticks in unison as if they'd received specific instructions beforehand."[26] The glowstick-waving, of course, was absolutely planned in advance. A polished, unspoken set of guidelines governs the elaborate rituals of chanting and glowstick movements executed at Vocaloid concerts. For the uninitiated attendee, the abrupt shifts between pulsing, double-time rhythms and fist-pumps accompanied by unified shouts at seemingly arbitrary moments can easily feel bewildering. Although Vocaloid fans have put their own unique spin on glowstick participation at live shows, the practice is common across much of Asia, particularly at concerts featuring pop idols, where fans perform lengthy sets of elaborate dance moves, with customized routines specific to certain songs by certain idols.

This type of participation is a part of the reciprocal relationship of effort and dedication that fans and idols offer one another. Fans develop, share, and master these sequences in advance, and correct execution of the dance signifies "true" fandom among the fan community. The practice is closely linked with a type of dance which fans in Japan refer to as "otagei"—the "ota" taken from "otaku," the Japanese term for someone who takes their fandom to obsessive lengths (especially for subjects related to pop culture or anime), and the "gei" using the same kanji that refers to fine arts or is found in the term "geisha." This style of synchronized group movement is viewed as a type of "cheerleading" to show support for the idol performing onstage.

[26] Millard, "The Virtual Pop Star Hatsune Miku."

In spite of the fact that Hatsune Miku and other virtual performers are unable to even witness or appreciate these shows of encouragement, the custom is now an integral part of Vocaloid concerts.

In English-language reviews, writers reporting on Miku's concerts more frequently refer to the Vocaloid as either a virtual superstar, a holographic superstar[27] or an "open-source superstar,"[28] framing her performances as the results of "a process that's half music software, half social network…something of a massive collective art project."[29] While these types of introductions do sometimes note the significance of the social aspect of Vocaloid music creation, by replacing the "idol" label (which would mean something different to Western audiences than Asian audiences) with a "superstar" label, these authors establish different expectations for Miku's relationship with fans, as well as for her performances. Economist Theodore Koustobinas' definition of superstars frames them as "highly rewarded and visible professionals" to whose services the market attributes significantly higher value.[30] Positioned as the most prominent representatives of their field, superstars serve as touchstones, with whom individuals can align themselves through strategic processes of social identity construction. In his study of superstardom in pop music, William Hamlen argues that while superstars experience disproportionate levels of success, there are quantifiable (albeit slight) differences in quality or ability underpinning their fame.[31] By all of these criteria, idols—with their image crafted to

---

[27] Rebecca Greenfield, "Meet Hatsune Miku, The Japanese Pop Superstar Who Is Entirely Virtual," *Fast Company*, October 24, 2014, fastcompany.com/3037383/meet-hatsune-miku-the-japanese-pop-superstar-who-is-entirely-virtual, accessed July 4, 2019.
[28] Robson, "If You Don't Go See."
[29] Millard, "The Virtual Pop Star Hatsune Miku."
[30] Theodore Koutsobinas, *The Political Economy of Status: Superstars, Markets and Culture Change* (Cheltenham, UK: Edward Elgar Publishing, 2014), 1-2.
[31] William A. Hamlen, Jr., "Superstardom in Popular Music: Empirical Evidence," *The Review of Economics and Statistics* 73 (Nov., 1991): 729-33.

convey a sense of relatability, averageness, and accessibility—differ significantly from superstars. This shift in terminology completely changes the norms surrounding Vocaloid concerts in Western countries.

A concert given by a pop music superstar comes with certain expectations in terms of its production quality, concert format, and charismatic stage presence. Attending one of these concerts enables the fan to enter into a physically co-present experience with the superstar, and to claim the cultural cachet associated with being present for that particular, unique event. Vocaloid concerts in North America work to replicate both of these aspects of a concert experience. For many reviewers witnessing a Vocaloid performance for the first time, the techniques currently used to project Miku onto the stage create a fairly compelling visual experience. Motion capture technology enables technicians to transplant polished dance moves from professional artists' bodies to Miku's virtual body. In 2014, a reviewer from *Vice* enthusiastically described the technology used by Crypton Future Media to create Miku's lifelike image and movements, noting that the additional presence of a live backing band "really brought the whole illusion to life."[32]

Describing the performances as "illusions" prompts us to ask whether the main goal of this technology really is simply to create a convincing simulation of a pop star as possible. We have more hopeful young vocalists than we have space or attention for on the concert stage. Why create subpar holographic replicas? This question sits at the heart of other reviewers' complaints about the holographic concerts. Frequently, some writers feel that in spite of the technological wizardry, Miku's performances come up short. A reviewer for *Live in Limbo* bemoans the fact that Vocaloid performances are stripped of the very attribute which, for the author, makes live

[32] Robson, "If You Don't Go See."

performance worthwhile: the potential for human improvisation. “One of the defining features of live gigs is the excitement of seeing something organic unfold before you. Anything could happen. Gear malfunctions and unexpected surprises are all part of the event. The environment affects the performance which circles around to affect the environment in turn. Hatsune Miku is anything but organic.”[33] The number of writers who echo this sentiment is significant. Reviewers for popular music blogs and periodicals in North America often attend Vocaloid performances with little prior knowledge of the music and culture, and many also attend with some measure of skepticism.

A writer for *Polygon* describes the concert experience in second person, putting her reader in the shoes of a skeptical, Miku-curious attendee:

> You'll see a handful of girls in blue wigs, styled like the Vocaloid idol; boys in Miku Expo shirts from past shows; and men wearing headphones around their necks, hands dug deep into jean pockets, sweat peeking through their graphic tees….There are a ton of parents here, accompanying their anime-loving tweens….You'll hope that the bartender will give them a sympathetic discount on what are surely overpriced beverages, but you'll also know that would never happen. You'll be better off without trying to wait in…line because people will start cheering. These diehards have been around the block a time or two, so they'll know that Miku is raring to get started.[34]

This particular author does not paint Vocaloid fans in a flattering light. The use of second person to describe the gathering intentionally distances the writer from the hordes of screaming teenagers and awkward, sweaty men.

But when these reviewers argue their point by claiming that there is “no story,” and contrast the Vocaloid events with live concerts at which “[a]nything could happen,” including gear malfunctions, what exactly are they bemoaning the loss of? Audiences do not attend performances hoping that an instrument will break or electrical equipment will fail. Perhaps the

---

[33] Weinstein, “Hatsune Miku at the Sony Centre.”

[34] Allegra Frank, “What to Expect at a Hatsune Miku Concert,” *Polygon*, May 31, 2016, polygon.com/2016/5/31/11818548/hatsune-miku-concert-review-nyc-may-2016, accessed July 4, 2019.

workarounds might make for an entertaining story the next day, but do they enhance the quality and immersive experience of the performance? How much unique and meaningful interaction is taking place with the audience at concerts where an exhausted lead singer shouts out the name of the wrong city, once the nightly stops on a concert tour have all started to feel the same? In the case of Vocaloid, carrying over idealized notions of live performance that fixate on the socially constructed and commodified aura of the live musician detracts from a discussion of what this genre is offering to musicians and audiences that is completely new and unique. During Hatsune Miku's North American tour, performances were structured as closely as possible to a pop concert format. Writers naturally responded by treating them as such, but this was not necessarily positive.

Hatsune Miku's tours in North America, which all of the above writers were reviewing, attempted to strike a difficult balance for their audiences. Vocaloid concerts in Canada, the U.S., and Mexico have been much less frequent than those in Asian countries, and the fanbase is neither as large nor as established in North America. The organizers sought to deliver an event that replicated the emotional frenzy and group unity of Vocaloid concerts in Japan which fans had seen online, but also needed to sell the virtual idol to those who attended the concerts purely out of curiosity. This was especially important given that the majority of journalists and concert reviewers who would be writing on the shows knew little of the Vocaloid world, and would be a harder sell than the fans who were instantly thrilled when the first few notes of a hit song from NicoNico rang out over the speakers. And so, Miku's North American performances on the Miku Expo tour were styled to resemble the pop concerts concertgoers were accustomed to. At concerts in Canada and the U.S., American electronic band Anamanaguchi opened for Miku (they were not present at performances in Mexico, however), providing a reassuring, human start

to the evening, and keeping the concert format more in line with what attendees were accustomed to. In contrast, cities on the Japanese leg of the Miku Expo tour did not include an opening band.

In North America, Miku kicked off her part of the performance with a rendition of "World is Mine" （ワールドイズマイン）—a peppy pop track that has long been the most popular Vocaloid song on YouTube in the west. After hours of singing, dancing, and virtual costume changes, concerts concluded with a lengthy encore. Anamanaguchi joined Miku onstage for three songs, after which the lights dimmed, softly illuminating Miku and a holographic Yamaha DX7 keyboard that had suddenly appeared on the screen. The virtual girl shyly sat down at the keyboard to accompany herself for one last quiet song. Video from several concerts on the tour, as well as reviewers' reports, pinpoint this intimate moment as strangely disorienting for audiences, despite the fact that the acoustic number is a standard move at many such concerts by human performers. After a long evening of dance and pop tracks, perhaps newcomers had grown more accustomed to the idea of a hologram lip-synching to a pre-programmed vocal track while a human band provided instrumentals, but they weren't ready to suspend their disbelief enough for a personal moment with a holographic girl with a synthesized voice accompanying herself on a virtual synthesizer. Many found the change jarring, with the attempt at the humanizing move rendering Miku even more inhuman, especially when her holographic freedoms had been played up only moments before. Of this moment, the *Polygon* reviewer wrote, "Her encore will be the most inhuman thing about her: She will play for another full hour, no holds barred. At one point, she will seemingly die, grow wings and ascend up toward the sky. She'll then reappear mere moments later, reborn. Also, she'll be a pianist all of a sudden."[35] Occasionally, audience

[35] Frank, "What to Expect at a Hatsune Miku Concert."

members left behind by the sudden emotional change continued to cheer or laugh while others fiercely shushed them.

Some aspects of the performance at a Miku concert could be considered an improvement when compared with a concert by a human singer: Miku's range and stamina outstrip any human performer, and a hologram never slips up. In Miku's 2016 North American shows, there were times when the performance took advantage of these larger-than-life singing abilities and foregrounded her pre-programmed capabilities as an element in some exciting visual effects, but on the whole, the concerts made a focused effort to frame her as just another stage performer, giving just another concert that adhered to the standard format audiences have come to expect. The sometimes-tepid tone of the reviews for Miku's North American tour may have stemmed from the fact that the concerts were neither here nor there—the performances at times clearly exceeded the bounds of a human musician's capabilities, reminding attendees that they were viewing something inhuman, but rather than fully committing to the idea of Miku as a superhuman performer, the shows remained tethered to the conventions of a typical pop concert. As a result, reviewers' natural response was to engage with them as typical pop concerts. The trouble is, when directly compared to pop music performances delivered by humans, Vocaloid concerts do come up short.

First of all, while the projection technology used to put Miku on stage is impressive, issues such as glowstick reflection on the screen, and a loss of visual depth for viewers seated to the side of the stage can fracture the immersive experience for some, serving as a reminder that the audience is watching a display on a screen. Secondly, while the concert's creators included pre-programmed efforts at audience interaction, such as having Miku introduce songs and express her thanks to the cheering crowd, Vocaloids are still unable to have a truly spontaneous

conversation with their audiences, eliminating the possibility for those unique glimpses into a performing musician's thoughts that can serve as memorable interludes in a concert program. Thirdly, when a Vocaloid reaches a spectacular high note in performance, the awe listeners might feel if a human vocalist did the same thing is dampened, since the audience knows there was no effort exerted by the performer. Writers who point to the absence of possible equipment failures or vocal flubs as a shortcoming of a Vocaloid concert are only scratching the surface of a larger issue. When we witness a pair of trapeze artists at work in the big top, or hear a daring rendition of the embellishments in Olympia's "Doll's Aria" from *The Tales of Hoffmann*, part of the thrill comes from the fact that the performers are pushing their bodies to the limits of human capabilities. There is inherent risk, and a real possibility of disaster. We aren't there hoping to witness disaster, but the prospect of the performers missing the swinging bar or the high A-flat adds emotional intensity because we as humans relate to the emotional intensity of the high-risk performance moment. The excitement of these experiences is lessened when we watch a recording on YouTube, since we already know the outcome. With Vocaloid, too, there is no need to hold our breath—we know that the performer will always hit her notes flawlessly.

When we underscore the losses inherent in a performance by an automated singer, however, we lose sight of what we stand to gain from an exploration of a new performance format that benefits from automation, much as in the case of the player piano and the sequencer. In a Vocaloid performance, although the singer's voice and dance moves play out without variation at each concert, the reviewers' fixation on the repeatability of these particular performance elements has meant that their attention is drawn away from the site of the most important, most fluid interactions: those taking place within the audience. The interviews conducted by Rafal Zaborowski, discussed previously, show that for Vocaloid fans, the open-

access creative culture behind Vocaloid is fundamentally linked to their feelings of identification with the genre. Fans feel a sense of agency when they participate in the development of Vocaloid music culture through their contributions on NicoNico, and as OngaCREST has shown, these contributions collectively and directly shape Vocaloid musical trends. Audience participation at Vocaloid concerts bears similarities to the glowstick-focused otagei dance routines often seen at concerts featuring live idols in Asia, and serves to confer an important sense of true fandom and group belonging on participants who know the right moves and can execute them successfully.

After Miku Expo 2016, it was two more years before a Vocaloid tour returned to North America. Miku Expo 2018 travelled across North America in the summer, and extended its route to include Europe, with stops in Paris, Cologne, and London in the winter, but despite the additional geographical territory covered, Miku Expo 2018 received less press coverage than the tour two years prior. The sensationalized headlines and leads about inhuman pop stars and weird pop culture were noticeably missing from newspapers and blogs as the tour made its way across North America. In 2018, after Miku had already toured North America once, and with news of ABBA and Maria Callas holograms circulating, a description of a holographic pop star simply lacked the shock value it had in 2016. Reviews from 2018 were published less by media companies like Vice, and more on private Vocaloid-, anime-, or tech-themed blogs. The tone of these reviews changed accordingly, from cheeky, arm's-length analyses that focused on feelings of incomprehension and disorientation, to pragmatic considerations of the venue's acoustics and the content of the setlist. Reviewer Brandon Wetherbee closed his description of Miku Expo's Washington D.C. performance with the assessment that the fans were "enjoying a shared live experience. The singer may not be made of flesh and blood, but this is an authentic

experience."[36] Wetherbee's emphasis on this event as a "shared" live experience is significant. Group interactivity, whether online or offline, is an important part of Vocaloid music culture, and as such, it is one thing to read sarcastic reviews from journalists or glowing reviews from fans, and it is another to be physically present at a concert. An absence of stories of gear malfunctions and flubbed dance moves in Vocaloid concerts is far less important than the presence of stories told through the creative community that brings Vocaloid to life. In a genre that is shaped, not by the top-down dictates of a label, but by fan uploads and fan interests, the focus, whether online or at a concert in an arena, should rest squarely on the audience.

And that was the reason I found myself waiting in a lineup that stretched across two New York City blocks in the oppressive July heat for Miku Expo 2018. There were still three hours until the doors were scheduled to open, and I had thought I had arrived plenty early, but the hundreds of people I passed in line on my way to the back indicated otherwise. The fans in line were a diverse group. There were junior-high-age students begging their parents to buy them electronic glowsticks, twenty-somethings in elaborate costumes, forty-somethings carrying Vocaloid merchandise, and grey-haired retirees sporting Hatsune Miku t-shirts. In conversation with the people around me, I met an education graduate student who had flown to New York for Miku Expo, and had brought her mom with her just for fun. I met serious fans who were attending their third Miku concert in five years, and younger fans for whom this was their first live concert of any kind. The attendees towards the front of the line had clearly set up camp early in the day, and their eye-catching cluster of teal wigs and cosplay outfits was drawing stares from passersby, some of whom stopped to lean over the barricade to ask what was going on. Small clusters of people in line occasionally gathered around a speaker pumping out Vocaloid

[36] Brandon Wetherbee, "Live DC: Hatsune Miku Expo @ The Anthem," *Brightest Young Things*, July 13, 2018, brightestyoungthings.com/articles/live-dc-hatsune-miku-expo-the-anthem, accessed June 30, 2019.

music and practised the calls for the song under their breath, or executed the glowstick moves in miniature.

The idea of practicing in advance of a live concert, not as a performer, but as an audience member, is a distinctive aspect of Vocaloid shows, and an important one. During the concert, knowing the songs and their corresponding moves and calls was clearly most of the fun. My experience at this show afforded me the opportunity to consider the experience of both the uninitiated journalist and the seasoned fan. Over the past few years, I have closely studied a handful of popular Hatsune Miku songs. I have watched concert footage from many different shows, and in doing so, I unconsciously picked up the moves and calls for those songs that I had watched so many times. Several of these songs were performed at Miku Expo 2018, and participating with the crowd in those moments, I understood the draw, the excitement, and the sense of togetherness that performing these movements with the group could confer.

At other times during the concert, when Vocaloids with whom I was less familiar took the stage, I was unable to participate. During these songs, I found that, as many journalists had written, I really did feel like I was merely standing and watching a music video in a crowd. Had I been watching a human musician perform, there would have been more interest there for me as an observer, and I would have been more inclined to pay close attention, because of the fact that I was witnessing a performance that would never be repeated exactly the same way again. With a Vocaloid concert, even when I lost my line of sight to the stage in the crowd, I didn't feel anxious about missing something happening onstage, because in the back of my mind, I knew that the exact same dance moves had played out on many other transparent screens at stops along this tour, and sometimes were even recycled from previous tours. I knew that if I really wanted to, I could find video footage of an identical playback of this pre-programmed choreography,

even if it was from a concert in Los Angeles or Mexico City. But if the choreography on the screen was less engaging to me than a typical concert, then it was made up for by the fact that watching the audience around me was far more interesting. A particular moment from the concert will illustrate why.

Partway through the show, after Hatsune Miku had sung several songs, there was a brief transition onstage, and the teal-haired hologram dissolved from the screen. As the audience cheered, the auditorium went dark, save for the green lights of glowsticks still held high. There was a pause, and then a quiet, looping rhythm began to play out into the crowd, accompanied by star shapes drifting lazily up the screen. In these few moments, I did not know what was coming next, but the audience did, and watching the transformation take place around me was fascinating. The audience recognized this looping version of the intro to the next song, realized that the next Vocaloid to appear was going to be Megurine Luka—the Vocaloid associated with the colour pink—and began fumbling with the buttons on their electronic glowsticks, while exclaiming to their neighbours, “Luka! It’s Luka!” Gradually, the sea of green glowsticks around me began to shift to a pink hue, and the audience started up a rhythmic chant, shaking their glowsticks in time towards the stage. The anticipation escalated as the wash of glowsticks grew more uniformly pink, the chant grew louder, and an indistinct pink shape began to coalesce at centre stage. In a flash, Megurine Luka materialized onscreen, accompanied by a dramatic drum fill and a cascade of yellow sparks, and delivered her signature opening line with a dramatic fist pump. The crowd absolutely lost their minds. Coordinated glowsticking failed for a moment as the audience screamed and cheered wildly. And I couldn’t suppress a grin, watching the sheer enthusiasm and joy of the people around me as they started up another rhythmic chant with smiles splitting their faces. In moments such as this one, where I lacked the knowledge or

experience to participate correctly, all I could do was stand and observe, albeit with great amusement.

Compared with most live concerts in venues like this one, at a Vocaloid show, there are much narrower boundaries around correct and incorrect forms of participation. I arrived at Miku Expo equipped only with two green chemical glowsticks, and this limitation prevented me from participating in songs that featured any Vocaloid other than Hatsune Miku, even if I had known the songs. During times like these, when I was merely watching the crowd around me waiting for the next call and then shouting it with all their might, or instantaneously switching glowstick moves at a climactic moment, I couldn't help but wish that I had been able to learn them myself, so that I could be in on the excitement. I considered the substantial amount of time that would have taken, and also realized that for committed fans, that was entirely the point. Precision involvement at a concert like this is a rare opportunity for fans to demonstrate their fandom—which, in the case of Vocaloid, is usually restricted to online interactions and private investment in activities like songwriting or purchasing collectibles—in a public setting, and in the company of other fans.

As intricate as participatory fandom is at a Vocaloid concert, the complexity is not meant to prevent engagement or deter newcomers. Fan-made videos online provide tutorials for the basic glowstick moves used at a concert. At the venue itself, attendees offered extra glowsticks to those who had come unprepared, and explained the colours. Perhaps most remarkably, a fan-made booklet circulated on Twitter during Miku Expo's run, containing no less than 30 pages of detailed instructions for the moves and calls in the songs that were likely to be performed on the tour (Figure 5-1). The booklet's creators printed out hundreds of paper copies at their own expense, handed them out at the Los Angeles and San Jose performances, and sought volunteers

on Twitter to print and distribute copies at other concerts, purely to enable other attendees to feel like they were in on the action.

Miku

by Anamanaguchi ft. Hatsune Miku

(Furi)
Miku, Miku, you can call me Miku
Blue hair, blue tie,
hiding in your wi-fi
Open secrets, anyone can find me
Hear your music running through my mind

Chorus:
(for this part, "dance" with glowstick by pointing at directions and chant "oo-ee-oo")
I'm thinking Miku **(down, up)**
Miku **(down, up)**
OOO-EE-OOO (left, right , left, right)
(repeat 4x)

I'm on top of the world because of you
I do nothing that they could never do
I'll keep playing along with all of you
I'll keep playing along

Chorus

Instrumental **(Hai Chant)**

Rap:
Where were we walking together?
I will see you in the end

Doctor=Funk Beat

by nyanyannya ft. KAITO

oshiawase ni douzo

(Hai Chant)
mada aoi tori o osagashi no kata wa
Come on, now
akirame kirenai kata wa raise de
Get a chance
mou aoi tori ga mieru anata wa It's too late
genkaku ni mazohizumu ni yuuforia…
mousoushou mou doushiyou
kindanshoujou shiawase ga hoshii? Got it!

majiku? not majiku! tane mo shikake mo medikaru
kokoro mo karada mo zenbu hitatte choudai
oyobi kai? **YES MY DOCTOR**
oyobi kai? **YES MY DOCTOR**
kitai no kisai no sutekina kono **DAITEN SAI!**
Get on!

DOCTER FUNK BEAT kaishin da Ready?
Oh!! interijensu no mondai da naoru wakenai darou
DOCTER HELP ME kyuukan wa Rowdy!
koufukukan tarinai nara tanin o hataki otoshite
happii happii tsugi no kata douzo
(clap)

majiku? not majiku!
(magic? not magic!)
ruurie howan in? nai nai daa!
(ruurie howan in? nai nai daa)
oyobi kai? **YES MY DOCTOR**
oyobi kai? **YES MY DOCTOR**
ukatsu ni konya mo kyokudo ni sutekina kore ga
DAI! DAI! DAI! DAI! DAITEN SAI!
Get on!

Figure 5-1: Pages from Miku Expo 2018 call book, @mmywong, @jerky, and @destizeph, *Miku Expo 2018 Callbook*, dropbox.com/s/luuqepo6o2zqpfr/miku%20expo%202018%20call%20book%20%28LA%2BSJ%20setlist%29.pdf?dl=0, accessed July 2, 2019.

This callbook was not created for seasoned Vocaloid fans, but for people who were perhaps attending their first Vocaloid concert without detailed preparation and could benefit from explanations of what "furi" and "kecha" were, and exactly when to do them. The callbook is not prescriptive, however; it is merely descriptive, and serves as a record, in text form, of the practices that have gradually coalesced around these songs over the years. Although some of these practices may originate organically in concert situations, many new additions have their origins online. Because of the interactive nature of NicoNico's commenting system, as discussed earlier, comments that are shown in real time at catchy or climactic moments often snowball into "sing-along" moments, as growing numbers of users add their typed-out echoes to the comment stream. These practices often carry over into live concerts, where thousands of fans who have never met but have watched these videos online can immediately participate all together. The "missing story" that the journalists quoted above were looking for at Vocaloid concerts is not found onstage in the preprogrammed holographic dance moves. At Miku Expo 2018, the story

was clearly unfolding all around me in this microcosm of participatory fandom. It was in the deep emotional connection the fans had with Vocaloid songs, the feelings their creators were sharing, and the opportunity to join in with a practiced group expression of fan enthusiasm.

Visually, Miku Expo performances are set up to resemble a typical pop concert. The singer occupies centre stage, while the band is spread out to the sides. The concerts include conventions such as band introductions, singer commentary, and encores—although at a Vocaloid show, all of this is automated. Mostly notably, even though holographic performers' pre-programmed singing does not require a microphone in order to be played out into the concert hall, much of the Vocaloids' choreography involves a microphone of some type, whether it is a mic on a stand, a handheld mic, or a headset. Music journalists have evaluated Vocaloid concerts in the West as pop concerts—and found them lacking—precisely because they have been presented just like pop concerts. While some of these choices have been made in an effort to legitimize new competencies as authentic musical practice, particularly when presenting these technologies to new audiences, the emerging musical practices associated with Vocaloid are worth being considered on their own merit. In the final section of this chapter, by examining a different format for Vocaloid concerts, I will argue that tethering a Vocaloid performance to the conventions of human pop concerts dilutes the unique strengths and possibilities of this medium. In order to explore their significance, we need to examine holographic performance in a format that minimizes its reliance on pre-existing conventions. Once the scaffolding of pop concert convention is stripped away, what new forms of artistic competency can we see emerging and being refined by Vocaloid users, and what do they mean for performers and listeners? If Miku Expo concerts, in their own way skinned with the human faces and hands of opening bands and backing bands, are designed to replicate live pop concerts as much as possible, then the annual

Vocaloid performances staged in Japan every year at an event called NicoNico Chokaigi offer an entirely different perspective on Vocaloid by eschewing the rituals and structures of human concerts that define Miku Expo.

Vocaloid at NicoNico Chokaigi

NicoNico Chokaigi （ニコニコ超会議）, billed as an event that seeks "to recreate NicoNico's virtual world in real life,"[37] takes place each spring in Chiba prefecture, Japan, drawing more than 150 000 visitors to the convention site and 5.5 million live-stream viewers online. Featuring exhibits and performances centring on the social video website's most popular content (including traditional Kabuki theatre, trains, cooking, dance routines, video games, and Vocaloid), Chokaigi has been growing in size and scope since the first event was held in 2012. People who wish to attend Chokaigi can participate in one of two ways: they can either purchase a ticket to physically attend one or both days of the event onsite in Saitama, or pay to watch a live online broadcast of the performances featured at the event.

Pay-per-view options for online viewership are by no means unique to Chokaigi, at a time when access to events ranging from boxing matches to Grateful Dead concerts can be purchased from television service providers for private, real-time viewing. What is unique about Chokaigi is the way in which the organizers of the live event attempt to replicate the online viewing experience of NicoNico at the Chokaigi event, by integrating the live performances taking place in Saitama with the comments from viewers who are watching the livestream online. On either side of the stage at the physical convention site, two huge screens offer not only the usual camera angles of the action onstage, but a live feed of the comments being contributed

[37] Dwango Co., "NicoNico Chokaigi 2017," chokaigi.jp/2017/en/, Accessed 2017/08/20.

by online viewers. These comments scroll across the stage-side screens in real time, just as they do when one watches any video on NicoNico. The difference here is that the comments are contributed and displayed in the arena as the event unfolds live, offering fans who are unable to attend in person an opportunity to participate from their home computers in a way that visibly adds to the excitement and dialogue in the arena itself. Other streaming services such as Twitch also feature live commenting capabilities during streaming events, but Chokaigi is unique in its integration of online viewers' contributions into the performance itself.

Each year, Vocaloids have performed their own concert at NicoNico Chokaigi, and the show has become one of the most popular and highly anticipated performances, serving as one of the headline events of the two-day gathering. Chokaigi performances are significantly different from the touring Vocaloid concerts that frame Miku as a humanized pop singer, however. Rather than the Vocaloid performers taking a mic at centre stage like a human performer, introductions to the 30-to-40-minute Chokaigi performances frequently begin with human actors who introduce the holographic performers to the stage by presenting a skit in which they "discover" the Vocaloids on a laptop screen, or mime a dramatic holographic conjuring. The Vocaloids themselves, by contrast, are never presented as human. Their virtual existence is foregrounded as they smash their way out from behind holographic computer screens, materialize from distorted masses of glitchy pixels, and feature in retrospective montages which sum up Vocaloid's computer-based history before they take the stage in any sort of standard performative fashion.

The 2014 NicoNico Chokaigi Vocaloid performance placed the holographic singers' over-the-top computerized abilities front and centre with an introduction that forewent all human concert customs in favour of an opening that emphatically foregrounded the automated aspect of their performance. Video from the event shows four human performers standing at the front of

the stage around a wooden barrel organ typical of street performers in the nineteenth century. One person turns the crank on the organ slowly, intentionally, while the other three watch her closely and wait, swaying in time to a music-box tune that plays out into the crowded venue. The audience observes silently. The mechanical notes of the music box melody chime out steadily for a few moments, and then eventually halt, but the human organ grinder continues to rotate the crank in a slow, silent circle. For what? We might expect the barrel organ to begin another automated tune, and the three onstage observers pause, listening expectantly, but instead of another melody, a cymbal crash accompanies a burst of white light from the screens overhead, and the disembodied voice of Hatsune Miku begins spitting out a machine-gun-like string of perfectly monotone syllables at a rate so fast as to be all but incomprehensible. The spotlight on the organ grinder—who is still dutifully turning the crank that now seems to be powering the inhuman stream of syllables uttered by the Vocaloid—gradually fades, and as Miku's outline becomes recognizable on the overhead screen, a stadium full of fans scream their approval and raise their glowsticks. A flood of text streams across the silhouetted image of the girl with long pigtails, surtitling the acousmatic voice.

The sea of multicoloured glowsticks in the arena gradually shifts to a more unified wash of Hatsune Miku's particular shade of green as fans identify the Vocaloid and flick their battery-powered devices to chromatically align themselves with the performer about to take the stage. Still emitting a robotic stream of uninterrupted syllables, Miku's form resolves out of the white silhouette, and translates down from the overhead screen, appearing as a life-sized figure occupying the transparent screen stretched across centre stage. The youthful-looking hologram then takes up her usual series of pop-inspired dance moves, but while her body is moving at a comfortable pace, in an eerie juxtaposition, her mouth continues to work at such a superhuman

speed that it almost becomes a blur. No one can sing along with this performance, but the glowsticks continue pumping towards the ceiling in time with the beat.

This breathless, robotic number is a NicoNico smash-hit titled “The Disappearance of Hatsune Miku -DEAD END-” （初音ミクの消失　-DEAD END-）. The infamous lyrics of this song are spit out at a rate that holds steady at an uncanny 720 syllables per minute in the verses—a speed considered to be impossible for humans (although many have tried, and a few NicoNico uploaders have gained considerable popularity after actually succeeding and posting videos of themselves performing the breathless strings of text). The song is a first-person narration by Hatsune Miku, describing her feelings as she is uninstalled by a user, and realizes that she will always remain less than human, subject to the whims of her creators, and unable to prevent herself from being uninstalled despite her wish to continue singing. Certain moments in the song utilize extreme vocal distortion to achieve effects simulating digital decay as Miku gradually fades from existence. Stuttering vowels create the impression of glitchy playback as Miku gasps out her final regrets and begs for the end to come quickly. In the final seconds of the song, after the Vocaloid haltingly utters a breathy farewell, a message repeats: “A critical error has occurred. A critical error…” （深刻なエラーが発生しました。深刻なエラ）. Compared with the cheery tone of “World is Mine,” the opening song for the North American Miku Expo tour, “The Disappearance of Hatsune Miku” sets an unsettling tone for the start of a concert. Opening a show with a morbid underscoring of the purely fictional, digital existence of the singer onstage and a simulation of her death does not particularly serve to generate the organic rapport of a concert given by a human performer. This inclusion is certainly not part of any tactic to create an illusion of human performance.

While the majority of Miku's songs position her as an empathetic human figure or an innocent fantasy girl, it is striking that a disproportionate number of the Vocaloid's top hits are songs such as "The Disappearance of Hatsune Miku" and "ODDS&ENDS," tracks that play into the trope of the fragile and sometimes bleak nature of the existence of the sentient AI, provoking the listener's compassion by framing Miku as a maligned companion who has gifted users with her voice and been neglected in return. These songs straddle the line between Vocaloid as the type of idol Aoyagi describes—a servant who labours for her fans and relies on them for support and encouragement—and Vocaloid as a computer program capable of executing superhuman musical feats while ultimately remaining nothing more than a piece of software operated by human users.

The final moments of this NicoNico Vocaloid medley from 2014 further underscore the focus on automation with which the segment opened. As the last notes of the last song fade away, the Vocaloid stars still onstage begin to flicker and disappear. Miku walks alone to centre stage as the same music box melody the audience heard in the opening moments plays out into the arena again. The teal-haired hologram bends to pick up a handheld music box that has appeared with her onstage, and, holding it in one hand, raises the other to salute the audience. As she takes her final bow and expresses her thanks, her voice is cut through with bursts of static, and she finally disappears completely. The music box, having fallen from her grasp, drops to the stage floor and falls open, while a holographic camera zoom reveals to the audience that the music box contains the whole cast of the show's Vocaloid performers, returned to a silent, frozen state inside the crank-operated box—a visual metaphor serving as punctuation to end the concert's statement about the automated nature of the holographic performers. Compared with Vocaloid's concert tours, NicoNico Chokaigi performances are stripped completely of the

trappings and customs of human concerts. The sound and imagery of the music box bookending the performance reinforce the concept of Vocaloids as automated performers who can be preprogrammed to execute the elaborate, flawless shows which the audience has just witnessed. Much more so than other concerts and tours, Chokaigi performances take advantage of the virtual nature of Vocaloid singers, throwing their images about during the set through an elaborate series of instantaneous and destabilizing set changes, dropping them underwater, smashing them through glass walls, and having them fight robots, duplicate themselves, and escape from holographic constraints—all while continuing to perform flawless pop star choreography and sing their choruses without drawing a single breath out of place. The effect is anything but human.

Vocaloid's live touring concerts such as Miku Expo force their audiences to consider the spectacle on the same terms as a performance by any other pop star, by adhering as much as possible to the conventions of human concerts, and the reviews treat them as such. In the context of a pop concert format, as these reviewers frequently point out, there are certain things that a pre-programmed performance will never be able to effectively replicate. For many fans, an essential part of a live concert is the physical presence of a performer who possesses a compelling stage presence and is able to create a feeling of rapport with their audience. Critics who point to holographic singers' inability to interact with a crowd are correct—Vocaloids currently possess no capacity to respond to their audiences in real-time. There is no human connection developed between singer and fans over the course of a Vocaloid show. And while touring concerts have frequently attempted to downplay this lack with humanizing moments such as acoustic encores, band introductions, and comments to the audience pre-programmed into the show, NicoNico Chokaigi opts for an opposite approach in many regards, choosing to

foreground and celebrate much of the holographic artifice to which touring concerts avoid drawing attention. At Chokaigi, or at any live Vocaloid performance, the relationship between a celebrity figure onstage and the crowd is less important than the relationships that already exist within the community and have been built around the virtual figure of Hatsune Miku as creators compose and collaborate, and fans participate in the content-symbiotic society that gave rise to the whole Vocaloid phenomenon.

NicoNico Chokaigi was designed to emphasize and celebrate this creative community, as is evidenced by the side-screens continuously streaming the flood of comments from online viewers. These performances pull together the year's best-loved tracks from NicoNico and offer up a holographic smorgasbord of dizzying visual effects, with the crowd's favourite characters at the centre of it all. Being present at one of these performances is about being a part of the community. Every time a new Vocaloid takes to the stage and the crowd switches the colour of their glowsticks, it isn't for the sake of the Vocaloid. When there are no humans on stage, the show of colour isn't directed at the performer. It's a participatory act that connects the glowstick-bearers in a sense of belonging and unity with the rest of the stadium—an insider's badge that identifies the participant as a member of the same amateur community that views, tags, and connects this diverse web of creative contributions.[38]

The meaning of the relationship between the NicoNico Chokaigi crowd and the Vocaloids on stage is perhaps best exemplified by the finale from the 2016 show. Although these elaborate numbers are professionally animated by a top-down creative team, they also carefully preserve the focus on the fans, their history with the medium, and their role in the music's

[38] For more on participatory fandom, see Kristin Michael Barton and Jonathan Malcolm Lampley, eds., *Fan CULTure: Essays on Participatory Fandom in the 21st Century* (Jefferson, NC: McFarland & Company, Inc., 2014) and Henry Jenkins, *Fans, Bloggers, and Gamers: Exploring Participatory Culture* (New York: New York University Press, 2006).

development. The Chokaigi Vocaloid performance in 2016 was a clear example of this, concluding with the hit song “ODDS&ENDS” by Supercell—a song which has become popular enough to be included in two rhythm video games (*-Project DIVA- f* and *–Project DIVA- Arcade Future Tone)*, and which most concert attendees would know very well.

As with previous Chokaigi concerts, the venue is a packed-out Saitama Super Arena, which official NicoNico footage of the event shows densely flecked with green glowsticks. After a full half hour of high-energy music performed by a rotating cast of nine Vocaloid singers, the crowd goes still as Hatsune Miku takes centre stage to introduce the final song: "ODDS&ENDS." A cheer goes up from the audience, and a wash of typed online reactions pour across the live-streaming side-screens as the familiar ascending synth line from “ODDS&ENDS” begins to loop. During the track’s instrumental introduction, a simple silhouette of Miku is projected onto the overhead screen, along with the caption, “Born in 2007, Hatsune Miku.” At the moment of the song’s first vocal entry, however, it is not Miku who takes up her famous melody. Another Vocaloid, Yukari Yuzuki enters the spotlight, singing the opening verse describing the struggling musician. As the verse progresses, one Vocaloid after another takes the stage to sing a line or two, handing the melody off to the next performer, occasionally lingering to harmonize in a duet, or contribute dramatic moves as the song narrates the desperation of the musician. Miku finally joins the rest of the Vocaloids onstage for a choreographed group chorus, issuing the invitation to “compose [your own words] and join them together, I’ll cry out those words and feelings!”—a call that now seems to be addressed to the audience.

As the second verse begins, however, while Miku remains at centre stage, she does not sing. Rather, pairs of Vocaloids approach her to sing a few lines and act out the lyrics, recounting the same story of the musician who eventually gained fame and recognition, but suffered from

isolation and the insults of critics who belittled “machine voices.” This time, significantly, the action on stage clearly frames Miku, rather than the human user, as the subject of this narrative. The teal-haired Vocaloid bows her head in discouragement as her companions quote her critics and narrate her loneliness.

At the start of the next chorus, in a visual move that invokes the illuminated, three-dimensional figure of Miku composed of cogs and springs which dominated the final scene in the “ODDS&ENDS” music video, here, Miku takes centre stage and again spreads her arms wide, but this time, a brilliant pair of wings spreads from her body. These wings are composed of a different sort of odds and ends—the colourful extensions are a collage of stills captured from Vocaloid music videos across years of user uploads. Backed by a wash of frames lovingly created by the fan community, Miku stretches her arms out to the audience and sings the line formerly directed to the struggling musician: “Because I know you’re really kinder than anyone else in the world.”

As we know from the original music video, however, the song has yet to reach its most desperate moment, in which the human musician weeps over his inability to revive his machine-voiced musical partner, realizing, “I’m powerless, unable to save even one of these odds and ends.” In the 2016 Chokaigi concert, as the performance approaches this moment, the audience witnesses a pale, grey-and-white version of Miku, stripped of her wings, stagger and collapse before slipping from the overhead screen and falling to the floor of the stage. As she slowly stands, the instrumentals deviate from the original song, and take up a looping chord progression that quietly accompanies Miku as she finds herself alone on a darkened stage, surrounded by a handful of NicoNico video frames that hang suspended in midair. Cautiously, she approaches each one and reaches out to touch it, but the images shatter, one by one, as her fingers pass

through them. The subdued instrumentals continue to repeat the same progression of chords, and Miku stumbles between frames that vanish in her hands, drawing increasingly ragged breaths, as she speaks, rather than sings, the line that formerly belonged to the struggling musician: “I’m powerless, unable to save even one of these odds and ends.” Over and over, the Vocaloid gasps this line with increasing urgency and despair, as the stage grows dark and empty.

Just as the last frame shatters, and Miku stands alone and discouraged, a white text bubble bearing a sentence in Japanese appears in the blackness behind her, accompanied by a distinctive “tick” sound reminiscent of touch-screen typing. A moment later, a second text bubble appears, followed quickly by a third, a fourth, and eventually a cascade of dozens of messages that clutter the stage. As Miku turns her back to the audience to examine them, an invisible chorus of Vocaloids gently takes up the line Miku had just been gasping out, harmonizing the melody on a neutral syllable. The messages, we realize, are from Vocaloid users and fans--an outpouring of gratitude for the impact of Vocaloid on their lives.

“In the world of Vocaloid, it is so fun to be able to be part of the excitement with everyone. Thank you” （ボーカロイドっていう世界で、みんあでワイワイやれるのが最高に楽しいんだよ。ありがとう）
“Soon it will be ten years? So many musical memories… From here on out, too, I hope we’ll have fun together!” （もうすぐ１０年かあ。思い出の曲沢山あるなー。これからもよろしくね！）
“If there was no Miku, this world of liberated music wouldn’t exist.” （ミクがいなかったら、こんなに自由な音楽の世界はなかったんだよ。）
“I’ve made so many friends!” （友達沢山できたよ！）
“I’m so glad Miku exists” （ミクが居てくれてよかった）

Slowly, Miku turns to face the audience again, drawing an audibly shaky breath before singing the words formerly sung by the struggling musician: “Emotions become falling tears, dampening those cheeks.” But this time, rather than the tears of despair shed by the musician at his lowest moment, for Miku, these are a different type of tears.

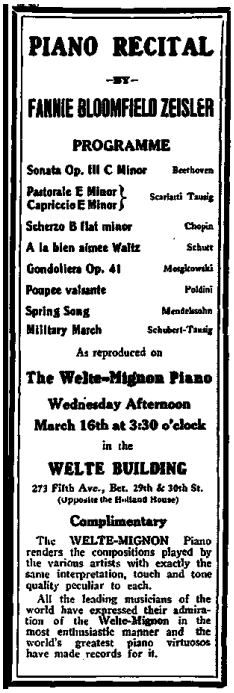
The triumphant final lines of the song are accompanied by the arrival of a full complement of Vocaloids. Fifteen brightly costumed holograms perform synchronized pop choreography, while the crowd in the arena screams their approval, pulsing glowsticks keeping time with the virtual performers. The online crowd responds in kind, with strings of green characters blanketing the side screens as users contribute their reactions to the frenzied finale. As the instrumentals vamp on the closing chords and a shower of confetti rains over the audience, the Vocaloids onstage turn their backs to the crowd, and watch as a retrospective montage plays out on the overhead screen, showing highlights from Vocaloid history arranged year by year. The Vocaloids point and laugh together, as though being reminded of their fondest memories. Finally, they turn to the audience again for a final bow, and the crowd goes wild, with numerous hoarsely emotional cries of "THANK YOU" cutting through the cheers. Are these attendees merely "anime-crazed" fans who want to believe in perfect holograms come to life? And was this pre-programmed concert a "flat" performance with "no story," as the reviewers above argued? Certainly not. In a Vocaloid concert, the story is the medium itself, and the agents are not individual superstars, but the countless passionate contributors who, for more than a decade now, have devoted their time to songwriting, arranging, Vocaloid tuning, adaptation, dance creation, freeware development, animation, online commentary, motion capture, and live concert participation. The moments when Miku or the Vocaloid group turned their backs to the audience in order to see comments posted by fans or snapshots of music videos, the Vocaloids themselves became part of the audience, viewing the collective actions of the fans who have nurtured this genre.

The experience of attending a live Vocaloid concert has a different dimension to it than attending the movie screenings to which Vocaloid has been compared, owing to the deep sense

of fan ownership and involvement in the production of this form of music, and the active participation in the live event. If reviewers attend looking for spontaneous improvisation by expert musicians, then yes, they are at the wrong concert. However, automation is not simply a bad substitute for spontaneity. In order to create a setting where enthusiastic preparation and participation from fans can be a significant part of the show, two factors must be present: predictability and repeatability. Automation permits repeatability. And repeatability permits deeper investment in fan culture. Our era of digital communication has enabled performative fandom to become more pervasive and more precise than ever before. Looking past the superficial strangeness of holographic concerts, we stand to gain important insights about the nature of audience engagement in the twenty-first century. At events like these, the acts of fandom being performed are no longer directed towards a human performer. In many of the cases discussed in this chapter, there isn't even a human performer present. Fans are not screaming for the attention of a figure onstage. In a significant way, the performance taking place in the audience is directed inwards, as a performative act that is both an expression of personal fandom and a participatory action directed towards other fans. Involvement matters at a holographic concert, and is the driving force that has propelled Vocaloid to such widespread and continued popularity.

CONCLUSION

For journalists who have penned reviews designed to squeeze maximum shock value out of their descriptions of holographic concerts, it may come as a surprise to learn that one hundred years ago, very similar things were afoot. A holographic Vocaloid or Maria Callas concert has a lot in common with the reproducing piano concerto which opened chapter 2, from the automated solo performance to the live orchestra or band accompanying it. Or consider an advertisement by Welte-Mignon that drew attention with tactics not at all unlike the recent headlines that have dramatically announced the upcoming holographic ABBA tour. A series of ads printed in early 1910, which ran in newspapers including *The New York Times* and *The American Hebrew & Jewish Messenger*, occupy only a narrow column and contain no photographs or drawings (Figure 6-1).



PIANO RECITAL

—BY—

FANNIE BLOOMFIELD ZEISLER

PROGRAMME

Sonata Op. 111 C Minor	Beethoven
Pastorale E Minor / Capriccio E Minor	Scarlatti Tausig
Scherzo B flat minor	Chopin
A la bien aimee Waltz	Schutt
Gondoliera Op. 41	Moszkowski
Poupee valsante	Poldini
Spring Song	Mendelssohn
Military March	Schubert-Tausig

As reproduced on

The Welte-Mignon Piano

Wednesday Afternoon

March 16th at 3:30 o'clock

in the

WELTE BUILDING

273 Fifth Ave., Bet. 29th & 30th St.

(Opposite the Holland House)

Complimentary

The **WELTE-MIGNON** Piano renders the compositions played by the various artists with exactly the same interpretation, touch and tone quality peculiar to each.

All the leading musicians of the world have expressed their admiration of the Welte-Mignon in the most enthusiastic manner and the world's greatest piano virtuosos have made records for it.

Figure 6-1: Welte-Mignon recital advertisement, Welte Mignon, Advertisement, *The American Hebrew & Jewish Messenger*, March 11, 1910, 487.

The top half of one such ad from March 11 boasts, "PIANO RECITAL BY FANNIE BLOOMFIELD ZEISLER," beneath which is listed a recital program that opens with a Beethoven sonata, and concludes with a Schubert march arranged by piano virtuoso Carl Tausig (Figure 6-1).[1] Bloomfield Zeisler was a well-known concert pianist in the late nineteenth and early twentieth centuries, and her name appeared frequently in New York newspapers and music periodicals, from tour announcements and reviews of her recitals to endorsements for products and updates on the state of her health. An advertisement indicating that this celebrity pianist was going to give a recital in New York City would certainly have caught the attention of interested readers. Halfway down the ad, however, in a small font that nearly vanishes in contrast with the all-caps and bold text above, Welte finally notes that this recital features Fannie Bloomfield Zeisler "as reproduced on" the Welte-Mignon.

Welte ran a number of these ads in 1910, promoting reproduced recitals featuring rolls by great artists such as Josef Hofmann and Ferruccio Busoni.[2] The layout of these ads is typical for recital program announcements in newspapers from this era. In an announcement that used a similar format a few months prior, the program for a Fannie Bloomfield Zeisler recital (given by the woman herself, not a reproducing piano version) was published a week in advance of her concert in Indianapolis.[3] Bloomfield Zeisler was planning to open this recital with a pair of Tausig's transcriptions. In the Welte-Mignon concert, too, this same pair of pieces appears back to back early in the program. Bloomfield Zeisler would have chosen to open her recital with works that showed her playing in the best light, and that her audience would be hoping to hear from her, and Welte carefully followed suit in their reproduced recital. This event is strikingly

[1] Welte-Mignon, Advertisement, *The American Hebrew & Jewish Messenger*, March 11, 1910, 487.
[2] Welte-Mignon, Advertisement, *The New York Times*, March 9, 1910, 18.
[3] "Program Announced for Bloomfield-Zeisler," *Indianapolis Star*, April 18, 1909, A6.

similar—particularly in terms of how it is framed and marketed, as well as in its purpose and execution—to a holographic concert, which is also billed as (a recreation of) a live performance, and can be staged while the artists themselves are in a different geographic location, or even deceased. The goals are similar, the use of automation technology is similar, but the century is different. Conjuring the presence of great artists has been lucrative and newsworthy business for generations; there really is nothing new under the sun.

This study came about as I sought to understand the recurring pattern that characterized the relationship between automation technology in music and the performers and listeners who engaged with it. In this pattern, a new type of automated musical device is introduced, people respond with concern and anxiety that the machine may forcibly replace human musicians, the meaning of the new device is gradually worked out as people discuss and use it, and the technology is eventually understood and adopted in an altered form as a non-threatening tool for musical creation. Automation technology, I argue, isn't a matter of disorienting technologies colliding with unsuspecting musicians and stripping away their agency, but of the gradual refinement of tools that have the potential to democratize music-making. From a certain standpoint, the recurring anxieties around automation technology are understandable. The incursion of new methods and tools into our established practices can feel destabilizing. But a broader perspective reveals that the ominous changes people have feared have never come to pass. Player pianos didn't render concert pianists obsolete. Drum machines and synthesizers were not a death sentence for rock bands. And it stands to reason that Vocaloids aren't going to replace singers. In each of these cases, users of these new technologies have gone on to carve

and then fill their own niches, rather than forcing earlier instruments and forms of music-making into retirement.

As this study progressed, it was increasingly clear that the value of this research was not merely in identifying recurring patterns, but in mapping the persistent elements of these reception histories onto the changing cultural landscapes of each time period in order to trace the slower, long-term shifts in our relationship with automation technology. The history of automation in real-time musical performance is not simply a carousel that spins through interminable iterations of this looping process without change. While the medium-length cyclical processes that we can observe more easily play out in each of these case studies, a larger process is unfolding beneath the repeating patterns. I identify the long-term shift which plays out behind these cycles—similar to Braudel's concept of the *longue durée*—as one of increasing participation. Beginning with player piano users who rejected the concept of an automaton to play their pianos for them, and instead favoured the idea of an assistive device that helped them to feel like co-creators in the interpretation of a piece of music, this study has revealed automation technology to be a democratizing force in music. With Vocaloid in the twenty-first century, not only are amateurs able to use more tools and access more spaces to create music and contribute to its development, but participatory fandom has afforded even more opportunities for involvement in the culture around this style of music, as well as in concerts.

I would argue, however, that there is more behind automation anxiety than simple worries about technological supercession. This reasoning ties directly in with the question of whether these new forms of music-making enabled by automation technology qualify as legitimate musicianship. This issue has been debated in every case study, and behind the veneer of concern, there is a strong element of gatekeeping present in these arguments against

automation. When critics and reviewers raise the issue of whether automation might provide a shortcut for prospective musicians, this argument seems to boil down to a matter of whether someone has "paid their dues" in order to be considered a valid musician. In 1905, one writer suggested that player pianos and other mechanical devices might spoil people's ability to fully appreciate the music they were engaging with by allowing them to skip over all the note-by-note practice necessary to master a piece:

> In these days of mechanism we cannot wonder at the constant endeavour of clever inventors to provide the world of music with machines which promise to save all the trouble and necessity of study and practice….A doubt may arise in the minds of some of us whether, by ruthlessly sweeping aside the old-fashioned methods of acquiring knowledge, step by step, and line by line, any vast boon is offered….We know that many sane men and women find health, mental and corporeal, in the exercise afforded by mountain travel, and it is questionable whether the like result would follow if, instead of plodding upwards from lowland to mountain-top, lovers of nature were provided with flying machines, or some other expeditious motor-power, which would relieve them of all their toil….[4]

This author's choice of words—suggesting that the old-fashioned methods would be "ruthlessly swept aside"—lends a sense of violent intentions to the technology. Demonizing the technology for sweeping aside tradition and offering a cheap shortcut is, of course, a much easier target than openly suggesting that people using automation technology simply aren't trying hard enough or practicing for enough years to meet an arbitrary standard for "real" musicianship. Furthermore, the expeditious, motor-powered gondolas that run up and down today's mountains do not prevent climbers who want to dig their hands into the dusty slopes from doing so. Nor do musical technologies bar practitioners from undertaking the study of a Beethoven sonata the "old-fashioned" way when they wish to do so.

In the late 1970s, Kraftwerk intentionally cultivated a sense of automation anxiety as a part of their aesthetic, proudly foregrounding their lack of traditional instrumental skills, and

[4] William H. Cummings, "Mechanical Music," *The Musical Times*, February 1, 1905, 93.

even stating they did not even consider themselves as musicians.[5] British synth player Gary Numan similarly irked readers of *Contemporary Keyboard* when he went on the record saying: "Well, I'm not really much of a musician anyway….My brother took piano lessons and he said that all my fingers are wrong. Apparently you have to use certain fingers for certain notes. Well I don't know none of that [laughs]. I'm very much limited to a one-finger motion, two at the most. To be honest, I'm not that good a player at all."[6] Theo Cateforis has articulated how the readers of *Contemporary Keyboard*'s contempt for Numan stemmed from his rejection of traditional markers of accomplished musicianship that included hard work, technical skill, and professionalism.[7] In other words, Numan's stardom was seen as unearned.

Unsurprisingly, critics of Vocaloid music also frequently point to the software users' lack of conventional skills on an instrument. In Supercell's "ODDS&ENDS," the lyrics quote detractors belittling a Vocaloid producer: "He's just a nobody who has to rely on a program." Songs sung by Miku's inhuman voice are derided by these same critics as "a terrible offense to the ear." If we compare player pianists, synth stars, and Vocaloid producers to Romantic piano virtuosos, rock guitarists, and singer-songwriters, the contrast is thrown into even sharper relief. The latter group, I would argue, conform to a certain type of visible musical authenticity through markers such as dramatic gestures and emotive facial expressions that seek to convey to an audience that the performer is exerting themselves, emotionally or physically. Performers using automation technology often fail to meet these expectations, and appear to be lacking in skill, investment, or both. Because it removes certain technical barriers, automation technology does make things easier. But gatekeeping the label of "musician" based on practice hours or

---

[5] Pascal Bussy, *Kraftwerk: Man, Machine, and Music* (Middlesex: SAF Publishing Ltd., 1993), 138.
[6] Bruce Dancis, "Gary Numan: Britain's New Wave Techno-Rocker," *Contemporary Keyboard*, August 1980, 39.
[7] Theo Cateforis, *Are We Not New Wave? Modern Pop at the Turn of the 1980s* (Ann Arbor, MI: University of Michigan Press, 2011), 167.

traditional skills does not benefit the music world—nor, more importantly, does it ensure musical quality.

Not only does automation technology permit repeatability, and repeatability permit familiarity, but this familiarity is opening up new opportunities for deeper investment by creators, contributors, and fans. Our era of digital communication has enabled performative fandom to become more pervasive and more precise than ever before, developing into a new type of performance in its own right. One of the most exciting things about being a participant in today's musical culture is in watching new means of involvement and creation open up, and in seeing the development of new spaces for this to take place. So where will we go from here? We can't say for certain, but I suspect the future is participatory.

BIBLIOGRAPHY

Abbate, Carolyn. "Outside Ravel's Tomb." *Journal of the American Musicological Society* 52 (1999): 465-530.

Adelt, Ulrich. *Krautrock: German Music in the Seventies.* Ann Arbor: University of Michigan Press, 2016.

Aeolian Company. Advertisement. *The Atlantic Monthly*, December 1922, 97-8.

———. Advertisement. *Boston Daily Globe*, October 2, 1898, 31.

———. Advertisement. *Cosmopolitan* 61, no. 5 (October 1916): 92-3.

———. Advertisement. *New York Times*, May 23, 1917, 7.

———. Advertisement. *New York Times*, November 23, 1898, 2.

———. Advertisement. *New York Tribune*, December 11, 1898, B1.

———. Advertisement. *New York Tribune*, November 9, 1899, 10.

———. Advertisement. *New York Tribune*, October 30, 1898, B3.

———. Advertisement. *New York Tribune*, October 8, 1898, 2.

AFP News Agency. "Astonishment as Hologram, Live Orchestra Put Callas Back Onstage." YouTube video. Accessed June 28, 2019. youtube.com/watch?v=ieTsKYg1_Qo.

Albiez, Sean, and Kyrre Tromm Lindvig. "*Autobahn* and Heimatklange: Soundtracking the FRG." In *Kraftwerk: Music Nonstop*, ed. Sean Albiez and David Pattie, 15-43. New York: Continuum, 2011.

Altman, Rick. "Introduction." *Yale French Studies* 60 (1980): 3-15.

———. *Silent Film Sound.* New York: Columbia University Press, 2004.

American Piano Company. Advertisement. *The Tuners Journal* 8 no. 13 (June 1929): 17.

Anti-Pianola. "Mechanical Pianoforte Players." *Musical Opinion & Music Trade Review* 25, no. 290 (Nov. 1901): 101.

Aoyagi, Hiroshi. "Pop Idols and the Asian Identity." In *Japan Pop!: Inside the World of Japanese Pop Culture*, ed. Timothy J. Craig, 214-25. Armonk, NY: M.E. Sharpe, 2000.

———. *Islands of Eight Million Smiles: Idol Performance and Symbolic Production in Contemporary Japan*. Cambridge, MA: Harvard University Press, 2005.

Auslander, Philip. *Liveness: Performance in a Mediatized Culture.* New York: Routledge, 1999.

Bangs, Lester. "KRAFTWERKFEATURE, Or, How I Learned to Stop Worrying & Love the Bahn." *Creem*, September 1975, 30-1.

Barker Bros. Advertisement. *Los Angeles Times*, March 14, 1926, C20.

Barton, Kristin Michael, and Jonathan Malcolm Lampley, eds. *Fan CULTure: Essays on Participatory Fandom in the 21st Century.* Jefferson, NC: McFarland & Company, Inc., 2014.

Beecher, Mike. "Kraftwerk Revealed: An Interview with Ralf Hütter." *Electronics & Music Maker,* September 1981, 62-3.

Benjamin, Walter. "The Work of Art in the Age of Mechanical Reproduction." In *Illuminations,* ed. Hannah Arendt, trans. Harry Zohn, 217-52. New York: Schocken Books, 2007.

Bijker, Wiebe E. *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change.* Cambridge, MA: The MIT Press, 1995.

Biteable. "Ad Maker." Accessed October 19, 2018. biteable.com/advertising.

Bjorken-Nyberg, Cecilia. *The Player Piano and the Edwardian Novel*. Burlington, VT: Ashgate Publishing Company, 2015.

Black, Daniel. “The Virtual Ideal: Virtual Idols, Cute Technology and Unclean Biology.” *Continuum: Journal of Media & Cultural Studies* 22 (February 2008): 37–50.

“Bokaro 2013-nen tsukibetsu toukoushasuu gurafu”「ボカロ 2013 年 月別投稿者数グラフ」[Graph of 2013 Monthly Vocaloid Uploader Counts]. NicoNico. Accessed October 26, 2015. ch.nicovideo.jp/kadotanimitsuru/blomaga/ar428894.

Bourdaghs, Michael K. *Sayonara Amerika, Sayonara Nippon: A Geopolitical Prehistory of J-Pop*. New York: Columbia University Press, 2012.

Brackhane, Fabian. “Kempelen’s Speaking Machine.” YouTube. Accessed May 19, 2019. youtube.com/watch?v=k_YUB_S6Gpo.

Braudel, Fernand. *The Mediterranean and the Mediterranean World in the Age of Philip II*, trans. Sian Reynolds. 2 vols. New York: Harper and Row, 1972-73.

Braun, Hans-Joachim, ed. *Music and Technology in the Twentieth Century.* Baltimore: The Johns Hopkins University Press, 2002.

Braverman, Harry. *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century*. New York: Monthly Review Press, 1974.

Bull, Michael, and Les Back, eds, *The Auditory Culture Reader*. New York: Berg, 2003.

Burgan, Mary. “Heroines at the Piano: Women and Music in Nineteenth-Century Fiction.” In *The Lost Chord: Essays on Victorian Music*, ed. Nicholas Temperley, 42-67. Bloomington: Indiana University Press, 1989.

Bussy, Pascal. *Kraftwerk: Man, Machine and Music.* Sarajevo: SAF Publishing Ltd., 2004.

Butler, Mark. *Playing with Something That Runs: Technology, Improvisation, and Composition in DJ and Laptop Performance.* New York: Oxford University Press, 2014.

Buxton, David. “Music, the Star System, and the Rise of Consumerism.” In *On Record: Rock, Pop and the Written Word*, ed. Simon Frith and Andrew Goodwin, 427-40. New York: Routledge, 2006.

Canales, Jimena. *A Tenth of a Second: A History*. Chicago: The University of Chicago Press, 2009.

Cateforis, Theo. *Are We Not New Wave? Modern Pop at the Turn of the 1980s.* Ann Arbor, MI: University of Michigan Press, 2011.

Chion, Michel. *Audio-Vision: Sound on Screen.* New York: Columbia University Press, 1994.

Choi, Grace Y. “‘Who Run the Music? Girls!’ Examining the Construction of Female Digital Musicians’ Online Presence,” *Popular Music and Society* 40 (2017): 474-87.

Colmenares, Gustavo, et al. “Computational Modeling of Reproducing-Piano Rolls.” *Computer Music Journal* 35 (Spring 2011): 58-75.

Conroy’s. Advertisement. *St. Louis Post – Dispatch*, December 11, 1921, B17.

Contact Music. “Studio Killers – Interview.” Accessed July 3, 2019. contactmusic.com/studio-killers/studio-killers-interview-2014-june.

Covey, Paul Michael. “Selling ‘The Things Money Can’t Buy’: Piano Advertising in the Mid-Twentieth Century.” *Journal of the Society for American Music* 13 (2019): 54-77.

Cummings, William H. “Mechanical Music.” *The Musical Times* 46, no. 744 (Feb. 1905): 93-4.

Currid, Brian. “’Finally, I Reach to Africa’: Ryuichi Sakamoto and Sounding Japan(ese).” In *Contemporary Japan and Popular Culture*, ed. John Whittier Treat, 69-102. Honolulu: University of Hawaii Press, 1996.

Dancis, Bruce. “Gary Numan: Britain’s New Wave Techno-Rocker.” *Contemporary Keyboard*, August 1980, 39.

Delasaire, William. “Player-Piano Notes.” *The Musical Times* 66 (July 1, 1925): 620-1.

———. “Player-Piano Notes.” *The Musical Times* 66 (October 1, 1925): 918-9.
Delwiche, Aaron, and Jennifer Jacobs Henderson, eds. *The Participatory Cultures Handbook.* New York: Routledge, 2013.
DeVale, Susan. “Organizing Organology.” In *Issues in Organology: Selected Reports in Ethnomusiology,* vol. 8, ed. Susan DeVale, 5-36. Los Angeles: Department of Ethnomusicology and Systematic Musicology, University of California, Los Angeles, 1990.
Doerschuk, Bob. “Orchestral Manoeuvres in the Dark.” *Keyboard,* April 1982, 30-6.
Dolan, Emily. *The Orchestral Revolution: Haydn and the Technologies of Timbre*. Cambridge: Cambridge University Press, 2013.
Dolan, Emily, and John Tresch. “A Sublime Invasion: Meyerbeer, Balzac, and the Opera Machine.” *The Opera Quarterly* 27 (2011): 4-31.
Doran, John. “Karl Bartos Interviewed: Kraftwerk and the Birth of the Modern.” *The Quietus,* March 11, 2009. Accessed May 27, 2019. thequietus.com/articles/01282-karl-bartos-interviewed-kraftwerk-and-the-birth-of-the-modern.
Duffett, Mark. “Average White Band: Kraftwerk and the Politics of Race.” In *Kraftwerk: Music Non-Stop,* ed. Sean Albiez and David Pattie, 194-213. New York: Continuum, 2011.
Duguid, Paul. “Material Matters: The Past and Futurology of the Book.” In *The Future of the Book,* ed. Geoffrey Nunberg, 63-102. Berkeley: University of California Press, 1996.
Dwango Co. Ltd. “NicoNico Chokaigi 2017.” Accessed 2017/08/20. chokaigi.jp/2017/en.
Ehrlich, Cyril. *The Piano: A History*. New York: Oxford University Press, 1990.
Eidsheim, Nina Sun. *The Race of Sound: Listening, Timbre, and Vocality in African American Music.* Durham, NC: Duke University Press, 2018.
Eilers, H. J. “Piano Players & Piano Sales.” *Musical Opinion & Music Trade Review* 28, no. 335 (Aug. 1905): 827-8.
Eyerman, Charlotte N. “Piano Playing in Nineteenth-Century French Visual Culture.” In *Piano Roles: A New History of the Piano,* ed. James Parakilas, 216-35. New Haven: Yale University Press, 2001.
F. J. Schwanovsky. Advertisement. *Detroit Free Press*, December 11, 1898, A1.
“First International Sewing Machine and Domestic Appliances Exhibition.” *The Journal of Domestic Appliances and Sewing Machine Gazette*, December 1, 1887, 24-5.
Flür, Wolfgang, Janet Porteous, and Barbara Uhling. *Kraftwerk: I Was a Robot.* London: Omnibus Press, 2017.
Frank, Allegra. “What to Expect at a Hatsune Miku Concert.” *Polygon*, May 31, 2016. Accessed July 4, 2019. polygon.com/2016/5/31/11818548/hatsune-miku-concert-review-nyc-may-2016.
Frith, Simon, and Simon Zagorski-Thomas. *The Art of Record Production.* Burlington, VT: Ashgate, 2012.
Furness, Zack. “Biketivism and Technology: Historical Reflections and Appropriations.” *Social Epistemology* 19 (2005): 401-17.
Galbraith, Patrick W., and Jason G. Karlin, eds. *Idols and Celebrity in Japanese Media Culture.* New York: Palgrave Macmillan, 2012.
Gann, Kyle. *The Music of Conlon Nancarrow.* New York: Cambridge University Press, 1995.

Gay, Leslie C., Jr. "Before the Deluge: The Technoculture of Song-Sheet Publishing Viewed from Late-Nineteenth-Century Galveston." In *Music and Technoculture*, ed. Rene T. A. Lysloff and Leslie C. Gay, Jr., 204-32. Middletown, CT: Wesleyan University Press, 2003.

Geo. J. Birkel Co. Advertisement. *Los Angeles Times*, November 21, 1909, II.

Gitelman, Lisa, and Geoffrey Pingree. *New Media, 1740-1915*. Cambridge, MA: MIT Press, 2003.

Gitelman, Lisa. *Always Already New: Media, History, and the Data of Culture.* Cambridge, MA: MIT Press, 2008.

Givens, Larry. *Re-Enacting the Artist: The Story of the Ampico Reproducing Piano.* Vestal, NY: The Vestal Press, 1970.

Goto, Masataka. "Frontiers of Music Technologies: Singing Synthesis and Active Music Listening." Presentation, CIRMMT Distinguished Lecture, Montreal, QC, September 24, 2015.

———. "OngaCREST Project: Building a Similarity-Aware Information Environment for a Content-Symbiotic Society." In *Human-Harmonized Information Technology, Volume 2: Horizontal* Expansion, ed. Toyoaki Nishida, 1-40. Tokyo: Springer Japan, 2017.

Greenall, John. Advertisement. *Journal of Domestic Appliances and Sewing Machine Gazette,* January 1, 1886, 33.

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

Greenfield, Rebecca. "Meet Hatsune Miku, The Japanese Pop Superstar Who Is Entirely Virtual." *Fast Company,* October 24, 2014. Accessed July 4, 2019. fastcompany.com/3037383/meet-hatsune-miku-the-japanese-pop-superstar-who-is-entirely-virtual.

Grew, Sydney. *The Art of the Player-Piano: A Textbook for Student and Teacher.* London: Kegan Paul, Trench, Trubner & Co. Ltd., 1922.

Gronholm, Pertti. "Kraftwerk – the Decline of the Pop Star." In *Kraftwerk: Music Non-Stop*, ed. Sean Albiez and David Pattie, 63-79. New York: Continuum: 2011.

Hadfield, James. "YMO's Yukihiro Takahashi celebrates a pair of 40th anniversaries." *The Japan Times*, November 23, 2018. Accessed June 17, 2018. japantimes.co.jp/culture/2018/11/23/music/ymos-yukihiro-takahashi-celebrates-pair-40th-anniversaries/#.XQhczBZKhaQ.

Hamlen, William A., Jr. "Superstardom in Popular Music: Empirical Evidence." *The Review of Economics and Statistics* 73 (Nov. 1991): 729-33.

Hankins, Thomas L., and Robert J. Silverman. *Instruments and Imagination.* Princeton: Princeton University Press, 2014.

Hardman, Peck & Co. Advertisement. *New York Times*, October 11, 1925, RPA6.

Harris, Neil. *Cultural Excursions: Marketing Appetites and Cultural Tastes in Modern America.* Chicago: University of Chicago Press, 1990.

Henke, James. "Yellow Magic Orchestra: Japanese Technopop is Poised to Invade America." *Rolling Stone* 319, June 12, 1980. Accessed July 28, 2019. rollingstone.com/music/music-news/yellow-magic-orchestra-188812.

Herbert, Haynes & Co. Advertisement. *Otago Daily Times*, July 27, 1911, 3.

Hickman, C. N. “A Spark Chronograph Developed for Measuring Loudness of Piano Tones.” *The Journal of the Acoustical Society of America* 1, no. 35 (1929): 138-46.

Hilgers, Philipp von. “The History of the Black Box: The Clash of a Thing and Its Concept.” *Cultural Politics* 7 (2011): 41-58.

“Hire Agreements.—Important.” *Journal of Domestic Appliances and Sewing Machine Gazette*, July 1, 1886, 13.

Holliday, Kent. “Some American Firms and Their Contributions to the Development of the Reproducing Piano.” In *Perspectives on American Music, 1900-1950*, ed. Michael Saffle, 105-36. New York: Routledge, 2012.

———. *Reproducing Pianos Past and Present.* Lewiston, NY: The Edwin Mellen Press, 1989.

Howe, Richard J. “The Ampico Research Laboratory and Recording Studio Photos.” *The AMICA News Bulletin* 29, no. 2 (1992): 10-14.

Howe, Sondra Wieland. “Music in the Private Sphere, Churches, and Community.” In *Women Music Educators in the United States: A History*, 51-70. Lanham, MD: Scarecrow Press, 2014.

Hütter, Ralf. “Interview.” *Beacon Radio, Birmingham, UK*, June 14, 1981. Accessed May 30, 2019. Retrieved from archive.org/web/20081202043525/http://kraftwerk.technopop.com.br/interview_122.php.

Inaba, Minoru. “Computer Rock Music Gaining Fans.” *Sarasota Journal*, August 18, 1980, 11A.

Jackson, Louise H., and Mike Dines. “Vocaloids and Japanese Virtual Vocal Performance: The Cultural Heritage and Technological Futures of Vocal Puppetry.” In *The Oxford Handbook of Music and Virtuality*, ed. Sheila Whiteley and Shara Rambarran, 101-10. New York: Oxford University Press, 2016.

Janosy, Zoltan. “Computer Analysis of Player Piano Rolls.” *Computer Music Journal* 18 (Autumn 1994): 9-10.

Jenkins, Henry. *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century.* Cambridge, MA: The MIT Press, 2009.

———. *Fans, Bloggers, and Gamers: Exploring Participatory Culture.* New York: New York University Press, 2006.

John M. Gallup & Co. Advertisement. *The Hartford Courant*, June 5, 1899, 10.

Joseph, Charles M. *Stravinsky’s Ballets*. New Haven: Yale University Press, 2011.

Joyce, Mike. “Yellow Magic.” *The Washington Post*, November 6, 1979, B7.

Katz, Mark. “The Amateur in the Age of Mechanical Music.” In *The Oxford Handbook of Sound Studies*, ed. Trevor Pinch and Karen Bijsterveld, 459-79. New York: Oxford University Press, 2011.

Keightley, Keir. “‘Turn It Down!’ She Shrieked: Gender, Domestic Space, and High Fidelity, 1948-59.” *Popular Music* 15 (1996): 149-77.

Kempelen, Wolfgang von. *Mechanismus der menschlichen Sprache nebst der Beschreibung einer sprechenden Machine.* Vienna: J.B. Degen, 1791.

Kennedy, Michael M. “The ‘Death’ of Live Musical Theater? ‘Virtual Orchestras’ and the 2003 Broadway Musicians’ Strike.” Paper presented at the Annual Meeting of the American Musicological Society, Rochester, New York, November 9-12, 2017.

Kenner, Hugh. *The Counterfeiters: An Historical Comedy*. London: Dalkey Archive Press, 2005.

Kiuchi, Yuya. “Idols You Can Meet: AKB48 and a New Trend in Japan’s Music Industry.” *The Journal of Popular Culture* 50 (February 2017): 30-49.

Klatt, Dennis H. “Review of Text-to-Speech Conversion for English.” *The Journal of the Acoustical Society of America* 82 (1987): 737-93.
Knabe. Advertisement. *New York Tribune*, March 24, 1918, F10.
———. Advertisement. *The New York Times*, January 15, 1920, 16.
Koutsobinas, Theodore. *The Political Economy of Status: Superstars, Markets and Culture Change.* Cheltenham, UK: Edward Elgar Publishing, 2014.
Kraftwerk and the Electronic Revolution. Dir. Rob Johnstone. New York: Films Media Group, 2013. eVideo.
Kranich & Bach. Advertisement. *American Homes and Gardens*, September 1912, back cover.
Landay Bros. Advertisement. *The New York Times*, December 24, 1908, 2.
———. Advertisement. *The New York Times*. July 27, 1908, 2.
Landecker, Hannah. “Cellular Features: Microcinematography and Film Theory.” *Critical Inquiry*, 31 (June 2005): 903-37.
Lawson, Rex. “On The Right Track - Dynamic Recording for the Reproducing Piano (Part Four).” *The Pianola Journal* 23 (2013): 11-26.
———. “On the Right Track: The Recording of Dynamics for the Reproducing Piano (Part One).” *The Pianola Journal* 20 (2009): 3-58.
Lerner, Neil. “Mario’s Dynamic Leaps: Musical Innovations (and the Specter of Early Cinema) in *Donkey Kong* and *Super Mario Bros.*” In *Music in Video Games: Studying Play*, ed. K.J. Donnelly, William Gibbons, and Neil Lerner, 1-29. New York: Routledge, 2014.
Levelt, Willem. *A History of Psycholinguistics: The Pre-Chomskyan Era.* Oxford: Oxford University Press, 2013.
Lewis, John. “Back to the Future.” *The Guardian*, July 4, 2008. Accessed June 18, 2019. theguardian.com/music/2008/jul/04/electronicmusic.filmandmusic11.
Littlejohn, John T. “Kraftwerk: Language, Lucre, and Loss of Identity.” *Popular Music and Society* 32 (2009): 635-53.
Loesser, Arthur. *Men, Women, and Pianos.* New York: Simon and Schuster, 1954.
Lovink, Geert. *My First Recession: Critical Internet Cultures in Transition.* Rotterdam: Nai Publishers, 2004.
Lucus-Flannery, Mary. “What I learned from a vocaloid and 1500 screaming millennials.” *Medium*, May 5, 2016. Accessed July 23, 2019. medium.com/@marylucusflannery/what-i-learned-from-a-vocaloid-and-1500-screaming-millennials-d181a26d5ce6.
Manning, Peter. *Electronic and Computer Music.* New York: Oxford University Press, 2013.
Matsutani, Minoru. “Voting for Idols is Bigger than Politics.” *The Japan Times,* July 1, 2013. Accessed July 4, 2019. japantimes.co.jp/life/2013/07/01/language/voting-for-idols-is-bigger-than-politics/#.WTwmTWjyvIU.
McCoy-Weber. Advertisement. *St. Louis Post – Dispatch*, December 2, 1921, 10.
McEvoy, J. P. “The Player-Piano Upstairs.” In *Slams of Life, with Malice for All and Charity Toward None*, 22. Chicago: P. F. Volland Company, 1919.
McGrath, Paul. “Multiplies Yellow Magic Orchestra.” *The Globe and Mail*, August 30, 1980, F6.
Meyer-Frazier, Petra. “Music, Novels, and Women: Nineteenth-Century Prescriptions for an Ideal Life.” *Women and Music: A Journal of Gender and Culture*, 10 (2006): 45-59.
Middleton, Richard. *Studying Popular Music.* Philadelphia: Open University Press, 1990.

Millard, Drew. “The Virtual Pop Star Hatsune Miku Is So Good She Makes Me Want to Throw Up.” *Noisey*, May 7, 2016. Accessed July 21, 2019. noisey.vice.com/en_us/article/hatsune-miku-show-review-2016.

Morris, Chris. “Wendy Carlos Takes Her Moog Music to East Side Digital.” *Billboard*, October 3, 1998, 69.

Moseley, Roger. “Digital Analogies: The Keyboard as Field of Musical Play.” *Journal of the American Musicological Society*, 68 (Spring 2015): 151-228.

———. *Keys to Play: Music as a Ludic Medium from Apollo to Nintendo.* Oakland, CA: University of California Press, 2016.

Nagy, Peter, and Gina Neff. “Imagined Affordance: Reconstructing a Keyword for Communication Theory.” *Social Media + Society* 1 (2015): 1-9.

Neves, M. J. “The Dehumanization of Art: Ortega y Gasset’s Vision of New Music.” *International Review of the Aesthetics and Sociology of Music* 43 (December 2012): 365-76.

Newman, Ernest. *The Piano-Player and Its Music*. Edinburgh: Riverside Press, 1920.

“A Notable Presentation of a Notable Instrument.” *New York Tribune*, November 25, 1917, 6.

Nye, Sean. “Minimal Understandings: The Berlin Decade, The Minimal Continuum, and Debates on the Legacy of German Techno.” *Journal of Popular Music Studies* 25 (June 2013): 154-84.

Ord-Hume, Arthur W. J. G. *Pianola: The History of the Self-Playing Piano.* London: Allen & Unwin, 1984.

Oricon News. 「supercell のメンバーにインタビュー」 [Interview with Supercell Members]. Accessed December 11, 2018. oricon.co.jp/trend/hayari/20080805_02.html.

Pattie, David. “Kraftwerk: Playing the Machines.” In *Kraftwerk: Music Non-Stop*, ed. Sean Albiez and David Pattie, 119-36. New York: Continuum: 2011.

Peters, John Durham. *Speaking into the Air: A History of the Idea of Communication.* Chicago: University of Chicago Press, 1999.

“The Piano Player Vogue.” *Musical Opinion & Music Trade Review* 26, no. 304 (Jan. 1903): 309.

Pinch, Trevor J., and Wiebe E. Bijker. “The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other.” *Social Studies of Science* 14 (August 1984): 399-441.

Pinch, Trevor, and Frank Trocco. *Analog Days: The Invention and Impact of the Moog Synthesizer*. Cambridge, MA: Harvard University Press, 2002.

Pinch, Trevor, and Karin Bijsterveld. “Sound Studies: New Technologies and Music.” *Social Studies of Science* 34, no. 5 (Oct. 2004): 635-48.

“Player-Piano Nomenclature: Words to Use and Avoid.” *Player Piano* 1, no. 5 (September 1911): 5-6.

“Press Notices on the Exhibition of Domestic Labour-Saving Appliances, 1881.” *The Sewing Machine Gazette and Journal of Domestic Appliances*, April 1, 1881, 32.

“Program Announced for Bloomfield-Zeisler.” *Indianapolis Star*, April 18, 1909, A6.

Prusa, Igor. “Megaspectacle and Celebrity Transgression in Japan: The Sakai Noriko Media Scandal.” In *Idols and Celebrity in Japanese Media Culture*, ed. Patrick W. Galbraith and Jason G. Karlin, 56-71. New York: Palgrave Macmillan, 2012.

Q. “Q Review: Enter Hatsune Miku’s Hologram Concert.” CBC Radio, May 24, 2016. Accessed July 12, 2019. cbc.ca/radio/q/schedule-for-tuesday-may-24-2016-1.3597178/q-review-enter-hatsune-miku-s-hologram-concert-1.3597187.

Rehding, Alexander. “Three Music-Theory Lessons.” *Journal of the Royal Music Association,* 141 (2016): 251-82.

Renfro, Kim. “Here’s Why Modern Songs Play on the Saloon’s Piano in ‘Westworld’.” *Insider*, October 11, 2016. Accessed July 23, 2019. thisisinsider.com/westworld-piano-songs-2016-10.

Riskin, Jessica. “The Defecating Duck, or, the Ambiguous Origins of Artificial Life.” *Critical Inquiry* 29 (Summer 2003): 599-633.

———. *The Restless Clock: A History of the Centuries-Long Argument over What Makes Living Things Tick*. Chicago: The University of Chicago Press, 2016.

Robson, Daniel. “If You Don’t Go See Virtual Pop Star Hatsune Miku in Concert You’re Insane.” *Noisey*, October 1, 2014. Accessed July 21, 2019. noisey.vice.com/en_ca/article/if-you-dont-go-see-virtual-pop-star-hatsune-miku-in-concert-youre-insane.

Roehl, Harvey. *Player Piano Treasury: The Scrapbook History of the Mechanical Piano in America, As Told in Story, Pictures, Trade Journal Articles and Advertising.* New York: Vestal Press, 1961.

Rousseau, Jean-Jacques. *On the Origin of Language,* trans. John H. Moran and Alexander Gode. Chicago: University of Chicago Press, 1966.

Rudolph Wurlitzer Co. Advertisement. *The Cincinnati Enquirer,* September 8, 1907, 4.

Rushkoff, Douglas. *Present Shock: When Everything Happens Now*. New York: Penguin Group, 2013.

Ryo. “Hatsune Miku sang original song「Melt.」” Accessed March 23, 2017. nicovideo.jp/watch/sm1715919.

Sarah, Duchess of Marlborough. *Private Correspondence of Sarah, Duchess of Marlborough,* vol. 2. London: Henry Colburn, 1838.

Savage, Jon. “Interview: Kraftwerk.” *Red Bull Music Academy,* August 30, 2012. Accessed May 28, 2019. daily.redbullmusicacademy.com/2012/08/kraftwerk-interview.

Schneider, Mitchell. “The Man-Machine.” *Rolling Stone,* May 18, 1978. Accessed May 27, 2019. rollingstone.com/music/music-album-reviews/the-man-machine-96960.

Seaver, Nick. “‘This is Not a Copy’: Mechanical Fidelity and the Re-enacting Piano.” In “The Sense of Sound,” eds. Rey Chow and James A. Steintrager, special issue of *differences: A Journal of Feminist Cultural Studies*, 22 (2003): 54-73.

Shiba, Tomonori. *初音ミクはなぜ世界を変えたのか？ [Why Did Hatsune Miku Change the World?]* Tokyo: Outa Shuppan, 2014.

Simonton, Richard C., and Ben Hall. Liner notes to *The Welte Legacy of Piano Treasures*. Hathaway and Bowers, Inc. HSTR-5370, 1963. LP.

Singer’s Sewing Machines. Advertisement. *The Sewing Machine Gazette and Journal of Domestic Appliances*, January 1, 1881, 12.

Slade, Alison, Amber J. Narro, and Dedria Givens-Carroll, eds. *Television, Social Media, and Fan Culture.* Lanham, MD: Lexington Books, 2015.

Smith, Bertram. “The Piano-Player.” *The Musical Times* 52 (May 1911): 308-9.

Sohmer & Co. Advertisement. *New York Times,* October 30, 1913, 18.

Spigel, Lynn. *Make Room for TV: Television and the Family Ideal in Postwar America.* Chicago: University of Chicago Press, 1992.
Stanyek, Jason, and Benjamin Piekut. “Deadness: Technologies of the Intermundane.” *The Drama Review*, 54 (2010): 14-38.
Steinhard, Erich. "Donaueschingen: Mechanisches Musikfest." *Der Auftakt* 6 (1926): 183.
Steinway & Sons. Advertisement. *Country Life*, 31 no. 803 (May 25, 1912): lxxxix.
Steinway Pianofortes. Advertisement. *Journal of Domestic Appliances and Sewing Machine Gazette*, January 1, 1886, 1.
Studio Killers. “About.” Studio Killers YouTube Channel. Accessed July 3, 2019. youtube.com/user/StudioKillers/about.
Suisman, David. “Nancarrow in Context: A Critical History of Player-Pianos and Mechanical Automation.” Paper presented at *Online Symposium: Conlon Nancarrow, Life and Music*, September 27 – October 27, 2012. Accessed December 4, 2018. conlonnancarrow.org/symposium/papers/suisman/suisman.htm.
———. “Sound, Knowledge, and the ‘Immanence of Human Failure’: Rethinking Musical Mechanization through the Phonograph, the Player-Piano, and the Piano.” *Social Text* 28 (Spring 2010): 13-34.
Supercell. “Biography.” Accessed July 8, 2019. supercell.jp/biography.html.
“Symphony Players in Novel Concert.” *New York Sun*, November 18, 1917, 9.
T. Davison. Advertisement. *Journal of Domestic Appliances and Sewing Machine Gazette*, January 1, 1886, 33.
Taruskin, Richard. *Stravinsky and the Russian Traditions: A Biography of the Works through* Mavra. Berkeley: University of California Press, 1996.
Taylor, Timothy. “The Commodification of Music at the Dawn of the Era of ‘Mechanical Music.’” *Ethnomusicology* 51 (Spring/Summer 2007): 281-305.
The Journal of Domestic Appliances and Sewing Machine Gazette, January 1, 1881, 1.
Thompson, Emily. “Machines, Music, and the Quest for Fidelity: Marketing the Edison Phonograph in America, 1877-1925.” *The Musical Quarterly* 79 (1995): 131-71.
Thomson, Ross. *The Path to Mechanized Shoe Production in the United States.* Chapel Hill: University of North Carolina Press, 1989.
“The Triumph Piano Player.” *Musical Opinion & Music Trade Review* 27, no. 318 (March 1904): 483.
Toffler, Alvin. *Future Shock.* New York: Random House, 1970.
Turkle, Sherry. *Alone Together: Why We Expect More from Technology and Less from Each Other.* New York: Basic Books, 2011.
U.S. Bureau of the Census. *Historical Statistics of the United States, Colonial Times to 1970.* Washington: U.S. Dept. of Commerce, Bureau of the Census, 1975.
Vogue Hosiery Shops Inc. Advertisement. *St. Louis Post – Dispatch*, December 2, 1921, 10.
Watkins, Glenn. *Pyramids at the Louvre: Music, Culture, and Collage from Stravinsky to the Postmodernists.* Cambridge, MA: Harvard University Press, 1994.
Weinstein, Leon. “Hatsune Miku at the Sony Centre for the Performing Arts.” *Live in Limbo*, May 23, 2016. Accessed July 23, 2019. liveinlimbo.com/2016/05/23/concert-reviews/hatsune-at-the-sony-centre-for-the-performing-arts.html.
Welte-Mignon. Advertisement. *The American Hebrew & Jewish Messenger*, March 11, 1910, 487.

———. Advertisement. *The New York Times*, March 9, 1910, 18.

———. Advertisement. *The New York Times*, Dec 7, 1911, 13.

Wetherbee, Brandon. “Live DC: Hatsune Miku Expo @ The Anthem.” *Brightest Young Things*, July 13, 2018. Accessed June 30, 2019. brightestyoungthings.com/articles/live-dc-hatsune-miku-expo-the-anthem.

Wilcox & White Co. Advertisement. *Cincinnati Enquirer*, February 19, 1899, 12.

———. Advertisement. *New York Times*, May 1, 1898, 20.

———. Advertisement. *The Washington* Post, December 13, 1898, 7.

Wilkinson, Scott. “HUMANOID OR VOCALOID?” *Electronic Musician,* August 1, 2003. Accessed July 23, 2019. emusician.com/mag/emusic_humanoid_vocaloid/index.html.

Winner, Langdon. “Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology.” *Science, Technology, & Human Values* 18 (1993): 362-78.

Womack, Catherine. “With ‘Callas in Concert,’ an Opera Diva Makes a Holographic Encore.” *Los Angeles Times*, April 8, 2019. Accessed June 28, 2019. latimes.com/books/la-ca-jc-fob-mini-callas-hologram-concert-20190408-story.html.

Wurtzler, Steve. “She Sang Live, but the Microphone was Turned Off: The Live, the Recorded, and the *Subject* of Representation.” In *Sound Theory Sound Practice*, ed. Rick Altman, 87-103. New York: Routledge, 1999.

X, Y, Z. Advertisement. *Journal of Domestic Appliances and Sewing Machine Gazette*, July 1, 1886, 13.

Yamada, Keisuke. *Supercell Featuring Hatsune Miku.* New York: Bloomsbury Academic, 2017.

Yano, Christine R. “Letters from the Heart: Negotiating Fan-Star Relationships in Japanese Popular Music.” In *Fanning the Flames: Fans and Consumer Culture in Contemporary Japan*, ed. William W. Kelly, 41-58. New York: SUNY Press, 2004.

“Yellow Magic Orch.” *Variety*, December 17, 1980, 72.

「YMO 以来!?ポルノが 24 年ぶりの快挙達成!」[Since YMO!? Porno have achieved it for the first time in 24 years!] August 17, 2004. Accessed June 16, 2019. oricon.co.jp/news/5122/full.

Zaborowski, Rafal. “Hatsune Miku and Japanese Virtual Idols.” In *The Oxford Handbook of Music and Virtuality*, ed. Sheila Whiteley and Shara Rambarran, 111-28. London: Oxford University Press, 2016.