Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Humanities
Department of Music

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Engineering the Live Experience:

Adapting Pop Studio Sound to Stage with Authenticity

Master's thesis in Creative Music Technology
Supervisor: Daniel B. Formo
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Abstract

This master's thesis explores the development of a live performance system for Gaaren, designed to transfer their studio sound into live settings with limited live musicians, using Ableton Live as the core technology. By integrating critical theories on 'Liveness,' 'Authenticity,' and 'Technological Mediation,' it addresses how to maintain the audience's perception of authenticity in live performances. The author's dual role as producer and performer brings a unique perspective to this research question. The methodology involves iterative testing and practical implementation, focusing on selecting core sounds and musicians to enhance visual-auditory alignment. The live performance system includes musicians, instruments and playback computers, emphasizing flexibility, user-friendliness, and reliability in the technological system to ensure efficient setups and rehearsals. The findings offer practical solutions for bands transitioning from studio to stage, aiming to balance artistic integrity with audience engagement. This contributes to live music performance discourse, providing a framework for artists to adapt to live demands while preserving their artistic vision.

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1 Introduction

During a songwriting camp in 2022, I came in contact with a singer-songwriter and another producer. Our collaboration during the camp was so fruitful that we decided to continue making music together after the camp's end. Over the next year, we worked closely in the same setting, we had enjoyed at the camp, just a vocalist and two producers with their laptop. Eventually, we started releasing the songs we made, under the group name 'Gaaren', inspired by the surname of our vocalist, Carine Gaaren.

Our music quickly caught the attention of national radio stations which further led to invitations to perform live. This introduced a significant challenge: our studio recordings, each featuring over 100 audio tracks per song, containing everything from electronic to acoustic instruments, real-life recorded instruments to software instruments, and complex vocal arrangements made from one vocalist doubling herself over and over again. These needed to be adapted for live performances.

Fortunately, I am skilled in playing the guitar, and my co-producer, Johan Nes, is a drummer, allowing us to perform these instruments live ourselves. However, what about the rest of our sound? For instance, the bass, piano, and synthesizers? Our recordings often feature multiple layers of the same instrument, such as the guitar, which I, as a guitarist, cannot play all at once. There is also the issue of the percussion elements that Johan cannot manage while he is drumming.

A vocalist, a drummer, a guitarist, and possibly a few hired musicians, would not successfully recreate the full depth of our artistic expression, as represented by our soundscape. We knew that electronic dance music artists like Deadmau5 or Alan Walker often simply play back their tracks using a computer, sometimes even without a live vocalist. On the other hand, we instantly, almost out of instinct, dismissed this approach as it seemed inauthentic for our genre and artistic expression.

This raises a central question: *how can a band like Gaaren faithfully reproduce its studio sound in live performances while maintaining the authenticity and engagement that audiences expect?* This question guides the investigation of this master's thesis, which explores the

development of a live performance system tailored to meet the unique challenges faced by Gaaren. To address this question, I engaged with critical theories such as 'Liveness', 'Authenticity', and 'Technological Mediation' from scholars in the relevant disciplines, like music technology, musicology, and media studies. These concepts effectively provided a scholarly foundation to develop the live performance system, we now use to play concerts.

My goal was to explore how I can utilize the tools we used in the studio to replicate the same sound live, without compromising the live concert element. I wanted to reuse the technological tools from our music production for two main reasons. First, to preserve the same sound on stage as in the studio, viewing the use of the same tools as a step towards this goal. Second, as an emerging band, we aim to save time and money by utilizing the same equipment and setup across both settings. Unlike larger, established bands with extensive "playback rigs," we strive to find creative and cost-effective solutions that maintain the quality and artistic vision of our music.

My dual role as both producer and live performer provides me with a unique perspective on ensuring that our music is always presented at its best, regardless of the setting or ensemble. This combination of roles allows for a seamless translation of our musical vision from production stage to performance stage, while upholding artistic integrity throughout the process. Additionally, being in the situation of mixing our own music, I leveraged our access to individual track stems to create customized live mixes, ensuring they maintained the studio's sound quality.

This work aims to provide insights and methods that can assist other bands facing similar transitions from studio to stage, ensuring that both artistic integrity and audience engagement are at the forefront of live music performances.

2 Historic Context and Relevance Today

2.1 HISTORICAL CONTEXT

The creation of complex studio recordings that challenge live reproduction is not a recent development. This evolution can be traced back to the advent of multitrack recording, which enabled the production of recordings with a depth of sonic information, surpassing what could be performed in a single physical space in one take.

Consider Pop music icons The Beatles as a prime example. The band were leaders in several aspects of the popular music business throughout the 20th century. One of these domains included doing experiments with innovative recording technologies. Through their collaboration with their renowned producer George Martin, The Beatles popularized the idea of studio-produced albums as the predominant form of Western music in the late 1960s.[1] Toynbee contends that without the support of studio technology, musicians would struggle to reproduce the sounds captured in recordings, when performing live.[2] He saw the Beatles' decision to cease touring in 1966 as a public acknowledgement of this inclination. Zak on the other hand argues that the decision to working solely in the studio was conscious, and that the artworks produced was never meant to be performed live.[3] This phenomenon can be explained by Bennett's concept of how advanced notation leads to the creation of “impossible music”, where sound recording is a technological form of advanced notation.[4] As further elaborated by Théberge: “Recordings allow musicians to distance themselves from the act of performance and create ‘impossible music,’ that is, music that could not otherwise be conceived or performed”.[5]

Kjus and Danielsen also highlights those who embraced the new recording technology but at the same time kept on touring, saying "there arose a deep-rooted practice of bringing music back and forth between studio and stage which many popular musicians routinely perpetuate

[1] Yngvar Kjus and Anne Danielsen, “Live Mediation: Performing Concerts Using Studio Technology,” *Popular Music* 35, no. 3 (October 2016): 2, https://doi.org/10.1017/S0261143016000568.
[2] Jason Toynbee, *Making Popular Music : Musicians, Creativity and Institutions* (London: Arnold, 2000), 86–87.
[3] Albin Zak, *The Poetics of Rock: Cutting Tracks, Making Records* (University of California Press, 2001), 35.
[4] H. Stith Bennett, “Notation and Identity in Contemporary Popular Music,” *Popular Music* 3 (January 1983): 228, https://doi.org/10.1017/S026114300000163X.
[5] Paul Théberge, *Any Sound You Can Imagine: Making Music/Consuming Technology*, Music/Culture (Hanover, N.H: Wesleyan University Press, 1997), 216.

to this day".[6] They also emphasize the individuals who enthusiastically adopted the new recording technology while simultaneously continuing to perform live, stating that "there arose a deep-rooted practice of bringing music back and forth between studio and stage which many popular musicians routinely perpetuate to this day".

During the 1980s, the prices of studio and live technologies significantly dropped, marking the birth of a consumer music production market. This development paved the way for the proliferation of DIY home studios, enabled by the falling costs of technology.[7] In the same era, musicians witnessed a notable enhancement in production skills, leading to a convergence and blending of the roles of composer, performer, engineer, and producer.[8] This elevation in expertise also enabled artists to incorporate some of these technologies into their live performances.[9]

Further, the link between recording studio methods and live performances may also be attributed to the development and widespread adoption of MIDI, a communication standard that simplified the real-time control and storage of sound parameters, artists were able to save and retrieve synthesis patches and control settings during live performances using gestures, automated procedures, or pre-programmed sequences.[10] These technological advancements allowed for the smooth integration of storage, retrieval, and automation of sound processing components. They also enabled the storage and activation of recorded sounds during performances, thereby providing the ability to accurately reproduce studio-recorded sound during live shows, as described by Knowles and Hewitt.[11] MIDI trigger pads, such as those mentioned by Knowles and Hewitt, enable the integration of studio drum sounds into live performances.[12]

Towards the end of the 1990s, advancements in computing and digital signal processing facilitated the transition of digital audio technologies to real-time operations. Formerly offline processes seamlessly integrated into software interfaces, allowing for immediate interaction,

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[6] Kjus and Danielsen, "Live Mediation," 3.
[7] Julian Knowles and Donna Hewitt, "Performance Recordivity: Studio Music in a Live Context," *Journal on the Art of Record Production* 2012, no. 6 (2012): 4–5.
[8] Knowles and Hewitt, 5; Kjus and Danielsen, "Live Mediation," 4.
[9] Knowles and Hewitt, "Performance Recordivity," 5.
[10] Knowles and Hewitt, 4.
[11] Knowles and Hewitt, 4.
[12] Knowles and Hewitt, 4.

auditioning, and hardware controller mapping.[13] This technological progress accelerated audio processing speeds, enabling software suitable for both live performances and studio use to emerge, such as Ableton Live's release in 2001.[14] Knowles and Hewitt term these “threshold technologies:

> The development of tools which were designed for both studio production and performance, with specific features and interface pages directed towards both tasks. These ‘threshold technologies’, which sit at the cusp of studio production and live performance have been central to electronica genres but have also had significant uptake by musicians working in genres outside this area.[15]

Simultaneously, digital production technologies, capable of more functions in real-time, began to serve as performance tools, irrespective of their original design intent.[16] Since the 2000s, this evolution has led to an increasingly diverse array of musicians innovatively employing studio technology in the live performance of their music, as noted by Kjus and Danielsen: "In our study from the second decade of the 2000s, however, we found that studio-related technology is used by artists and musicians to realise their own musical vision, unrestricted from the band-instrument constellations upon which they would otherwise depend."[17] Knowles also describes how, in parallel, the development of digital mixers enabled even greater flexibility in the transition from studio to stage: "This opened up a range of opportunities to deploy detailed mix changes from song to song and subsong level in a Live Set much in the same way that an automated studio mix can contain very detailed processing and balance changes against specific time and musical cue points."[18]

2.2 RELEVANCE TODAY

This historical overview demonstrates that the issue of creating complex studio recordings, which are challenging to perform live, is not unique to our era. Multitrack recordings and albums as independent art forms have been the norm since the Beatles era. It's been about 40 years since MIDI was introduced as an innovation, and 20 years since the launch of Ableton Live. So why do I believe it is particularly relevant to write this thesis today? To explain this,

[13] Knowles and Hewitt, 5.
[14] Kjus and Danielsen, “Live Mediation,” 4.
[15] Knowles and Hewitt, “Performance Recordivity,” 7.
[16] Knowles and Hewitt, 6.
[17] Kjus and Danielsen, “Live Mediation,” 14.
[18] Knowles and Hewitt, “Performance Recordivity,” 6.

I need to break down my arguments into four steps. Firstly, the democratization of music technology has made advanced tools, enabling the creation of high-quality and credible productions, accessible to a wider audience at lower costs. The second step is understanding that the continually improving quality of tools in home studios is expanding the diversity of genres that can be produced from home studios, moving beyond primarily electronic genres to a broader range of musical styles, including more organic ones. This further increases the likelihood that you as a songwriter/artist, more independently of genre than ever, are creating your work directly within a Digital Audio Workstation (DAW) from the outset, more so now than ever before. This is in contrast to the past when writing in a studio was reserved for the biggest and most financially robust artists. The fourth step will then be to understand how this change in studio workflow changes what we percieve as musical qualities of a song. I want to reffer to Holmes' introduction to the movement of *musique concrète*, where the magnetic tape "led to the creation of a new kind of music that existed *only* as a recording."[19] When the music is becomes physical product from the start, the music is not nessecarily what is being recorded, but the recording IS the music. Transfarably, when making the music into a DAW, the music is captured as a physical product from the very start. In my opinion: In the described modern songwriting process the sonic qualities become as integral to the song's "DNA" as the lyrics and melodies.

When performing the music live, preserving a selection of these sonic qualities can be more important than ever, arguably as important as retaining the same chords and melody. Consequently, my thesis aims to devise a live performance framework that facilitates the faithful reproduction of our songs' sonic DNA as captured in our recordings, marrying this fidelity with the dynamic and organic qualities anticipated by audiences at live concerts.

[19] Thom Holmes, *Electronic and Experimental Music: Foundations of New Music and New Listening*, 2nd ed. (Milton: Routledge, 2003), 73, https://doi.org/10.4324/9780203427064.

3 Concepts

When developing my live performance system, I based my framework on three main research articles. In the article by *Live mediation: Performing concerts using studio technology*, Yngvar Kjus and Anne Danielsen examine the use of studio technology in live concerts.[20] They explore how musicians integrate tools such as sound recording, editing, and processing into their live performances and discuss what it means to play live. In another article published the same year, *Performance Recordivity: Studio Music in a Live Context*, Julian D. Knowles and Donna Hewitt, investigates how practices from recording studios are integrated into live performances of popular music.[21] It provides a conceptual overview of new trends where studio techniques and tools are adopted in live performance contexts. In 2016, Anne Danielsen, this time in company of Hannah Helseth's wrote the article *Mediated Immediacy: The Relationship between Auditory and Visual Dimensions of Live Performance in Contemporary Technology-Based Popular Music*.[22] In this article they focus on norwegian alt-pop artist Susanne Sundfør's live performance system and how audiences perceive the use of backing tracks as part of a live performance. These three texts set a framework for the development of our system, making it easier to attach our initial intuitions about live performances to concrete academic theories. They help shape concepts that have served as the framework for the choices, testing, and reflections conducted throughout this thesis.

3.1 LIVENESS: WHAT IS LIVE?

To fully explore how various choices in a live performance will influence audience perceptions, it is crucial to first define what "live" means. What prompts us to consider live performances as uniquely distinct experiences? Numerous scholars have grappled with defining the essence of a genuinely "live" performance. In this section, I will delve into these scholarly perspectives to gain a deeper understanding of the dynamics and significance of live musical expression.

[20] Kjus and Danielsen, "Live Mediation."
[21] Knowles and Hewitt, "Performance Recordivity."
[22] Anne Danielsen and Inger Helseth, "Mediated Immediacy: The Relationship between Auditory and Visual Dimensions of Live Performance in Contemporary Technology-Based Popular Music," *Rock Music Studies* 3, no. 1 (January 2, 2016): 24–40, https://doi.org/10.1080/19401159.2015.1126986.

3.1.1 Physical Presence

In his work *Liveness: Performance in a Mediatized Culture*, Philip Auslander explores how recordings necessitated a clear distinction between live and non-live performances. He explains that "divorce of the auditory from the visual in recorded music was one of the conditions for the development of the concept of liveness as a response to the need to distinguish live performances from the playback of recordings heard over the air.".[23] Danielsen and Helseth argues by quoting Simon Emmerson, saying “this real-time aspect is not enough—there must be an accompanying physical presence for us to feel that we are witnessing something actually live." [24] In John Durham Peters’ article "Witnessing”, he asserts that the essence of real-time events significantly derives from their physical presence, providing live events with a unique status, enhanced by direct and vivid sensory experiences.[25] He argues this is what enables live experiences to move beyond simply being perceived as copies.[26] The significance of live performance also lies in the collective presence of both the artists and the audience. Kjus and Danielsen emphasize that the unique atmosphere of a live performance is partly due to the audience's presence, setting it apart from studio productions.[27]

3.1.2 Visual

Building on the idea of physical presence, Danielsen and Helseth articulates the essence of live performance, stating, “Playing live, then, is clearly more than just playing there and then in front of an audience: it is about generating a feeling of liveness, in the sense of an immediate 'living presence' that often takes the form of a special intensity in the moment" [28] When defining music, Kjus and Danielsen defines of artistic work as “the act of ‘conveying experience – one through which experience is given a form that others can share with their senses”.[29][30] Hearing is an obvious sense that is used when taking in music, both recordings and live. Second to hearing, Danielsen and Helseth puts forward visual aspects as a dimension that separates the

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[23] Philip Auslander, *Liveness: Performance in a Mediatized Culture*, 3rd ed. (London: Routledge, 2022), 81, https://doi.org/10.4324/9781003031314.
[24] Danielsen and Helseth, “Mediated Immediacy,” 4.
[25] John Durham Peters, “Witnessing,” *Media, Culture & Society* 23, no. 6 (November 2001): 711.
[26] Peters, 718.
[27] Kjus and Danielsen, “Live Mediation,” 5.
[28] Danielsen and Helseth, “Mediated Immediacy,” 6.
[29] In fact, they attribute Raymond Williams for this definition. However, upon reviewing the referenced book “The Long Revolution” p.54, I was unable to find this definition.
[30] Kjus and Danielsen, “Live Mediation,” 4–5.

experience of live performance from studio version, enhancing the live music by “supporting the communication of the auditory aspects."[31]

3.1.3 Sharing the Creativity Process

Kjus and Danielsen explore the distinction between creativity and expressivity to articulate the fundamental differences between studio and live performances. They define "creativity" as “an inner process through which music is conceived”, often influenced by external stimuli, and "expressivity" as “the outward-oriented process by which musical intentions are communicated to others”.[32] In the studio setting, artists make a musical product for future listeners, who only experience the final expression, while the concert setting, the artist can directly and continuously express their musical intentions to the audience, enabling everyone present, both musicians and audience, to actively engage in shaping the music. For my thesis, a connection can be drawn from Kjus and Danielsen’s discussion of creativity and expressivity in studio and Live Settings to the use of pre-recorded tracks on stage. An abundance of pre-recorded material may prevent the audience from engaging in shaping the music, potentially leading to feelings of being “robbed” from participation and thus alienated from the musical experience.

3.1.4 Risk

Playing live music also inherently carries an element of risk, a dynamic that significantly differentiates live performances from studio recordings.[33] In a Live Setting, numerous uncertainties exists: musicians might forget the lyrics, play incorrect notes, or encounter unexpected technical issues. These potential mistakes contribute to the unique thrill and spontaneity of live performances, aspects that attract both artists and audiences despite the risks. Kania clarifies this further by emphasizing the fundamental metaphysical differences between live performances and studio recordings.

> No matter what studio technology becomes available for live shows, the most salient feature of what goes on in the studio can never be exported to the stage. In the studio, one can take one’s time to pick and choose which of the sounds that get on tape should go into the mix. One can always in principle go back and change something until one is happy with the result. So it is not mere current technological shortcomings that make studio and live performances different.[34]

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[31] Danielsen and Helseth, “Mediated Immediacy,” 10.
[32] Kjus and Danielsen, “Live Mediation,” 4.
[33] Knowles and Hewitt, “Performance Recordivity,” 19.
[34] Andrew Kania, “Making Tracks: The Ontology of Rock Music,” *The Journal of Aesthetics and Art Criticism* 64, no. 4 (2006): 403, https://doi.org/10.1111/j.1540-594X.2006.00219.x.

Thus, the essence of live performing—embracing the inherent risks—is contributes to a vivid and immediate connection with the audience that studio recordings cannot replicate. Pre-recorded backing tracks can significantly reduce the risk element, potentially leading to a more predictable and less engaging experience for the audience. Thus, while Kania's theory encompasses more than the ability to redo takes, this aspect remains a crucial point in understanding why live performances offer a unique experience distinctly different from studio recordings.

3.1.5 Live Produced vs. Pre-Recorded Material

In 1990, the so-called "Milli Vanilli-scandal" (named after the music duo involved) revealed that the duo had lip-synced to pre-recorded backing tracks during their concerts. This inevitably led to abrupt end of their musical careers, and revocation of their Grammy Award.[35] The incident sparked a public debate and attention regarding the "liveness" of live performances in an era increasingly dominated by pre-recorded material.[36] The world' reaction to the Milli Vanilli incident exemplifies how the use of backing tracks in live performances, particularly in pop culture, often carries strong connotations of making a show feel less "live". The apprehension towards technology in the music industry has deeply influenced entire music genres, often serving as the basis for rock musicians to assert ownership over their work by playing their records as they were recorded during live performances. [37] This skepticism isn't confined to rock alone, as encapsulated by artist Brunvoll's remark to Kjus and Danielsen: "Just replaying something you have already made... then you might as well leave [the] stage, really", suggesting that simply reproducing a pre-recorded track doesn't constitute a genuine live show.[38] Danielsen and Helseth's pinpoint pre-recorded vocals as the cardinal sin in the realm of pre-recorded material in live performances, even in genres like pop, where pre-produced tracks are commonplace.[39] Nevertheless, the acceptance of pre-recorded tracks varies significantly across different musical genres, based on audience expectations. Danielsen and Helseth illustrate how audience acceptance of pre-recorded tracks varies across genres:

[35] Knowles and Hewitt, "Performance Recordivity," 19.
[36] Knowles and Hewitt, 20.
[37] Kjus and Danielsen, "Live Mediation," 4.
[38] Kjus and Danielsen, 11.
[39] Danielsen and Helseth, "Mediated Immediacy," 6.

electronic music fans might not react to entire performances, including vocals, played back from a song file, whereas dedicated rock fans often see any playback as "inauthentic or weak".[40]

3.2 VISUAL-AUDITORY ALIGNMENT & AUTHENTICITY FACTORS

Musicians play a crucial role in making live performances feel genuinely alive. As Knowles points out, even electronic acts, typically reliant on sequencing and automation, often incorporate live musicians to make their shows more "played" and enhance the live feel of their performances.[41] However, this decision becomes complex when studio recordings feature densely layered instruments and soundscapes. The logistical challenges of having live musicians recreate every studio element often compel artists to choose between delivering a fully live performance and relying on pre-recorded tracks.[42] This reliance, as discussed in the previous section **3.1** on “liveness”, raises questions about maintaining the "live authenticity" of the performance. The second concept I will introduce, therefore, concerns balancing the use of musicians versus technology as part of the live performance. How can musicians function as authenticators of a live performance, while utilizing technology as transparently as possible to maintain authenticity of the performance?

3.2.1 Visual-Auditory Alignment

The first consideration one will need to take is the relationship between what the audience hears and sees. As mentioned in section **3.1.2**, the incorporation of visuals into live music settings enhances the audience's experience. That said, the alignment between what the audience sees and hears is crucial for full engagement. A mismatch, such as a rich soundscape paired with minimal visual activity, can disrupt the concert's immediacy, underscoring the importance of a logical match between the auditory and visual elements.[43] This can be explained by the auditory perception’s primal function which, according to Clarke, involves identifying what sounds signify and how to respond to them.[44] Danielsen and Helseth elaborate on this, explaining that when visual elements align with the audio, it naturally directs our attention to the origins of

[40] Danielsen and Helseth, 6.
[41] Knowles and Hewitt, “Performance Recordivity,” 22.
[42] Kjus and Danielsen, “Live Mediation,” 8.
[43] Danielsen and Helseth, “Mediated Immediacy,” 27.
[44] Eric F Clarke, *Ways of Listening : An Ecological Approach to the Perception of Musical Meaning* (Oxford: Oxford University Press, 2005), 19.

those sounds.[45] The visual-auditory alignment therefore plays a significant role in creating a believable and engaging live performance. Therefore, one of the significant challenges in integrating technology into live performances is avoiding logical-sensorial ruptures—moments when there's a disconnect between what the audience sees and hears. Danielsen and Helseth describe this concept as either seeing a sound source without hearing its sound or hearing a sound that cannot be visually linked to its source.[46] Such ruptures can lead to a sense of disconnection from the audience, challenging the authenticity of the live performance, and even alienating the artist from their art.[47]

That said, the visual-auditory relationship does not need to be a perfect 1:1 match. Danielsen and Helseth found that audiences often prioritize the overall artistic impression of a performance over the exact reproduction of live-produced sounds. They explain this phenomenon by stating “the visual representation of a sound source simplifies the process of linking it to its sound and dismissing the impact of any technological mediation".[48] This suggests that audiences are open to a more flexible interpretation of ‘live,’ provided the overall artistic integrity is maintained. Like the varied acceptance of backing tracks that I discussed earlier, it is reasonable to assume that this willingness to prioritize artistic impression over precise sound reproduction also likely varies from genre to genre, reflecting nuanced expectations about live performance authenticity across different musical styles.

3.2.2 Hybrid forms – Live Musicians + Pre-Recorded Tracks

One compensatory strategy for improving the visual-auditory relationship when using pre-recorded tracks, is incorporating some live musicians on stage. Kjus and Danielsen refer to live performances that combine pre-produced audio with live elements as hybrid forms.[49] They commend this approach for blending the meticulousness of studio editing with the spontaneity of live performance and is a common approach to enhance the performance's perceived authenticity.[50] Examples of these hybrid forms range from a live singer performing with a backing track to a live drummer using sample triggers to produce electronic drum sounds in

[45] Danielsen and Helseth, “Mediated Immediacy,” 11.
[46] Danielsen and Helseth, 22.
[47] Kjus and Danielsen, “Live Mediation,” 4.
[48] Danielsen and Helseth, “Mediated Immediacy,” 17.
[49] Kjus and Danielsen, “Live Mediation,” 4.
[50] Kjus and Danielsen, 4.

real-time. Danielsen and Helseth argue that even though these musicians may not fully reproduce the full soundscape live, their presence and play serve as a symbolic representation of the music's diversity.[51] This approach aligns with Clarke observation that seasoned instrumentalists often seamlessly blend the ergonomic and choreographic elements of playing an instrument into their live performances, which ad to the visual aspect and audience engagement of the concert experience.[52] This claim is supported by other articles by scholars such as Jane Davidson, Broughton & Stevens, and Huang & Krumhansl.[53]

3.2.3 Identifying Core Sounds – What to Be Played Live

Using musicians can significantly enhance the authenticity of a live performance, even when incorporating pre-produced material. However, when the number of musicians is insufficient to reproduce the entire soundscape, artists must make crucial decisions about which elements should be performed live and which should be handled by backing tracks. In such cases, artists engage in a process of identifying "core sounds" that are essential for the live rendition. This requires deconstructing studio recordings to determine which elements are vital for the performance and can feasibly be reproduced on stage. [54]According to Kjus and Danielsen, this decision-making process extends beyond sound; it also involves ensuring that the performance's visual elements complement and enhance the core musical elements, thus shaping the audience's perception and enhancing their appreciation of the performance. Simplified, this means that the audience's attention is directed towards the sound elements that are physically represented on stage.

3.2.4 Playing Instruments on Stage

To produce the core sound live, a common way is to use “real” instruments on stage: This is because the authenticity of a performance is influenced not only by the musicians but also by the instruments they play. When handled visibly, instruments serve as reliable indicators of the

[51] Danielsen and Helseth, “Mediated Immediacy,” 23–25.
[52] Eric F. Clarke, “Creativity in Performance,” *Musicae Scientiae* 9, no. 1 (2005): 172.
[53] Jane W. Davidson, “Visual Perception of Performance Manner in the Movements of Solo Musicians,” *Psychology of Music* 21, no. 2 (1993): 103–13; Mary Broughton and Catherine Stevens, “Music, Movement and Marimba: An Investigation of the Role of Movement and Gesture in Communicating Musical Expression to an Audience,” *Psychology of Music* 37, no. 2 (2009): 137–53; Jennifer Huang and Carol Lynne Krumhansl, “What Does Seeing the Performer Add? It Depends on Musical Style, Amount of Stage Behavior, and Audience Expertise,” *Musicae Scientiae* 15, no. 3 (November 2011): 343–64.
[54] Kjus and Danielsen, “Live Mediation,” 8.

forthcoming sounds and offer insights into the performer's intentions.[55] The audience's recognition of the skill required to play these instruments enhances the belief that the sounds they hear are being produced live on stage, as put by Knowles and Hewitt "the mark of authenticity is carried by the proof of agency".[56] This perception is crucial for the performance to be perceived as authentic, as Auslander exemplifies: "Listeners steeped in rock ideology are tolerant of studio manipulation only to the extent that they know or believe that the resulting sound can be reproduced on stage by the same performers. When that belief is substantiated, the music is authenticated".[57] Knowles summarizes this by stating, "this combination of performative agency, proof of skill, and the capacity to reproduce sounds heard on recordings, subsequently leads to an authentication of the performance".[58] This symbolic presence of musicians and instruments is maybe best exemplified, in the case of Susanne Sundfør's performance, where a lone cello could stand in for an entire symphony orchestra, enhancing the live experience through its symbolic representation rather than direct sound production. [59]

3.2.5 The Power of Acoustic Instruments and Singularity of Live Vocals

Building on this, traditional instruments greatly enhance the sense of liveness in a performance, with acoustic ones proving even more impactful due to their physical characteristics. In the study of Susanne Sundfør's Live Setup, Danielsen and Helseth note that instruments like percussion, synthesizers, and especially acoustic ones such as the cello and vibraphone, played a crucial role in reinforcing the live essence of the performance.[60] This can be explained by the fact that acoustic instruments have a direct and observable connection between the musician's actions and the resulting sound, which Jensenius argues offers a clear 'action-sound coupling' based on mechanical laws and are therefore instinctively understood by audiences.[61] While electronic instruments can also develop a natural-feeling relationship between action and sound over time, Jensenius suggests that this perception might not be as inherently strong as that formed with acoustic instruments.[62]

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[55] Kjus and Danielsen, 15.
[56] Knowles and Hewitt, "Performance Recordivity," 17–19.
[57] Auslander, *Liveness*, 104.
[58] Knowles and Hewitt, "Performance Recordivity," 18.
[59] Danielsen and Helseth, "Mediated Immediacy," 23.
[60] Danielsen and Helseth, 17.
[61] Alexander Refsum Jensenius, "An Action–Sound Approach to Teaching Interactive Music," *Organised Sound* 18, no. 2 (August 2013): 181.
[62] Jensenius, 181.

This theory extends naturally to the human voice, considered as an instrument. Kjus and Danielsen describe singing to an audience as capturing an "immediacy signature," where what the audience hears is directly emanating from the performer's body in the moment it is.[63] In fact, across the three studies—by Danielsen and Helseth, Knowles and Hewitt, and Kjus and Danielsen—vocals are consistently highlighted as the most crucial element of a live performance. Knowles emphasizes that live performances provide a unique space where audiences can experience the unfiltered production of sound, with live vocals offering a nuanced expression that stands as a hallmark of authenticity.[64] This explains why, as noted in the section 3, vocals are typically the last element to be substituted with pre-produced backing tracks in Live Settings.

By including acoustic instruments in Live Setups, artists can strengthen the link between their physical actions and the sounds produced, thus enhancing the performance's authenticity. Moreover, Kjus and Danielsen argued that when such a robust connection is made, it increases the likelihood that audiences will attribute other sounds they hear on stage to the artists' live actions, even when those sounds are electronically generated or less visible.[65] The effect of using acoustic instruments in live performances to validate authenticity is so powerful that it's become commonplace for artists and bands to opt for acoustic over digital elements when on stage, even if the original recording was produced digitally, exemplified multiple times in Kjus and Danielsen's study:

> … both of these artists usually bring with them certain acoustic sound sources to be played live, even though they might not have been played acoustically on the record.[66] (…) most of the artists—even those who had created everything electronically in the studio—tended to use acoustic sound sources on stage, either integrating them with the recorded elements or manipulating them in real time.[67]

3.2.6 Technological Mediation: Transparent or Opaque

Enhancing the perceived authenticity of a performance is not solely about the positive impact of musicians and instruments. The way technology is used to convey the music can also

[63] Kjus and Danielsen, "Live Mediation," 2.
[64] Knowles and Hewitt, "Performance Recordivity," 18–19.
[65] Kjus and Danielsen, "Live Mediation," 15.
[66] Kjus and Danielsen, 9.
[67] Kjus and Danielsen, 15.

negatively affect the perception of liveness. Danielsen and Helseth define mediation in the context of music as the mechanism through which something is conveyed from one point to another, emphasizing that music inherently involves some form of mediation.[68] In her PhD, *Music in Bits and Bits of Music: Signatures of Digital Mediation in Popular Music Recordings*, Brøvig-Hanssen distinguishes between *transparent* and *opaque* mediation: Transparent mediation allows the technology behind the music to remain unnoticed by the listener, whereas opaque mediation makes the process and its material traces evident, drawing the listener's attention to the technology itself.[69]. This delineation highlights how the use of mediating technology can either be obscured or accentuated, depending on the intended listener experience. In the context of using backing tracks together with musicians, putting core elements on the backing tracks, would make the backing tracks attract more attention, thereby turn them opaque. A practical example of this is how vocals are managed in a hybrid live performance. The inherent value of vocals, being a central live element, also renders them particularly vulnerable to disruptions that can lead to logical-sensorial ruptures. In their detailed study of Susanne Sundfør's performance, Danielsen and Helseth observed that while vocal mediation usually remained subtle to maintain the integrity of her voice, there were instances where it became noticeably opaque. This opacity was most evident when Sundfør's distinctive voice seemed to double, potentially challenging the audience's perception of the authenticity of the live experience.[70] The goal should instead be to use supplemental elements on the backing tracks, to keep the technological as transparent as possible.

3.2.7 Visibility of Technology

We previously discussed how the visibility of instruments could direct the concertgoer's attention toward the sounds they produce (or at least represent). Similarly, the visibility of technology on stage may also influence how the audience's musical perception. Danielsen and Helseth highlight the need for technological mediation to remain unobtrusive, aligning with the genre and context of the performance.[71] The primary aim is to ensure that technology enhances rather than detracts from the live performance. This consideration ties into the previous discussion about how visual representation can direct listening attention to what is

[68] Danielsen and Helseth, "Mediated Immediacy," 7.
[69] Ragnhild Brøvig-Hanssen, "Music in Bits and Bits of Music: Signatures of Digital Mediation in Popular Music Recordings" (Doctoral thesis, 07 Gruppen, 2013), 159–62, https://www.duo.uio.no/handle/10852/59962.
[70] Danielsen and Helseth, "Mediated Immediacy," 17–18.
[71] Danielsen and Helseth, "Mediated Immediacy."

visually displayed. As Kjus and Danielsen reveal through discussions within bands, the decision about how much technology, especially computers, should be visible on stage is contentious.[72] On one side, displaying technological tools like computers on stage draws the audience's attention to the processes likely used to produce the sound, making the technological mediation more apparent and less transparent.[73] On the other side, making these tools visible can somewhat reduce logical-sensorial ruptures. By showing where the soundscape elements, not represented by musicians, originate, the visible technology clarifies the source of the sound, thus aligning the audience's auditory and visual perceptions.

3.3 GAAREN'S GENRE AND PERFORMING STYLE

3.3.1 Requests for Further Research

In Knowles and Hewitt's article, they advocate for broader research endeavors within the domain, asserting, "A much deeper investigation is needed into the complex unfolding relationships between studio and live performance practices on both human and technological levels".[74] Additionally, Kjus and Danielsen encourage researchers across various genres to delve into the subject matter, stating, "Further studies of other genre communities and individual practices are needed to enhance our understanding of the new relationships between stage performance and traditional studio work".[75]

Responding to these calls for further exploration, this thesis aims to contribute specifically from the perspective of our genre and how our music is made. The significance of genre in shaping live performance practices cannot be understated. Kjus and Danielsen observe in their article that "the ways in which music reaches (and is renewed on) the concert stage are at least partly governed by genre conventions and expectations".[76] They note, particularly in the context of rock music, that the use of pre-recorded material during live performances is often viewed as a sign of inauthenticity or a flaw.[77] In stark contrast, genres that incorporate digital production tools frequently present performances with a soundscape that is partially or completely pre-produced. Danielsen and Helseth articulate this point clearly: "In contemporary

[72] Kjus and Danielsen, "Live Mediation."
[73] Danielsen and Helseth, "Mediated Immediacy," 11.
[74] Knowles and Hewitt, "Performance Recordivity," 23.
[75] Kjus and Danielsen, "Live Mediation," 16.
[76] Kjus and Danielsen, 3.
[77] Danielsen and Helseth, "Mediated Immediacy," 6.

genres based upon digital tools for music production, one might instead encounter a musical performance whose soundscape has been partly or entirely pre-produced—that is, created and 'completed' at a place and time that are distinct from the shared space and time of the performance itself".[78]

Therefore, in determining the approach for Gaaren's live performances, it is essential to clearly define and understand the expectations associated with Gaaren's genre and style. Gaaren's music is categorized within the alt-pop genre, with influences from disco and R&B, while also incorporating elements of indie/alternative rock. To effectively address live performance strategies, an initial review of critical theories on genres and live performances is necessary.

3.3.2 Song Based

Kjus and Danielsen categorize live performers into three distinct groups based on their onstage approach: "Song based"—where the audience expects that the artist or other artists have composed the music elsewhere and now simply presenting it on stage. "Improvisation based"—where the audience looks forward to a spontaneous performance, although some playing techniques and common phrases are usually planned. "Sample based"—in this scenario, the audience recognizes that the artists will be playing back, and remixing, pre-recorded tracks live on stage.[79] Among these, the 'song based' category aligns most closely with Gaaren's method, given that we create pop songs intended to be performed in arrangements that closely mirror those of our studio recordings.

3.3.3 Presentation & Participation Based

In *Music as Social Life: The Politics of Participation*, Thomas Turino has offered an alternative framework for classifying live performances, distinct from the typology presented by Kjus and Danielsen. Turino distinguishes between presentational performances, which focus on the artist's actions, and participatory performances, which involve active engagement from all attendees.[80] Considering Kjus and Danielsen's description of 'Song Based' performances as simply presenting songs on stage, one might initially assume Gaaren's performances to fit

[78] Danielsen and Helseth, 3.
[79] Kjus and Danielsen, "Live Mediation," 3.
[80] Thomas Turino, *Music as Social Life: The Politics of Participation*, Chicago Studies in Ethnomusicology (Chicago, Ill.: University of Chicago Press, 2008), 90.

neatly into Turino's presentational category only. However, an Kjus and Danielsen's examination of Carlsen and Ball's approach to live performance invites a reevaluation:

> Lastly, Carlsen and Ball use the studio to create catchy, danceable tracks that also impact their creative transition to the stage. While the live performances of the other artists are largely in a presentational mode, Carlsen and Ball seek participation in the form of dancing. When preparing their performances, then, they do not prioritize the opportunity to be musically creative on stage but instead try to maximize the expressive and 'energetic' potential of the recording.[81] …

Furthermore, in live performance, "they very much want to transmit the exact grooves and hooks they developed in the studio, or even intensify them.[82] Seeing our audience dance at our concerts is gratifying, yet it's the structural composition of our songs that affirms that Gaaren also belong int the participatory categoriy. Our songs undergo a meticulous arrangement process in the studio to ensure that each segment, each hook, and each breakdown occurs at the most impactful musical moment. Crafting pop music often involves creating an expectant arrangement pattern, exemplified by the ubiquitous verse-chorus structure prevalent across the genre. Kjus and Danielsen's insights further align with our approach: They observe that "the artists who aimed for more participatory concerts tended to bring more co-performers and instruments on stage, while also replaying longer or larger sections of their recorded tracks using machines".[83] As we will see in **Chapter 6**, in Gaaren's transition to live performances, we aimed to enrich the stage with additional musicians and make extensive use of stem tracks, not to mirror the studio process but to amplify the event's energy and audience involvement.

Kjus and Danielsen also discuss the varying degrees of pre-planning and spontaneity artists bring to their performances, noting that some artists structure their shows around key pre-planned elements to maintain control, while others allow the technology and spontaneous interactions to shape the performance.[84] In Gaaren's situation, we meticulously plan our performances to ensure each element aligns with our artistic vision, yet we strategically embrace the dynamic interplay of technology and live elements, allowing the concert's atmosphere to evolve naturally, reflecting Kjus and Danielsen's observations on how artists balance structured elements with the spontaneous potential of Live Settings.

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[81] Kjus and Danielsen, "Live Mediation," 10.
[82] Kjus and Danielsen, 9.
[83] Kjus and Danielsen, 14.
[84] Kjus and Danielsen, 13.

4 Method

4.1 GOALS FOR LIVE PERFORMANCE SYSTEM

To develop the live performance system, I established three main goals, heavily based on the historic context and relevance outlined in **Chapter 2**, the concepts on liveness and authenticity discussed in **Chapter 3**, as well as my own perspectives of what a system like this must possess.

4.1.1 Goal 1: Preserving Sonic DNA

In the **Chapter 2**, on historic context, I explored the historic grounds for how we ended up technologically where we are today. I then proceeded to present my perspective on the importance of sonic qualities, in contemporary music. Drawing from this, my first goal for the performance system was to develop a system that allows us to perform our songs in a way that remains true to their 'sonic DNA', and thereby also true to the music and artistic expression.

4.1.2 Goal 2: Giving Authentic Live Performances That Feel "Live"

As we saw in **Chapter 3**, there are several common challenges encountered when reproducing a studio recording on stage. For one, it will be almost impossible to bring enough musicians to reproduce all sound elements live. Consequently, this often leads artists to put some elements on backing tracks instead. However, using playback can alienate the audience from the live experience if perceived as a too dominant part of the performance. My second goal is to develop a system that enables performances perceived by the audience as authentically live, basing my decisions along the way on critical theories of liveness and discussions on authenticity.

4.1.3 Goal 3: Keeping the Technological System Flexible, User-Friendly and Robust

Lastly, when developing a technological system designed to deliver a specific output, the quality of the output is not the sole aspect to consider. Equally important is ensuring the process of generating this output is as efficient as possible. Take, for instance, the creation of a bread-making machine for professional bakers; the machine's operational efficiency and user-friendliness are as critical as its ability to produce bread that meets the taste preferences of customers. Similarly, in the realm of live music performance systems, user-friendliness, flexibility, and reliability are paramount. The system should facilitate a seamless live performance that captivates the audience, being straightforward to use during both concerts and rehearsals. Ideally, it should require minimal time-consuming setup or adjustments after

initial configuration. Moreover, the system must offer flexibility in terms of musical capabilities and the ease of making adjustments between shows, ensuring artists can adapt their performances to different setlists, instrumentalists, venues or audience expectations without significant effort. Additionally, it is crucial that system is robust and dependable, as the risks associated with technical failures during live events can compromise both performance quality and audience experience. Therefore, in sum, the third main goal is to make a system that is easy to use, flexible and reliable.

4.2 PRACTICAL TESTING AND IMPLEMENTATION

To meets the goals outlined in the previous section, I employed practical approach, focusing on the development and iterative testing of a tailored playback system address the real-life research questions. The method involved conducting several live concerts throughout the fall of 2023 and the spring of 2024. In addition to the concerts themselves, these also required considerable rehearsal time in advance, allowing for room for experimentation with different configurations and strategies. The constant cycle of rehearsals and concerts continually put us in situations where we encountered both anticipated and unexpected challenges, allowing us to map out the system's needs in great detail and breadth. This way, the hands-on testing not only allowed us to adapt our system dynamically but also helped us identify and resolve unforeseen problems and challenges. Ultimately, the experience gained from these Live Settings significantly shaped the final design of the playback system, ensuring it met our specific needs effectively.

5 Essential Ableton Live Functions

In this chapter, I have chosen to focus on Ableton Live, which serves as the central technological component of our live performance system. The DAW is widely regarded as the industry standard for running backing tracks during live performances, making it an ideal choice for our needs. Its versatility is recognized in both studio and live contexts, as discussed in the historical context section. This choice also directly aligns with my strategy to utilize 'threshold technologies' in designing our live performance system. Being the DAW I regularly use for music production, my familiarity with Ableton Live simplifies our setup and eliminates the need for additional software investments. To aid understanding for those not deeply familiar with its capabilities, I will outline some essential functions of the software. This explanation aims to demystify the program, thereby enhancing the comprehension of the system presented later in the thesis.

5.1 VIEWS

Ableton Live has two main views: the Arrangement View and the Session View. Ableton Live's Arrangement View is a timeline-based workspace designed for traditional linear music production and recording. It features horizontal lines representing tracks, with musical elements arranged sequentially over time. Users can place and edit audio clips, MIDI notes, and automation along the timeline, offering a clear representation of the song's structure from beginning to end. This view is particularly advantageous for detailed editing of a song's progression in small time-frames.

Figure 1. Simple Arrangement View Illustration

In contrast to Arrangement View, Session View in Ableton Live is not timeline-based. It emphasizes flexibility and improvisation for playing and arranging clips in real-time. Here, a grid of "slots" is used where each column represents a track, and each row represents a scene. Users can trigger clips independently, enabling experimentation and spontaneous composition. This view is what separated Live from other DAWs when released, because of the freedom in arrangement and improvisation, as well as for creative exploration of different arrangement ideas without committing to a linear structure.

Figure 2. Simple Session View Illustration

5.2 RACKS

A powerful tool in Ableton Live is an Instrument Rack, which allows you to combine multiple instruments and effects into a single MIDI track. It acts as a container for adding and manipulating various instruments or sound generators, enabling the creation of complex sound textures by stacking different sounds. Within an Instrument Rack, you can add multiple "chains," allowing for independent control of instruments, samplers, or effects with adjustments like volume, panning, and effects on each chain separately. Another key feature is "macros," which control multiple parameters across chains or switch between active chains — ideal for crafting unique sounds, intricate sound design, or swift sound changes during live performances. Similarly following this principle is the Audio Effect Rack that processes

incoming audio signals instead of MIDI. This setup allows for parallel signal processing and toggling between chains via macros.

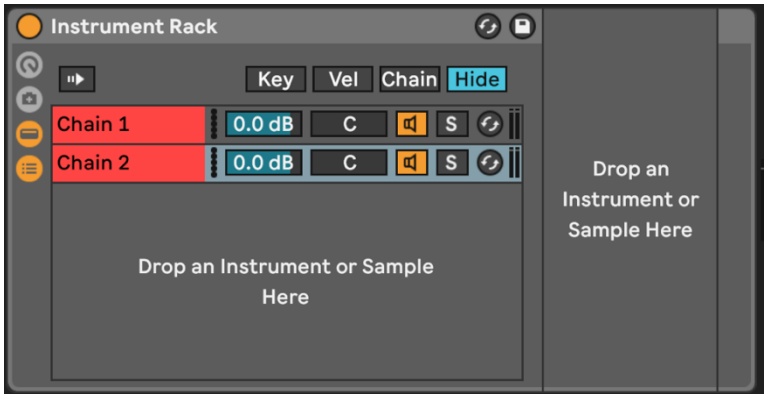

Figure 3. Simple Instrument Rack Illustration

5.3 LIVE SET

A "Live Set" in Ableton Live is the file type created to work within the Ableton Live software. It serves as the project file where all aspects of a music production or live performance are assembled and organized, including MIDI and audio tracks, devices, plugins, and arrangements specific to Ableton Live's environment. It is the digital workspace where artists can compose, design sounds, arrange their pieces, and perform live.

5.4 LOCATORS

Locators are small "flags" that you can place on the timeline in Arrangement View. These can be used as small play-buttons to start playback wherever they are placed, either with clicking on them with a mouse, or by mapping them to a MIDI-controller. You can see them in **Figure 1**.

6 Live Performance System

This chapter concerns the live performance system I designed to transition our studio recordings to the stage. Defined as an integrated ensemble of musicians, instruments, and playback system, this system is my best attempt to replicate our complex studio productions in live performances while maintaining the authenticity and engagement expected by our audience.

The initial section **6.1** of our live performance system concentrates on the musicians and their instruments. As established in **Concepts**, the selection and use of instruments on stage significantly influence the audience's perception of authenticity and liveness. This section explains which musicians and instrumentalists we chose and the reasons behind these choices, supported by the insights from the **Concepts** chapter. It also explores various setups tested during live performances, discussing their effectiveness and how each configuration aligns with the theoretical frameworks previously introduced.

Following the discussion on musicians and instruments, the next section **6.2** will delve into the details of our playback system, which features Ableton Live at its core. This system is meticulously tailored to complement the live instrumentation, ensuring that the full complexity of our studio recordings is effectively delivered during live performances. With the theoretical framework about liveness and mediation in mind, I will elaborate how the playback system was designed to meet our artistic objectives and performance style, enhancing the live experience without overshadowing the musicians' performances. In addition, I will discuss how we designed our system to be flexible and user-friendly, ensuring ease of use not only during concerts, but also in rehearsals and preparation phases.

Lastly, after detailing our playback system, we will then turn our attention to a key aspect of our Live Setup: redundancy. Section **6.3** is dedicated to the redundancy strategies employed to ensure continuous, fault-free performances. We will thoroughly examine the safeguards in place for crucial equipment like keyboards, guitars, and backing tracks, demonstrating how these redundancies protect against potential technical failures. This section underscores our commitment to delivering flawless live performances, ensuring that no technical issue can compromise the quality of our show.

This comprehensive approach ensures that each element of the live performance system is not only optimized for performance but also coherent with our artistic vision. By dissecting these components, this thesis aims to provide insights into the meticulous planning and strategic execution behind our successful live performances.

6.1 MUSICIANS & INSTRUMENTS

As previously mentioned, our productions can feature over hundred tracks per song. However, these tracks are never 100 different instruments or sound sources, but often layers of the same instrument/sound source contributing to the production in different ways. A typical example of this is multiple guitar tracks that might be fulfilling distinct roles—some providing rhythm, others laying down chords, or playing solos. When preparing our songs for live performance, it then calls for a strategic selection process. As explored in the **Chapter 3**, Kjus and Danielsen found that all the interviewees distinguished between “core sounds”, which are essential to a song's identity, and supplemental sounds, which enhance but are not indispensable. This concept guided us when managing what sounds to play with instruments and which to place on the backing tracks. To use the guitar as an example again, we typically put rhythm-less chord tracks on backing tracks if there's also a rhythmic guitar part being played live. However, a guitar solo, which carries more weight and is a focal point, will always be played live because it is considered a “more core” element. Further, if a rhythm guitar track doesn’t add value or even detracts from the performance when played over backing tracks, we might decide to remove it entirely from the live arrangement. The point of this strategy is to helps us avoid opaque mediation due to logical-sensorial ruptures.

Building on the concept of “core sounds”, it became clear to me that merely deciding which sounds to play live was only part of the preparation. The process extends beyond simply identifying instruments that produce the "core sounds" of a song. To truly enhance both authenticity and the live experience, it's crucial to consider which instruments most significantly impact these aspects, as discussed in **Chapter 3**. Additionally, the chosen instruments should collectively represent the diversity and complexity of the soundscape. Inspired by this, I propose to expand upon this concept by introducing the term "core musicians". These musicians are not just instrumental in producing specific sounds; their

presence on stage is essential for conveying the full musical experience to the audience. This consideration leads to a dual-layered approach or "negotiation" that intertwines identifying "core sounds" and choosing “core musicians”.

6.1.1 Choosing “Core Musicians”

As introduced earlier, Gaaren consists of a trio with two producers and one vocalist. The necessity of live vocals, previously discussed as essential, was an obvious choice. Coincidentally, one producer is a drummer and the other a guitarist, making the inclusion of these instruments in live performances a natural decision.

6.1.1.1 Drummer

Conversely, the choice of using a live drummer was not just out of convenience. After the vocal, drums are often the second instrument that is given live priority to be played live, because of their direct and powerful live effect.[85] This is implementation is often done even when there are no "real drums" on the recording. This effect may partly be explained by Jensenius’ theory on acoustic instruments, where the brain more easily makes a coupling between action-sound through mechanical laws.[86] The way we incorporate the drums, is by muting all the drum tracks from the recording and replacing them by an acoustic drum kit.

6.1.1.2 Guitarist

Jensenius also writes that electronic instruments will develop a similar coupling as acoustic instruments over time (but probably never as strong). The electric guitar is a mix of acoustic and electronic, in the sense that a fundamental acoustic sound that is amplified with electronic microphones and manipulated with electronic effects. The instrument has also existed since the first half of the last century, so the audience understands what an electric guitar is, and has a visual impression of the action-to-sound relationship. Most concertgoers will also be familiar with distortion, echo, and other typical guitar effects. Therefore, these forms of technological mediation will appear more transparent. To flip the argument, prominent guitar elements will not perform well on backing tracks because the audience has a strong mental connection

[85] Kjus and Danielsen, 15.
[86] Jensenius, “An Action–Sound Approach to Teaching Interactive Music,” 181.

between action and sound for this instrument, giving us even more reason to use it as a live instrument.

6.1.1.3 Keyboardist

I also saw it necessary to have a keyboardist on stage. In the article describing Susanne Sundfør's live performance, Danielsen and Helseth concluded that the most important thing was that different parts of the soundscape were visually represented.[87] In our recordings we have many layers of keys and synths to fill the soundscape. On stage the keyboardist usually plays one of these "layers" at the time, and in this way becomes the symbol of the synthesized sounds.

6.1.1.4 Bassist

The last musician we brought into the live ensemble, was a bassist. Some of our studio recordings, such as "Losing Myself", have driving electric bass lines as a fundamental element.[88] In these recordings, regardless of whether the bass is recorded by a live bassist or produced by a sampler instrument, listeners are likely to envision a real bass guitar upon hearing the bass lines. Thus, the same arguments apply as for the electric guitar. However, in other songs such as "Any Day Now" the bass is synthesized, providing a subtle background presence that primarily fills the low-frequency areas of the soundscape.[89] Had all the songs had such a bass, the need for a bassist would not be the same. Then one could argue that the bass synth could have been visually represented by the keyboardist instead. Given that some tracks feature prominent bass lines, we opted to include a bassist for all our live performances. In songs where the studio version uses synthesized bass, the bassist replicates the synth bass to the best of his ability, by adapting his playing style and effect pedal processing.

With this combination of musicians, the "diversity" of sound sources in our soundscapes covered. Furthermore, a classic band setting was established, which presumably gives the audience an impression of an authentic live performance. The next section details how these five core musicians' instruments were configured to meet the main goals of reproducing the

[87] Danielsen and Helseth, "Mediated Immediacy," 26.
[88] gaaren, *Losing Myself*, 2023, https://www.youtube.com/watch?v=P7iXn_GkTMY.
[89] gaaren, *Any Day Now*, 2023, https://www.youtube.com/watch?v=dESHzhz90UA.

songs' sonic DNA live, representing the core sounds, and preserving the authenticity and liveness.

6.1.2 Instrument Setup & Configuration

6.1.2.1 Central Equipment

Hardware/Software	**Purpose**
MacBook Pro #1	Running Ableton Live
MacBook Pro #2	Running Ableton Live
Ableton Live 11	Backing tracks, MIDI-instruments, Audio processing
Apollo Twin X Duo	Audio Interface, A/D & D/A-conversion
iConnectivity PlayAudio1U	Audio Interface, MIDI-Interface, D/A-conversion
Komplete Kontrol s49	MIDI-keyboard, controlling software (VST)-instruments
Line 6 Helix Floor	Guitar Processing: Multi-effects and Amp simulation
Line 6 Helix Stomp	Bass Processing: Multi-effects and Amp simulation
Novation Launchpad X	MIDI triggering pads

6.1.2.2 Integrating Live Instruments with Backing Tracks

Before detailing the setup of each instrument, I find it When preparing a song for live performance, we sort through our mix session and determine which sound elements are going to be played live and which are going to be handled by the computer, as a part of the backing tracks. For the guitar and keyboard, we only muted the actual part that the musicians are playing live, and assigned the rest to the backing tracks. For the other instruments, however, the selection process required more careful consideration. As described in section **3.2.6**, vocals are especially sensitive to logical sensorial ruptures. Additionally, as exemplified by the Milli Vanilli there is also a strong stigma associated with having vocals played back in a live performance. In the light of this, I decided to mute the main lead vocal completely. I further also lowered the volume of the backing vocals so that they take up less space in the soundscape

(compared to the studio recording), but still serve their supporting role, enhancing and harmonizing the lead vocalist. For bass, I found that clashing bass frequencies are disastrous for the live mix. I therefore decided to mute all tracks with bass information, so that there is no low frequency information outputted through the backing tracks when the bassist is playing. Regarding the drums, a doubling of the live acoustic kit with the recorded drums sounds is theoretically feasible. In practice however, this comes with a significant challenge. In their article on *The precedence effect* Litovsky et al. describes a phenomenon called *the echo threshold*: *"*As the delay increases, the lagging source becomes audible as a separate auditory event; this perceptual boundary between 'one fused sound' and 'two separate sounds' is often referred to as the echo threshold".[90] A part of what makes drums perfect rhythmic instruments, is their sharp transients, meaning a rapid initial peak in volume when played. However, Litovsky's research shows that the sharper the transients, the lower the echo threshold.[91] Therefore, aligning live drumming with pre-recorded drum tracks would require the drummer play extremely rigid and precise to match the transients of drum sounds on the backing tracks, and keep the clear rhythm intact. This is both nearly impossible and undesirable from a musical perspective. Knowing this, I decided to exclude any drum kit elements like kicks, snares, hats or toms from the backing tracks. I kept some percussive elements that is sonically distinct from a typical drum kit, like shakers, tambourines, and handclaps in the backing tracks, but only in sections where the stage activity is so high, and the mix is so dense, that these elements serve a supporting role, not drawing attention unwanted attention, minimizing any chance of logical-sensorial ruptures.

6.1.2.3 Vocals, Drums and Bass Setup

Gaaren's live performances feature traditional handling of the vocal and drum elements. The vocalist sings into a stage microphone connected directly to the front-of-house, where external sound engineers process the vocals independently of the Ableton Live system on stage. The acoustic drum kit is mic'd up and mixed live by the sound engineer. The bass guitar player uses

[90] Ruth Y. Litovsky et al., "The Precedence Effect," *The Journal of the Acoustical Society of America* 106, no. 4 (October 1, 1999): 1634, https://doi.org/10.1121/1.427914.
[91] Litovsky et al., 1636.

a Line 6 HX Stomp amplifier simulator to send a balanced and processed signal to the front-of-house mixer.

6.1.2.4 Keyboard Setup - Instrument Rack

Gaaren's keyboard setup for live performances is ingeniously crafted around the interplay of a MIDI keyboard and Ableton Live. The outer rack contains one chain for each song, within which there is an Instrument Rack featuring a chain for every patch used in the song. Additionally, within each patch, there is a third layer of Instrument Racks to group the MIDI instrument with additional effects and processing.

Figure 4. Keyboard Instrument Rack

A key feature of this setup is automated sound switching; a macro knob named "Song Selector" controls the built-in chain selector device in the outer rack, allowing easy switching between different songs' chains during performances. Furthermore, I mapped another macro knob named "Patch Selector" to control the switch between different patches within a song. I also mapped the "Patch Selector" to the on/off toggle of each patch's Instrument Rack (third layer) to optimize CPU usage by activating only those specific patch plugins that are being used. This meticulous configuration enables Gaaren to seamlessly switch between different songs and patches during live performances, ensuring smooth transitions and efficient use of CPU resources.

Figure 5. Song Chain Selector

As discussed earlier, different instruments have different impacts on the audience's perceived authenticity and liveness experience, because of ingrained expectations about the relationship between an instrument's visible action and its sound, and their understanding of what it means to play an instrument. It's therefore vital that the musicians' actions on stage resonate with what the audience recognizes and associates with live music performance. If the task of changing sounds compromises the instrumentalist's ability to deliver a superior musical performance or interacting with the audience, it effectively undermines the live experience by diverting attention to activities that the audience may find irrelevant. Conversely, this automation setup aims to eliminate the need for manual switching of sounds or patches on the MIDI keyboard, enabling Gaaren's keyboardist to focus on the best instrumental performance as possible, with the actual keyboard keys.

I tried out different ways of automating the patch switching knobs during the performance. The first and maybe most obvious one was using the standard line automation function in Ableton. The advantage of this method is that you can do it all on the same track, without the needs of additional configuration. The downside we found is that automation can be tedious and time-consuming to set up, especially when dealing with multiple songs and patches, and sometimes cumbersome to get completely accurate, especially when you need to automate subtle changes, like going from 2 to 3 on a scale from 0 to 127. The risk for human error is also greater with line automation, and we often found ourselves having audio dropouts from the MIDI-Instrument because we set one automation point an increment to high or low for the given patch.

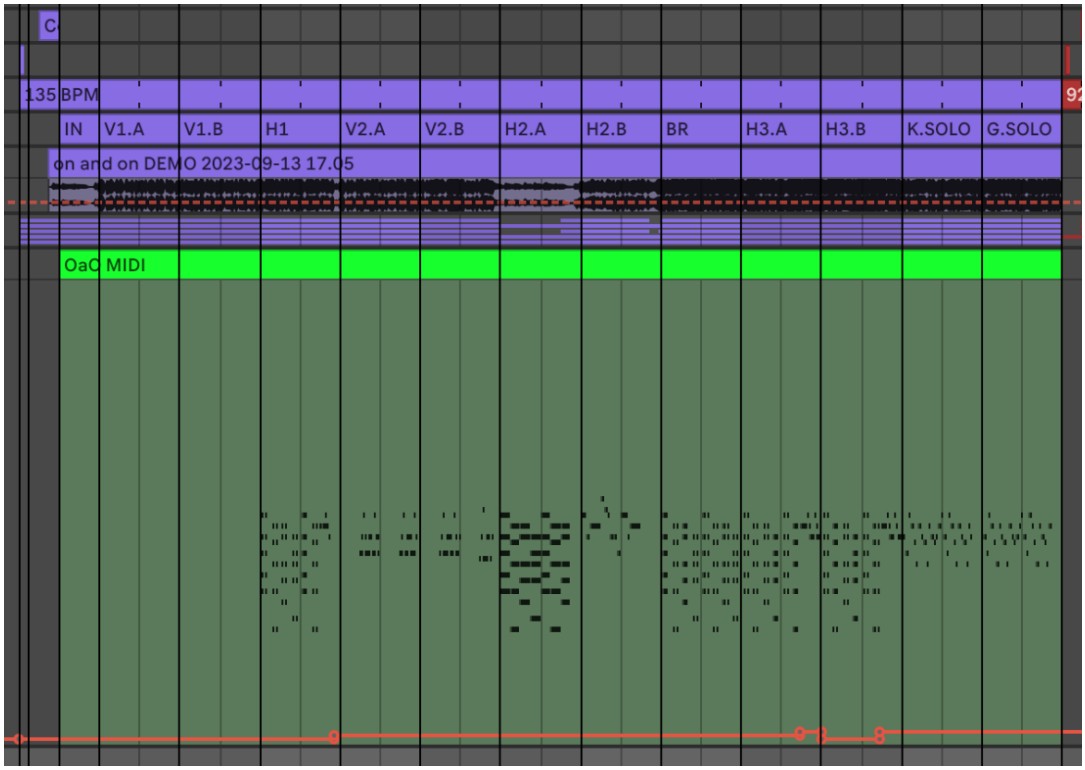

Figure 6. Line Automation

To streamline the automation process and reduce the risk of human errors, I explored an alternative method for automating patch switching, utilizing what I term “MIDI Message Clips”. In the Info Tracks, we reserved specific empty MIDI tracks solely for inserting MIDI Clips that transmit CC-values. The Keyboard’s MIDI Message Track (named KEYS PATCH MESSAGE in the Live Set) are set to send MIDI messages to the Keyboard Instrument Racks’ MIDI Input Channel. In our system, this is MIDI Channel 1. By pre-saving clips with individual, constant CC-values in Ableton Live's Browser, they can easily be dragged into Live Set and positioned on the timeline where patch changes are desired. I experienced this way of automating the macro knob as significantly faster and safer, compared to the traditional line automation. See the following figures; **Figure 7**, **Figure 8** & **Figure 9**, for illustration.

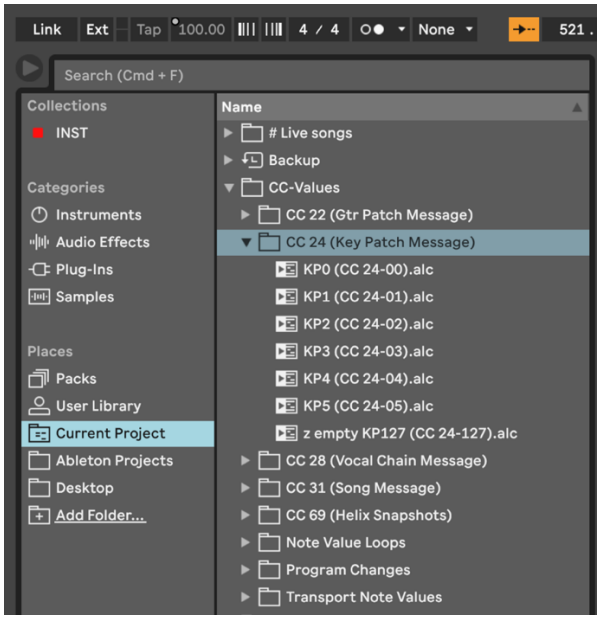

Figure 7. Storing MIDI Clips with set CC-values in browser

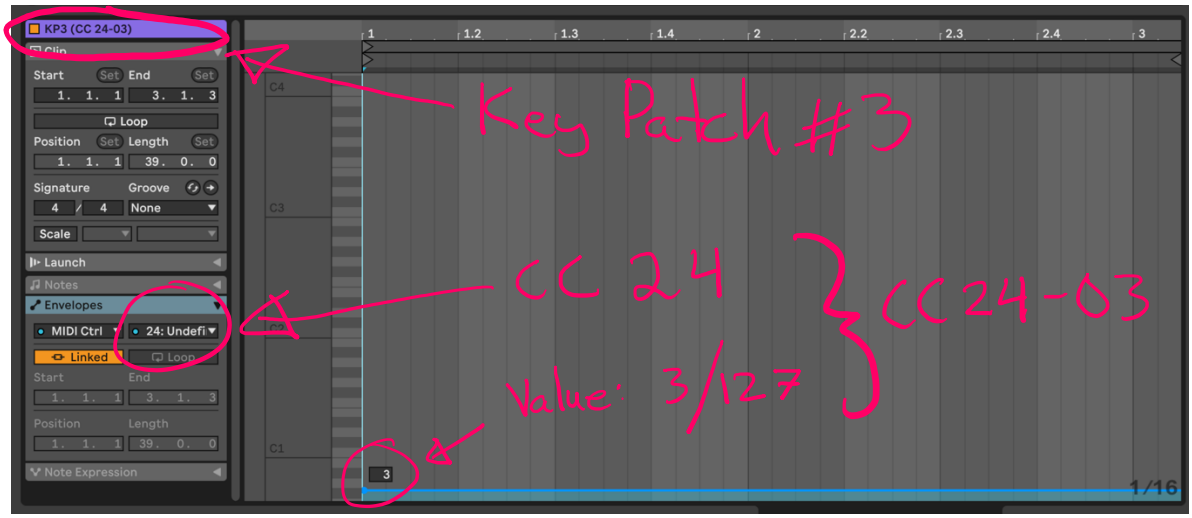

Figure 8. Clip Automation

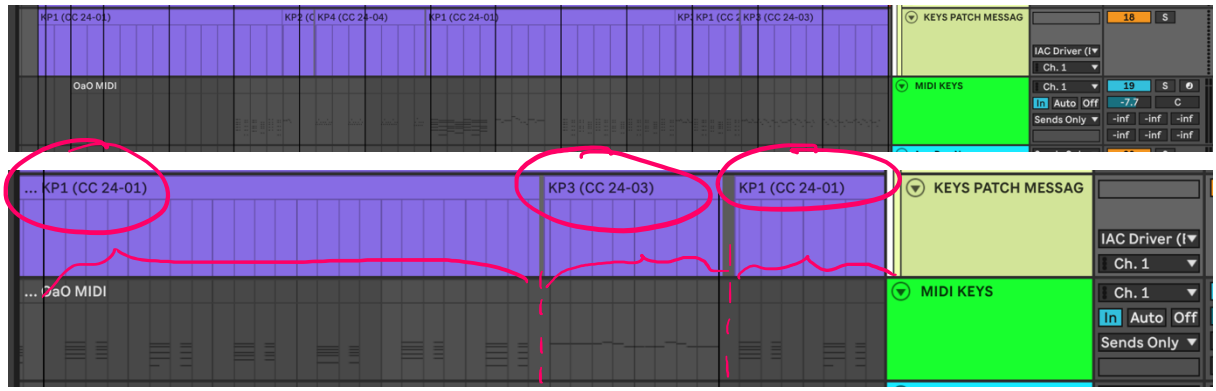

Figure 9. Clip Automation on Timeline

6.1.2.5 Electric Guitar Setup

6.1.2.5.1 Processing Electric Guitar Using Analog Pedals and Amps

Processing an electric guitar traditionally has involved using analog pedals and amps. The signal flow starts from the guitar, goes through a series of pedals with various effects (such as distortion, chorus, reverb), and then into an amplifier. This method has been the standard way of processing the guitar for decades. Because this is the traditional approach, it is often the first one that most guitarists learn and become familiar with. It was also our initial choice when we began planning to take our music to perform on stage. Using analog pedals and amps has the obvious advantage of providing an authentic and organic sound. It is easy to get started, allowing you to gradually build your pedalboard by adding pedals over time. However, we soon encountered major drawbacks when using analog equipment for live performances. While in the studio, we meticulously dial in different sounds from song to song and even within each song section. This level of precision and control became difficult to replicate during live shows, especially when transitioning between different sounds quickly. Firstly, because the pedals are on the ground, it is practically impossible to adjust the knobs while playing. Secondly, with individual analog pedals, you can only activate (or deactivate) one effect at a time; thus, making significant changes in sound from one song section to another is not possible. Finally, the output signal from the pedal board also depends on the order of effects being used which remains fixed throughout performance (unless cables are unplugged, and pedals are moved mid-show as required). In order to address these challenges and achieve more flexibility in live performances, we decided to explore the use of digital processing for the electric guitar.

6.1.2.5.2 Processing Electric Guitar Using Ableton Live

When recording guitar for our records in the studio, we have always used DI from the guitar and utilized "Guitar Rig 6" by Native Instruments for virtual amp simulation and effects, along with other effect plugins.

To replicate the guitar sound on stage, we explored one approach to process the electric guitar using Ableton Live as the host for signal processing. Our setup was quite similar to the keyboard setup. Instead of using the Instrument Rack, we used Ableton's Effect Rack for the guitar's audio signal while keeping everything else—such as song selector, patch chains, and macro knob functions—the same. This allowed us to use the exact same processing chain in

our live performance as we do in studio recordings by grouping plugins inside each patch's Audio Effect Rack (third layer).

Figure 10: Guitar Live Set Main Window

Figure 11: Guitar Patch Rack - combining Guitar Rig 6 with other audio effect plug-ins

Running backing tracks, the Keyboard Instrument Rack, and the Guitar Effect Rack simultaneously in one Ableton Live Set proved to be too taxing for the processing power of a single computer. We decided to run the Guitar Processing Rack in its own dedicated Ableton Live Set on a separate MacBook, which we'll now refer to as the Guitar Live Set.

For the same reasons as for automating the switching of keyboard patches, I wanted the guitar patch switching to be automated as well. However, when the Guitar Effect Rack is moved out of the Main Live Set, it cannot be directly automated in the Live Set like the Keyboard Instrument Rack. Conversely, connecting two Macs with an ethernet cable allows for MIDI data to be sent between them. This can be accomplished by creating a MIDI Network Session

using the Audio MIDI Settings app installed on all Macs and utilizing the built-in IAC Driver – a virtual MIDI bus enabling transmission of MIDI data between applications and computers. Further exploration led us to discover two methods for automating the switching of guitar patches.

One method involved using MIDI Clock data from the Main Live Set to sync the Guitar Live Set on the separate computer with the Main Live Set's timeline. Then, the patch switching could be automated, with either line automation or clip automation, directly on the timeline of the Guitar Live Set. This method has a significant advantage because it is timeline dependent. It allows for the creation of complex automation for guitar effects that follow the song's timeline, as well as automatically syncing time-based effects in the Guitar Live Set to the Main Live Set's BPM. The downside of this method is that the timeline of the two Live Sets needs to be identical through the whole live performance. Any small adjustment or change in the Main Live Set's timeline will require corresponding adjustments in the Guitar Live Set, which again opens up the possibility for human error. It should also be noted that this method is only applicable in Arrangement View, as Session View lacks a timeline for synchronization.

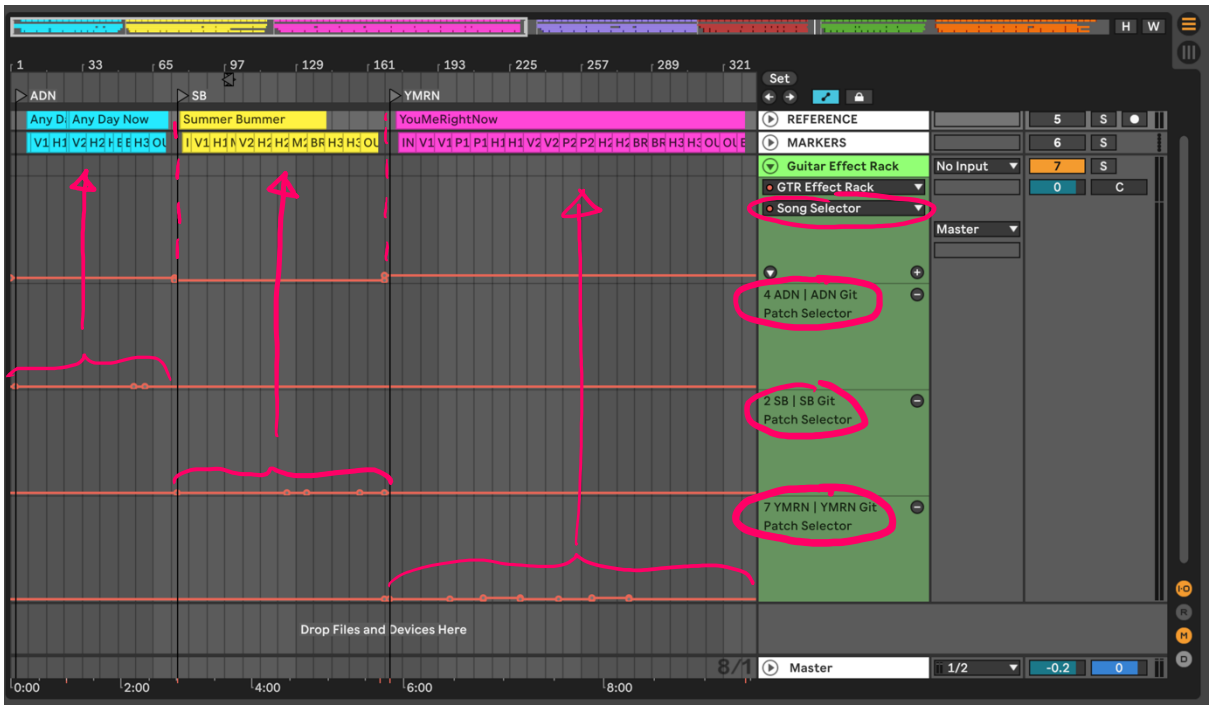

Figure 12. Automating guitar patches with Line Automation, synced with MIDI Clock

This led us to explore a timeline independent approach for automating the switching of guitar patches. The second method we tried involved using MIDI Message Clips, similar to the approach used for automating patch switching in the keyboard setup.

Rather than synchronizing the clocks of the two sessions via an ethernet connection and placing a MIDI-message track in the Guitar Live Set, this approach keeps the MIDI Message tracks (SONG MESSAGE and GTR PATCH MESSAGE) within the Main Live Set. It sends the patch-changing CC-values directly to the Guitar Effect Rack in the Guitar Live Set. The advantage of this method lies in its simplicity because there is no need for timeline-syncing; it minimizes communication between macs to just a minimal amount, transmitting only simple MIDI CC-values indicating which patch changes needs to occur. As a result of its timeline independency, this method of automating the patch switching is compatible with working in both Arrangement View and Session View

Figure 13. Automating guitar patches with MIDI Clips

A significant limitation of not synchronizing the Guitar Live Set with the MIDI-clock of the Main Live Set is the loss of advanced automation capabilities for guitar processing parameters along the timeline. I attempted to make a workaround for this. For instance, if I wanted a low pass filter on the guitar to slowly open during a specific section of the song, I could place a MIDI clip with a MIDI automation envelope in an empty slot on an empty MIDI track, in the Guitar Live Sets' Session View. This envelope should then be mapped to the low pass filters frequency parameter. Then the envelope clip could be triggered at the appropriate timing in the song by mapping the envelope clip's play-button to simple MIDI messages placed on the timeline in the Main Live Set. This workaround's main drawback is that the MIDI envelopes will be limited to values from 0 to 127, which may not offer enough resolution for certain parameter controls. Translating CC values into the desired parameter value when drawing the automation envelope is also not intuitive. For example, how do you draw a curve from 330 Hz to 4.3 kHz using values ranging from 0 to 127?

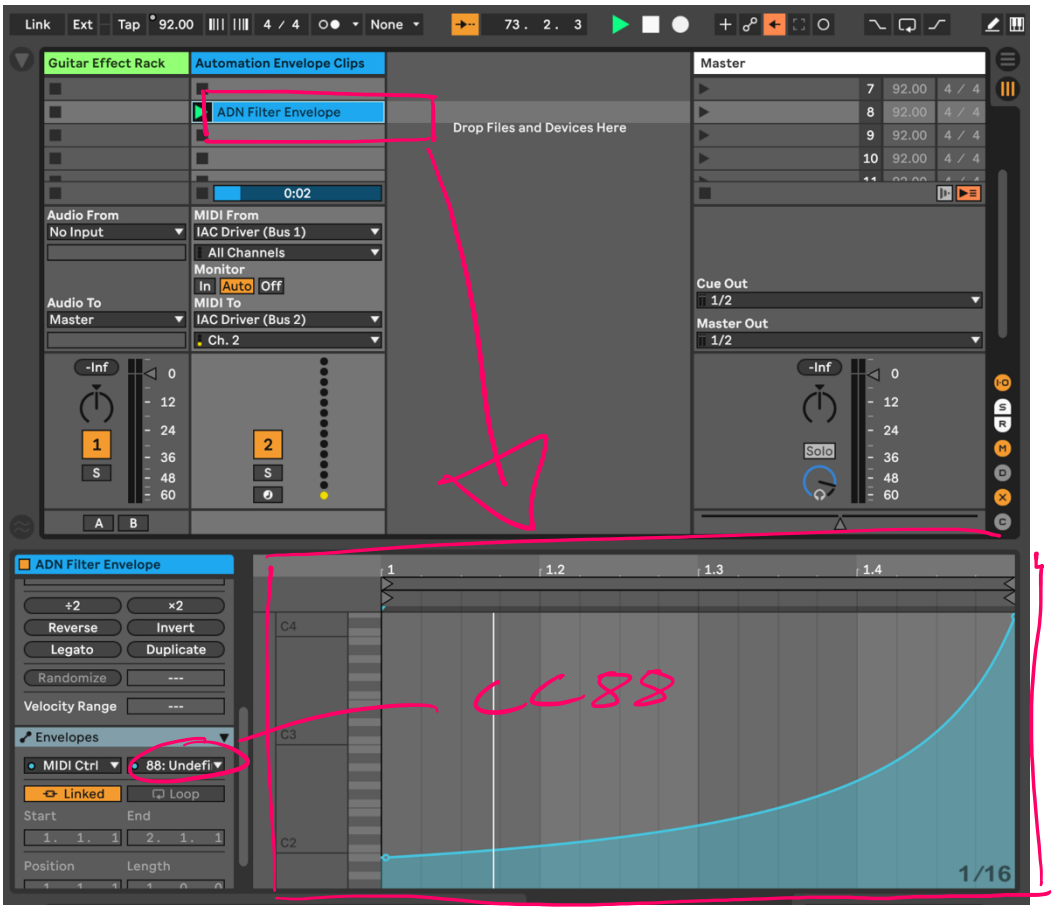

Figure 14. Automation Envelope Clip in Session View

6.1.2.5.3 Processing Electric Guitar Using Multi-Effects and Amp Simulation Hardware

A third method of processing the guitar involves using a multi-effects hardware device with an amp simulator. We utilized the Line 6 Helix Floor for this purpose, which served as a middle ground between the two previously mentioned methods. Similar to the Guitar Effect Rack, the digital interface of the multi-effect hardware allows for quick preset storage and instant switching between different combinations of effects and amp simulations. At the same time, it also offers foot pedals to switch presets and turn off single effects manually, like you would on an analog pedal board. The Helix and other similar multi-effects hardware have the possibility to connect via MIDI cables (either USB MIDI or DIN 5 pin MIDI). This opens up possibilities to send MIDI messages from the Main Live Set to automate changes in presets and parameters on multi-effects hardware, just like we did when using Guitar Effect Rack in our Guitar Live Set. Compared to using the Ableton Guitar Effect Rack, this method is weakened by the fact that when we utilize multi-effects and amp simulation hardware, we are constrained by the

available presets and parameter options on the specific device. This means that we cannot reproduce the exact combination of sound shaping devices used in the studio recording on stage; instead, we have to recreate each patch as closely as possible on the multi-effects hardware. This can be challenging, as the available parameter options and resolution may not match those of the original studio setup.

Figure 15. Line 6 Helix Floor offer both multi-effects and amp-simulation

6.1.2.5.4 Guitar Processing Alternatives Compared

There came advantages and disadvantages with all three guitar solutions. Among these, the analog pedals setup was found less fit for our needs. The competition was much closer between the two the other setups mentioned. Using the Helix required less setup at concert and rehearsel, taking less time and less work. In comparison, using a separate computer with its own external audio interface, necessitated a more complex rigging solution, involving a keyboard stand, extensive cabling and power supplies. Moreover, establishing a fully redundant setup with a foot controller (as discussed later, in section Error! Reference source not found.) significantly increased the complexity of rigging and managing equipment, both when entering and leaving stage—this was particularly cumbersome during festival gigs with strict setup and soundcheck schedules.

That said, The Helix although simpler for practical reasons, was not the unit used to sculp the guitar sounds in studio: We use amp simulator plugins directly on the audio tracks, and record guitar *direct in.* This means that to replicate the exact studio guitar tones live, the sounds must

be meticulously re-sculpted on the Helix, to ensure they faithfully match the guitar sounds in the studio recordings.

Another approach could be to change our studio workflow to sculpt sounds directly on the Helix and record the processed audio into the session permanently (a technique known as 'printing'). This is a viable solution, yet based on my experience, even when initial tones are set with amp simulation plugins, we often return to adjust these sounds post-recording, either within the plugin itself or using additional effects. Consequently, the final studio guitar sound can differ significantly from what was initially 'printed' from the Helix. The Guitar Effect Rack method addresses these issues like no other solution do, considering the possibility it enables to extract the exact processing chain that was used, even at the very end of a song's production process.

Ultimately, the choice of guitar processing method heavily depended on our logistical needs regarding rigging and transportation capabilities.

Sidenote: There exists a plug-in called Helix Native, that allows for the use of the Helix interface like a plugin in a DAW.[92] While this plugin comes with a hefty price tag, using it when making the songs in our DAWs would facilitate a more seamless transfer to live performances. Yet, it does not accommodate third-party plugins, which limits its utility in replicating complex studio effect chains.

6.2 PLAYBACK SYSTEM

Having explored the roles of musicians and instruments in enhancing our live performances, this section will shift focus to the supportive component of the live performance system: the playback system. Centred around Ableton Live, the playback system plays a pivotal role in filling the gaps left by live musicians, completing the soundscape of our complex studio recordings when brought to the stage. In this way, it helps preserve the fidelity of the songs as originally conceived, maintaining their sonic DNA. A major function of the playback system is also to synchronize the musicians on stage with the backing tracks and each other, providing a set tempo, metronome clicks, and other relevant information during concerts and rehearsals.

[92] "Helix Native," Line 6, accessed May 13, 2024, //line6.com/helix/helixnative.html.

The section will present the system's configuration of various track types and how they are set up—including Info Tracks, Live Instrument Tracks, Backing Tracks, and Return Tracks. Furthermore, this section will detail the preparation process for live performances, highlighting how we designed our playback system to maintain an effective workflow by formatting our Live Sets to maximize flexibility and user-friendliness. This was crucial for facilitating quick setups and efficient rehearsals, enabling smooth transitions both between and during live shows. In the final part of this section, I will compare the Arrangement View and Session View in Ableton Live, explaining my choice of using one over the other. Additionally, I will discuss strategies for overcoming the initial limitations associated with each view, providing insights into how and when these can be effectively utilized in a Live Setting.

6.2.1 Types of Tracks

6.2.1.1 Info Tracks

The Info Tracks transmits information to various destinations, such as the musicians on stage, internal devices within the Live Set, or external devices on stage. The following section is a detailed description of each individual Info track in our Live Set.

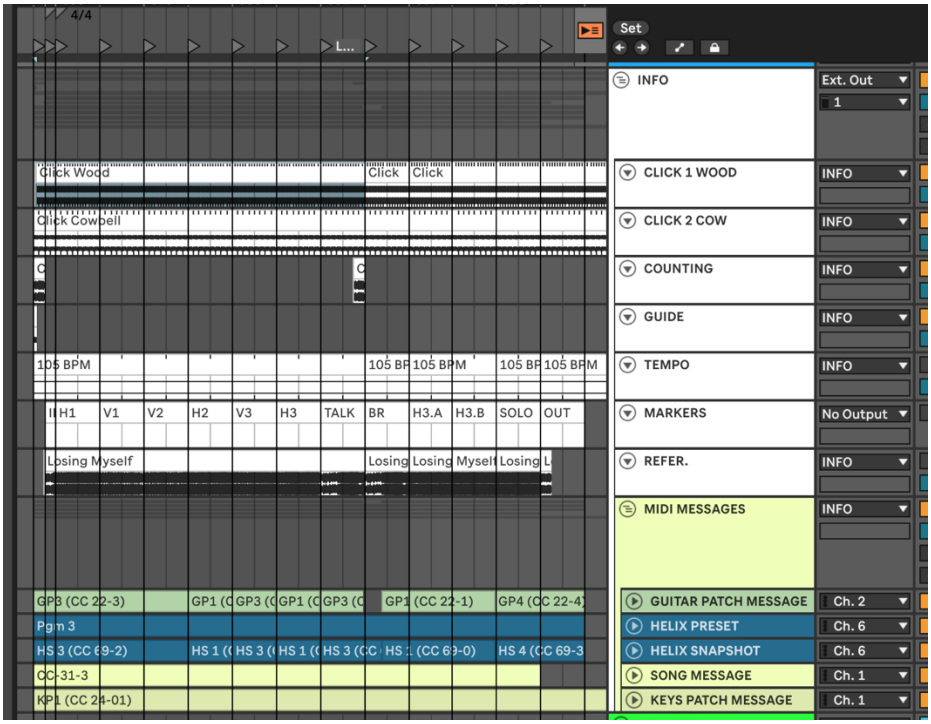

Figure 16. Info Tracks

6.2.1.1.1 Click Track

The click track provides a consistent and precise pulse that the musicians can follow during the performance, here described by Knowles and Hewitt:

> Increasingly click tracks are being used live in order to allow the use of sequenced materials in performances alongside live players. Not only does this provide the facility to combine quantized sequenced materials with real time performance, but also the capacity to sequence and trigger automated processing states and moves against a timeline.[93]

This click acts as a rhythmic anchor, ensuring all elements of the music stay synchronized. The musicians can monitor the click through in-ear monitors. Having the click on its own audio track offers the flexibility to change the click sound, alter subdivisions, and adjust the click volume for different songs.

6.2.1.1.2 Count-in Track & Guide Track

The Count-in track contains recordings of a voice counting in, which helps in cueing the start of various sections, ensuring that all musicians enter at the same time. Similarly, the guide track assists musicians in keeping track of the arrangement throughout the performance.

6.2.1.1.3 Tempo Track

Since our songs have different tempos, the master tempo in Ableton Live must accurately reflect the BPM of the current song. Ableton Live's default method for automating the master tempo is line automation on the Master Track. This work method proved highly ineffective when song stems are moved around within the Live Set or transferred in and out, the automation does not accompany them. To combat I dedicated an audio track to control the tempo throughout the song using *dummy clips*. These are audio clips with no actual sound information but can still be set to override the master tempo when designated as "Lead" with Ableton Live's Warp function. By assigning each song a dummy clip with matching length and tempo as the other song clips, the tempo remains consistent with the song, because the dummy clip is always moved along with the rest of the song's clips.

[93] Knowles and Hewitt, "Performance Recordivity," 11.

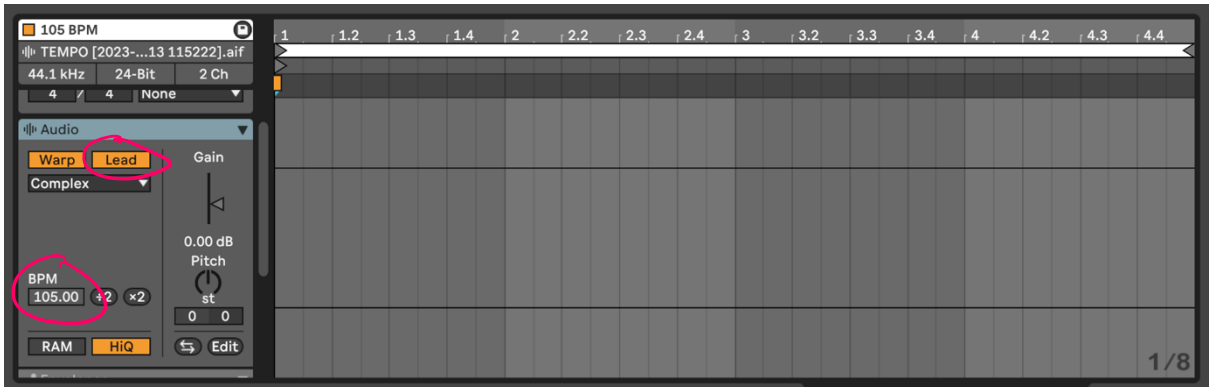

Figure 17. Tempo Track's 'Dummy Clip' contains no audible information.

6.2.1.1.4 Markers Track

We have implemented a system of markers in each Live Set to assist with navigation in songs. These markers are composed of empty MIDI clips within a blank MIDI instrument, each labeled according to different sections of the songs such as verse, hook, and bridge. They provide visual reference points, particularly useful during rehearsals, and offer a clear overview of the song structure, making navigation easier. Although Locators could serve a similar function, I have opted to use MIDI clips as markers instead, for reasons analogous to using dummy clips for setting the master tempo: they remain aligned with the song during movements, cuts, pastes within the session, and when songs are exported or imported – capabilities that Locators do not support. Marker clips also function universal between Arrangement View and Session View, in the sense that they fill the same function if you copy song clips between the two views. That said, when a Concert Live Set order is established, marker clips can be used to efficiently add Locators to the timeline, by jumping from one to the next.

6.2.1.1.5 Reference Track

Each Live Set includes a reference track that is an exact copy of the original studio recording. This track serves as a guide for the musicians during rehearsals, providing them with a clear benchmark of how the song should sound, including the arrangement, song structures, and sonic ideals.

6.2.1.1.6 MIDI-Message Tracks

As outlined in section **6.1.2**, these consist of empty MIDI-instrument tracks that send MIDI messages, such as program changes and CC values, to internal and external instruments and effect processors. This setup often eliminates the need for tedious line automation work, thereby streamlining the automation of patch changes across several instruments.

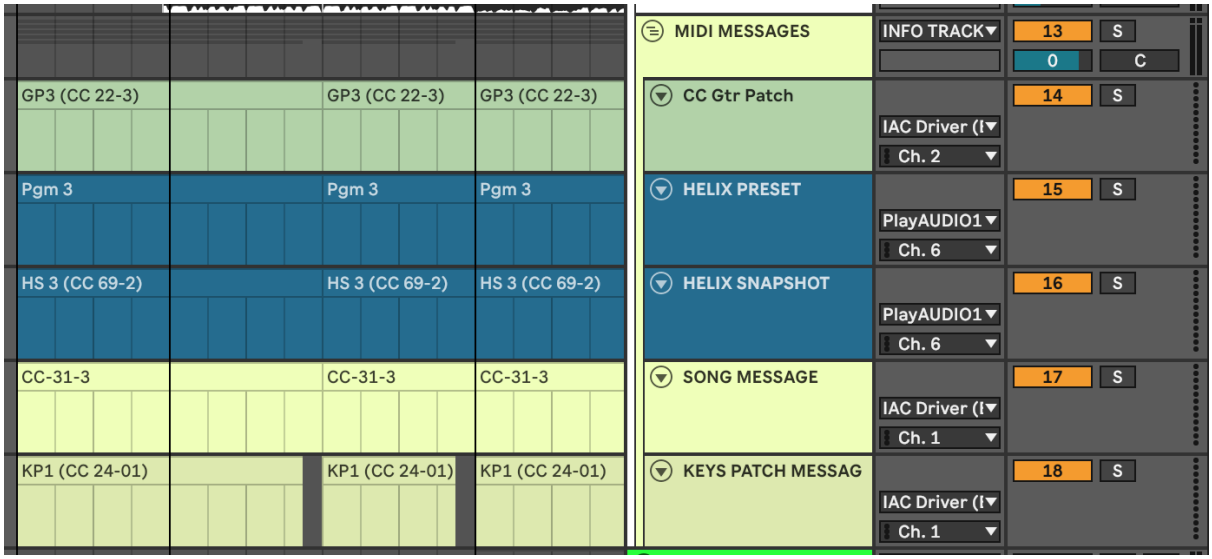

Figure 18. MIDI Message Tracks

6.2.1.2 Live Instrument Tracks

These tracks host instruments that are played live on stage. They can include MIDI instruments triggered by MIDI keyboards, such as the Keyboard Instrument Rack, or audio tracks that process live sound signals, like how the Guitar Effect Rack processes the guitar signal, both described in section **6.1.2**.

6.2.1.3 Backing Tracks / Stem Tracks

Stem tracks include separate instrumental voices from the original studio mix, such as vocals, percussion, guitars, audio effects, and more. These stems are organized and exported from the mix session to be integrated into the live performance, supporting the musicians with sound elements they cannot play live. This approach ensures that live performances faithfully mirror the studio sound, even when not all parts can be executed live.

Figure 19: Backing Tracks / Stem Tracks for the song Losing Myself

6.2.1.4 Return Tracks

Return Tracks are Ableton Live's built-in send/aux function, which allows you to send a copy of the audio from one track to a parallel, summing audio track. For example, one may send a copy of all vocal tracks from different songs to a "vocal return track" to process all vocals uniformly. In this project, return tracks are used to consolidate all stems from the instrument type on a single track before selecting their output from the audio interface. This workflow enhances flexibility by enabling simultaneous output changes for all tracks within an instrument group. As illustrated in **Figure 19**, all tracks appear active (track button is yellow), despite the knowledge that certain instrument stems will be replaced by live instruments. Conversely, in **Figure 20**, the return tracks that sum stems from instruments that will be played live are deactivated (track button is grey), reflecting their non-use in the Live Setup.

Figure 20. Return Tracks

6.2.2 Preparing a Live Performance

In designing the playback system, one of our main goals was to maximize flexibility. I aimed to avoid the need to create a new concert Love set from scratch for every performance. To achieve this, I took inspiration from approach developed by certified Ableton Live Trainer, Will Doggett. His “three-part framework for running tracks” is based on formatting each song in its own Song Live Set mirroring the Concert Live Set, streamlining song importation through Ableton's internal browser. The following sections will explain how this is implemented, from individual song preparation to the overall concert setup.

6.2.2.1 Formatting Songs

The formatting process starts in the given songs mix session. In studio settings, there can be multiple overlapping keyboard layers and live performances may pose challenges for reproducing all these layers simultaneously by a single keyboardist. Therefore, some of these layers are played back as stems in Ableton during live performances while allowing the keyboardist to focus on performing more prominent or important parts- maintaining energy and essence of live performance. Initially, all stems are exported by instrument group from the mix session, excluding guitar and keyboards. I then review the keyboard tracks in the session, identifying and highlighting the “core parts” for live play. These core parts are muted, and the remaining sections are exported as the "keys" stem, which serves as a backing track during performances. Subsequently, we invert the muting process (unmuting the core elements and

muting the rest) to create a "keyboardist DEMO" stem. This stem aids the keyboardist in practicing their parts and acts as a backup for redundancy, as detailed in section **Error! Reference source not found.**. After completing the process for the keyboard tracks, the exact same steps are applied to the guitar tracks.

When all stem tracks are exported from the mix project, they are imported and placed on individual audio tracks in the Song Live Set and grouped under the name of the song (see **Figure 19**). This is where Doggett's framework is applied: Each stem is sent to its designated Return Track by sending unity gain (100% of track level) to the corresponding return track. For example, the Drum stem track sends unity gain to Return A, named DRUMS; the Perc stem sends unity gain to Return B named PERC, and so on. By default, Ableton Live Groups act as summing tracks for all their contained tracks. It is therefore crucial that the Group's output is set to "Sends Only" to avoid duplicating any of the audio signals. The rationale for using Ableton Live's Sends function to route audio to the Return Tracks, rather than the Track Output, lies in maintaining functionality similar to that of a VCA (Voltage Control Amplifier) on a Digital Mixer. Even though the tracks are not summed within a Group, using the Sends allows the Group's volume knob to control the overall volume of all included tracks effectively, mimicking a VCA's role in adjusting group volume levels.

Next, we set up the information tracks with the correct clips for that song (tempo clip, place markers, add reference track etc.). Lastly, we gather the keyboardist's patches for the core elements intended for live performance from the song's original production Live Set. These are organized into a "song chain" within an Instrument Rack (see section **6.1.2.4** for more details). A similar process is applied to the guitarist's patches, which are arranged using an audio-effect rack.

Essentially, when done formatted, The Song Live Set is very similar to a Concert Live Set with only one song in it.

6.2.2.2 Building a Concert Live Set

The brilliance of Doggett's framework lies in its consistency: when all tracks are formatted uniformly, not only are all stems of the same instrument type across different songs automatically routed to the same return track and thus to the same output upon importation, but

it also allows for collective output adjustments for all tracks of the same instrument type. This is achieved by changing the set output of their shared return track.

To prepare or "build" a Concert Live Set, each individual Song Live Set is imported into the Concert Live Set and arranged in sequence, either in Session View or Arrangement View. All Info clips from each song's Info Tracks are transferred to the Concert Live Set's Info Tracks, accumulating all songs' Info clips into common Info tracks. Similarly, chains from the individual songs' Instrument Rack are combined into the Concert Live Set's Instrument Rack, forming the Keyboard Instrument Rack described in section **6.1.2.4**. However, stem clips are maintained on their individual tracks within their respective groups; thus, in the concert project, there is one group per song. This setup facilitates volume adjustments between songs if necessary and allows for the showing or hiding of individual stem tracks for specific songs as needed.

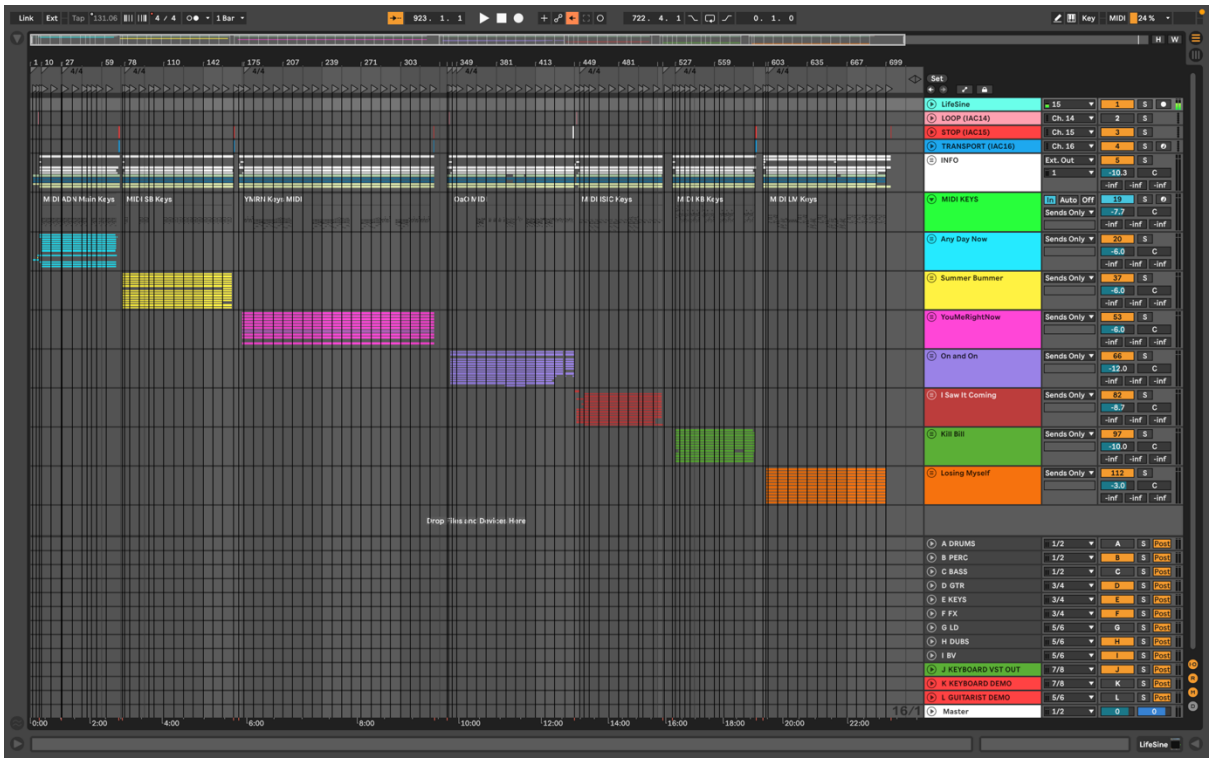

Figure 21. Main Live Set at concert

6.2.3 Playback Control

The drummer utilizes a Launchpad X MIDI controller to manage the Live Sets on the playback computers. The Custom mode on the Launchpad enables MIDI-mapping of all its 64 pads to various CC- and MIDI Note-values. This is used to control transport functions within the

Concert Live Set, including starting and stopping playback, navigating to specific sections of the Live Set, turning on and off loops as described in section **6.2.5.3**, and even deactivating individual stem tracks.

The decision to employ the Launchpad over traditional mouse and keyboard control stems from multiple considerations. Firstly, its physical interface allows for quicker and more precise actions, minimizing the potential for human error during performances. Moreover, it addresses a prevalent prejudice in pop culture regarding musicians' use of laptops onstage, a sentiment echoed even within DJ culture, where acceptance of pre-recorded elements is high.[94] The stereotype of performers appearing as though they are "checking their email" on stage underscores the need for exploring more visually engaging alternative.

Referring back to our discussion on visible technology in **Chapter 3**, it became clear that having technology visible on stage can make the technical aspects of the soundscape more apparent to the listener. In this case, the laptop often represents pre-recorded material, possibly due to its close ties to studio processes or even its common everyday use among the audience. In contrast to theories suggesting that the visible manipulation of instruments enhances performance authenticity by demonstrating agency, the presence of a laptop tends to have the opposite effect. It serves as a reminder to the audience that its primary function is to provide backing tracks, potentially leading them to perceive the backing tracks as more central, and thereby musicians as less central, to the performance than they actually are.

However, including the concept of visual-sensorial alignment to the discussion, suggests that the total absence of visible cues indicating the presence of backing tracks may also fall short. Building on Jensenius's theory, briefly mentioned earlier, about humans increasing visual-auditory relationship with electronic instruments over time, Knowles and Hewitt's insights on performance controllers further highlight the potential for integrating controllers such as the Launchpad into live performances: "the wave of new performance controllers provides the platform to make the virtuosity of manipulating these new digital tools visible to an audience while arresting any doubts about ‘liveness’ in performance".[95]

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[94] Ed Montano, "'How Do You Know He's Not Playing Pac-Man While He's Supposed to Be DJing?': Technology, Formats and the Digital Future of DJ Culture," *Popular Music* 29, no. 3 (2010): 411.
[95] Knowles and Hewitt, "Performance Recordivity," 7.

Incorporating the Launchpad into the live performance system enables us to control the technical aspects of the performance using a controller that is more closely associated with a sense of "agency," handling a laptop directly. This enhances transparency regarding the non-musician-created sounds, thereby reducing the sense of mystery surrounding backing tracks in a less obtrusive manner compared to the eye-catching presence of a laptop.

6.2.4 Choosing an Ableton Live View

As presented in **Chapter 5** *Essential Ableton Live functions*, Ableton Live offers two distinct viewing modes, each with its own unique workflow: Arrangement View and Session View. To cite Knowles and Hewitt: "Ableton Live, a software production tool which has separate interface pages optimized for studio arrangement and live performance respectively – although it is possible to use both pages in either context".[96] For this thesis I saw it as necessary to test both views for live performance. For this thesis, it was necessary to evaluate both views in a live performance setting. In doing so, I found that each mode presents its own set of strengths and weaknesses. As this section will demonstrate, the choice between them should be based on the type of live performance envisioned and which functions are critical to achieve that.

6.2.4.1 Session View

Session View was a groundbreaking feature when Ableton Live was first introduced, revolutionizing the linear approach to recording music that had been the standard since the onset of physical recording media. It draws from a tradition of cyclical composition and performance, especially prevalent in genres like Hip Hop and House, where musical ideas are looped, and progression is primarily driven by adding and removing elements. Session View allows performers to break songs into "scenes" that loop by default, enabling them to easily jump between different parts of a song by triggering the corresponding scene. It simplifies rearranging songs by moving entire scenes up or down in the setlist with the mouse.

Session View provides the flexibility to trigger individual clips from different scenes, enabling the activation, stopping, and combination of clips across scenes. For example, you can spontaneously switch drumbeats between scenes or add a percussion element mid-verse using

[96] Knowles and Hewitt, 7.

the mouse, keyboard, or a MIDI controller. In addition to using pre-recorded loops, Session View allows for real-time recording of audio or MIDI into empty slots. For these purposes, Session View is not just a great option; it is often the only choice available.

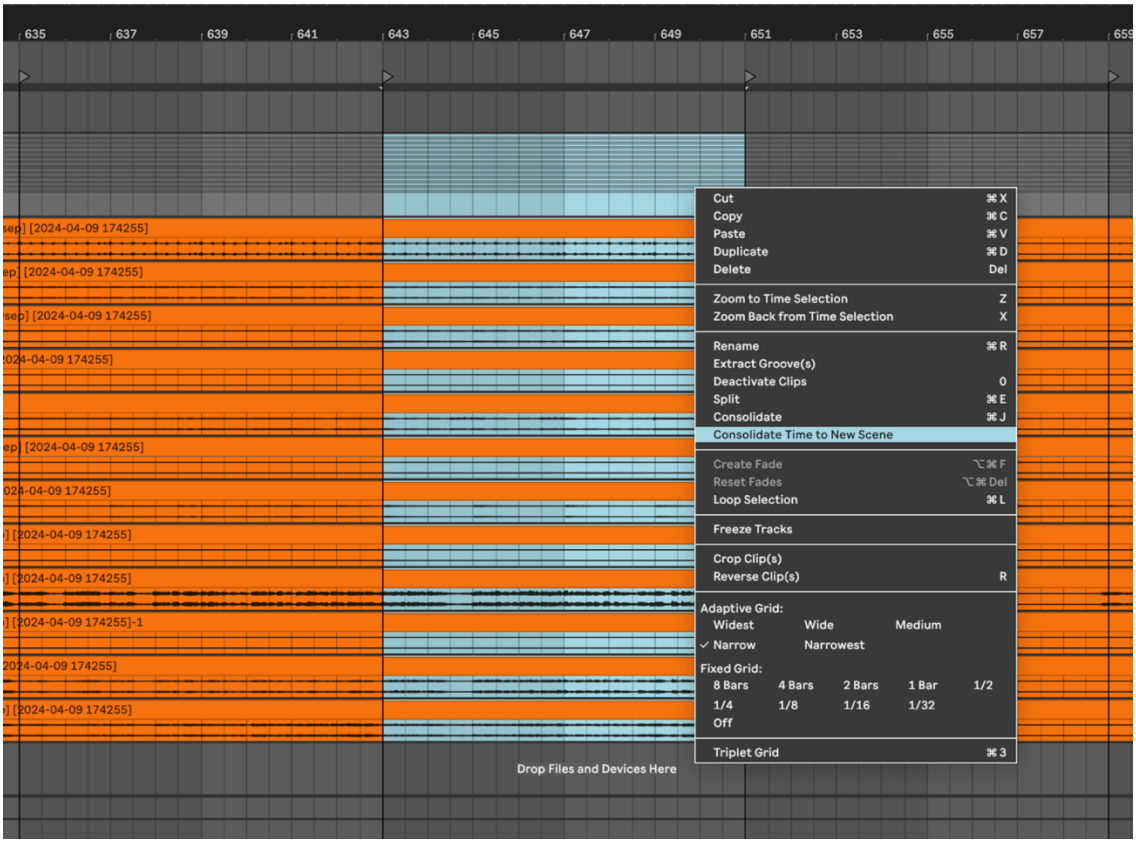

Figure 22. Exporting Song Section from Arrangement View to Session View

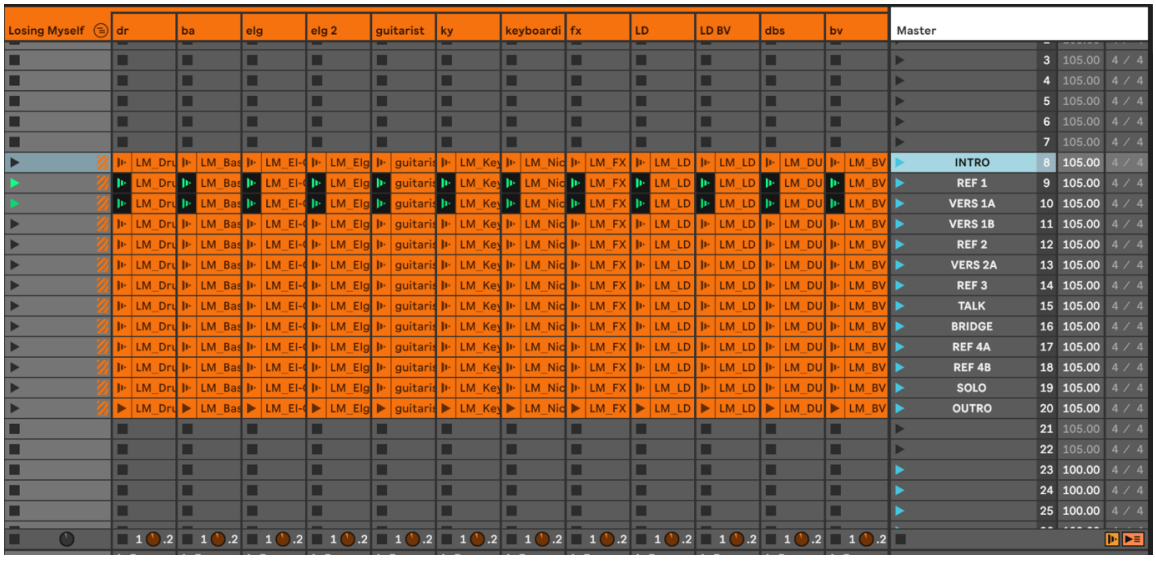

Figure 23. Song cut into sections to be triggered in Session View

The default setting in Session View loops each scene until another is triggered. If the song is to be played automatically from one section to the next, you must select all clips in Session View and enable “Follow Action” and choose “Next” so that each clip triggers the clip below after playing once.

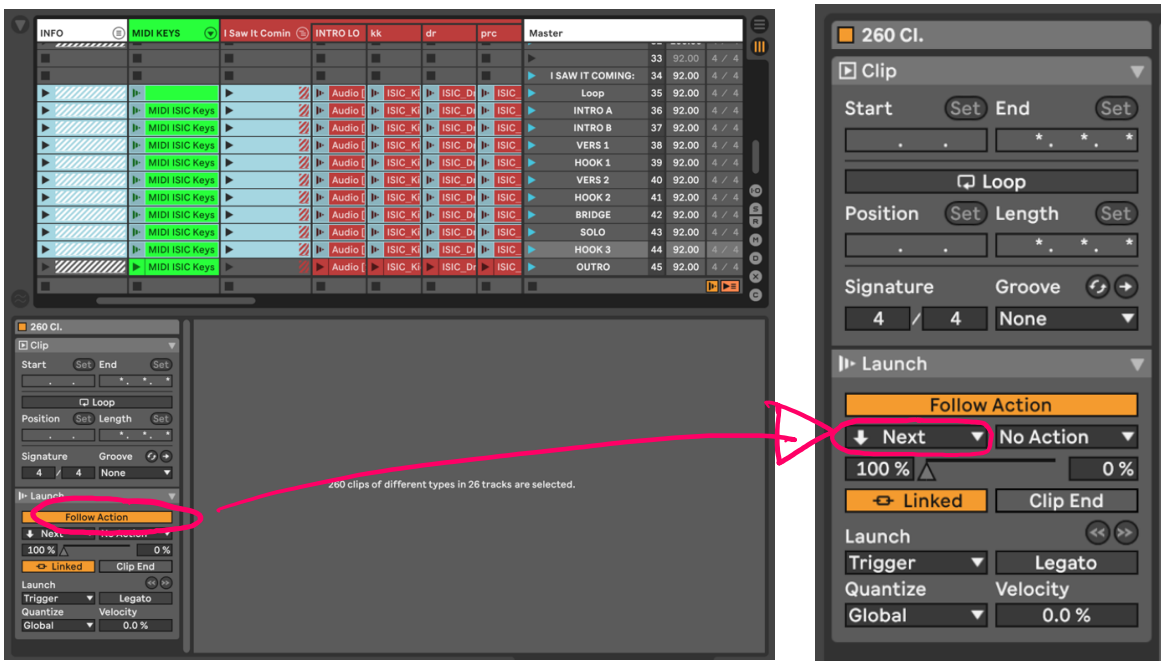

Figure 24. Enable ‘Follow Action: Next’ to connect song sections in Session View

However, we discovered that this way of connecting song sections in Session View only works if you have filled all slots in Session View with clips at the same length. **Figure 25** display a lonely Count-in clip in the 8th section/scene of the song, not being triggered like the other clips in the 8th scene, because there is no clip in the scene above.

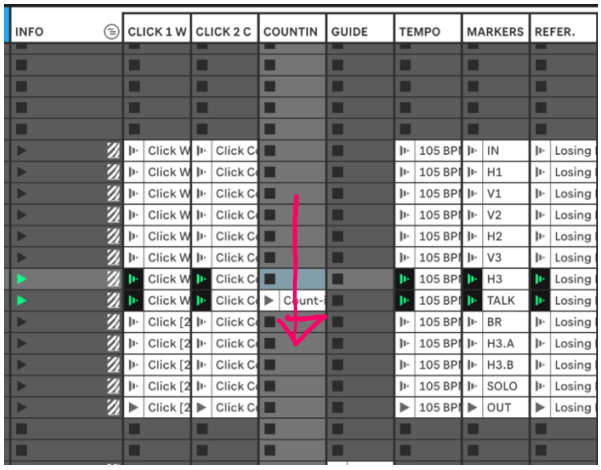

Figure 25. Clips not launching if preceding slot is empty.

The easiest way we found to combat this was to consolidate each track in Arrangement View, so that every active track in the song has an audio clip lasting the song length.

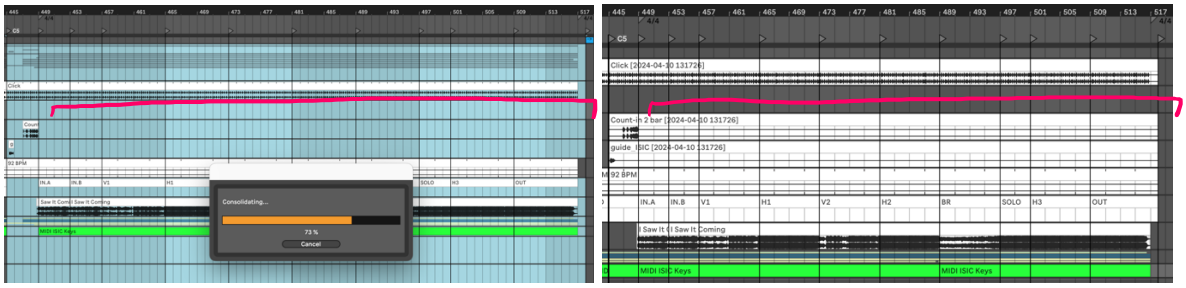

Figure 26: Consolidating all tracks to full song length.

Then, when exporting sections from Arrangement View to Session View, the slots that were empty before are now filled with clips. These clips do not contain any audio, but functions as dummy clips to make the sections follow each other, even sections without audio.

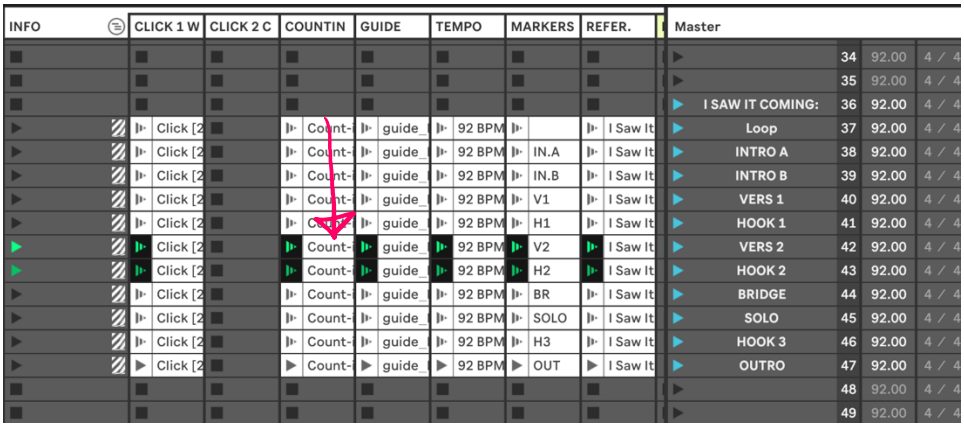

Figure 27. All slots in Session View filled to connect all sections on all active tracks.

Another drawback of this view is its difficulty in navigating within a song in detail. While the Session View enables easy jumping from, for instance, verse to chorus and back as needed, it also disables starting playback in the middle of a scene. Although one can start playing in the middle of an individual clip, that specific clip will then be out of sync with other clips in the same scene. This became particularly challenging during practice sessions when aiming to rehearse a part of a song by commencing playback a few beats or bars before that section begins.

Figure 28. Clips in Session View out of sync.

Furthermore, another challenge we faced in using the Session View was automating changes across clips. While it is relatively easy to automate effects or sound changes within a scene at the clip level, it becomes complicated when trying to do so across scenes. One particularly troublesome scenario for us was automating the switching of keyboard chains. We discovered that changing the patch exactly as the keyboardist plays can lead to noise from VSTs, hanging MIDI notes, and loss of MIDI notes due to natural human inaccuracy. Since it is usually more crucial for the keyboardist to play on the first beat of a measure rather than on the last eighth note, our solution was always intended: shift any sound change just before reaching this critical moment within a new part. In a linear view (like the Arrangement View) where you see an entire timeline of your song, making this adjustment is quick and provides a good overview of when sounds are changed.

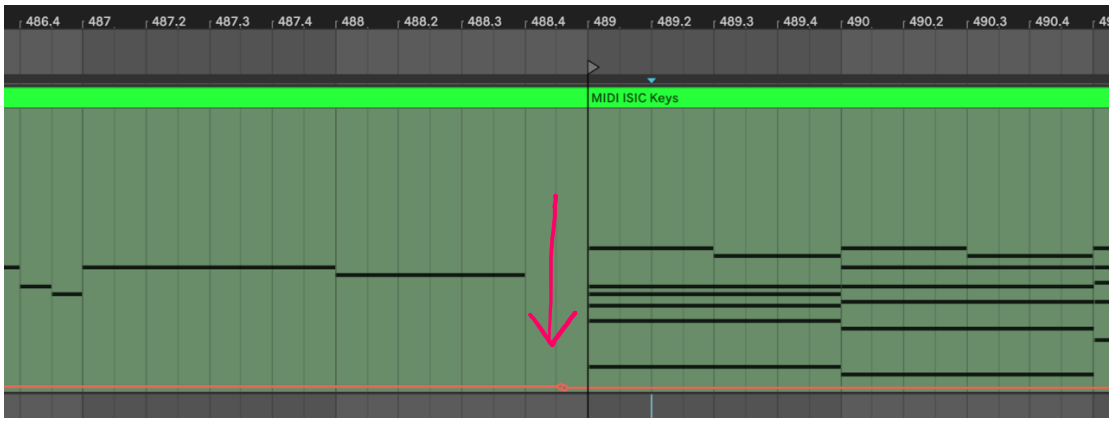

Figure 29. Automating Patch Switching in Arrangement View

In contrast, Session View requires significantly more effort and planning because you have to go into each preceding clip and add an automation switch right at its end. This process negates some of Session View's inherent flexibility mentioned earlier. To illustrate, imagine a song

with three different parts: A, B, and C, each with its intended keyboard patches. To avoid the issues of changing patches while playing, you would insert an automation at the end of part A that switches to the B patch, and similarly from B to C. However, if you want to leverage Session View's spontaneity and flexibility by transitioning directly from A to C, this means that the keyboard patch switches from A to B at the end of scene A and then immediately switches to the C patch when part C begins - yet still encountering the aforementioned problems. See **Figure 30** for illustration.

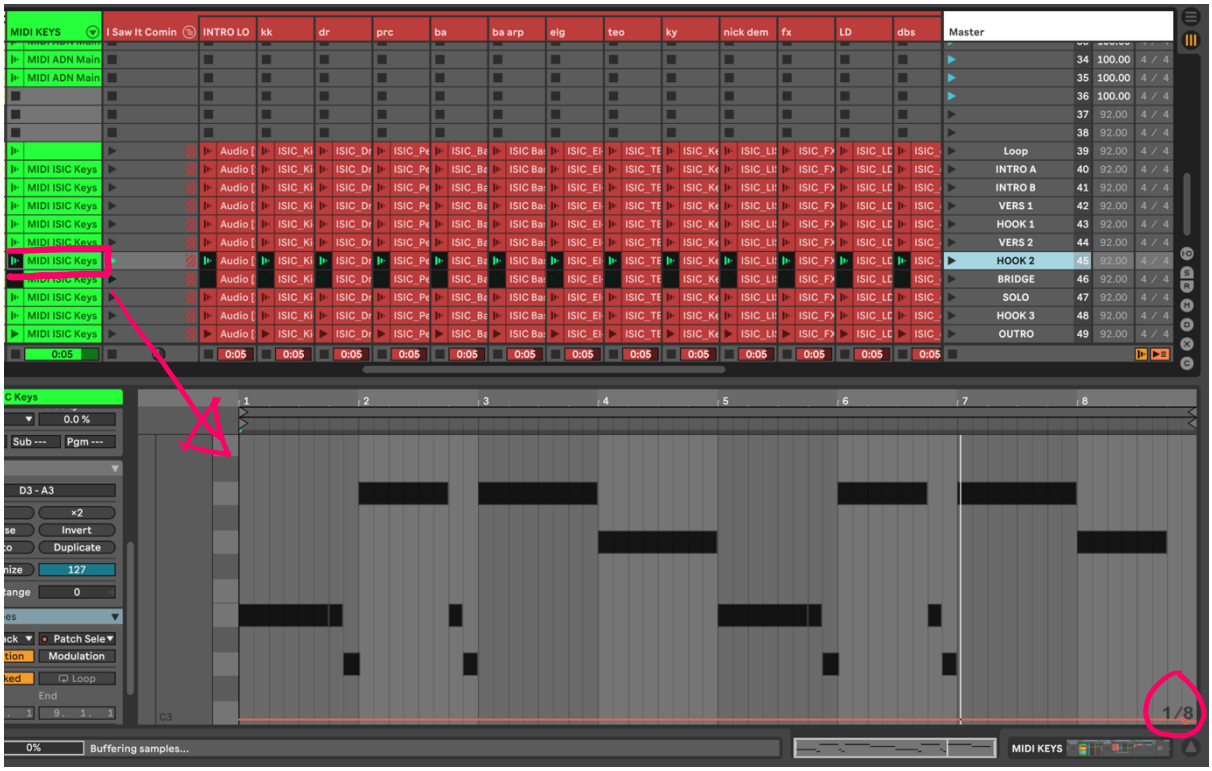

Figure 30. Automating Patch Switching in end of a Session View clip

6.2.4.2 Arrangement View

Arrangement View also has its own benefits and drawbacks. One advantage of Arrangement View is that you can see the entire arrangement of the songs linearly, as you are accustomed to seeing music when producing and mixing in a traditional DAW. You can navigate very precisely along the timeline of the song, start playback from anywhere, which is especially useful in practice contexts. By placing Locators for each part of the song, you can skip back and forth between Locators by mapping specific Locators to specific MIDI values (or keyboard keys). Working along a timeline enables precise placement of new musical elements, cues for

musicians, or writing automation exactly where needed, without the constraints of the fixed structure of scenes and clips in Session View.

From a producer's perspective, pre-composing segments of a concert performance becomes more manageable in Arrangement View. Creating smooth transitions from one song to another on directly on the timeline of the Concert Live Set simplifies the process, eliminating the need to export sections to conform to Session View's format. The efficiency gained facilitates implementing such customizations on-the-fly, even during rehearsals.

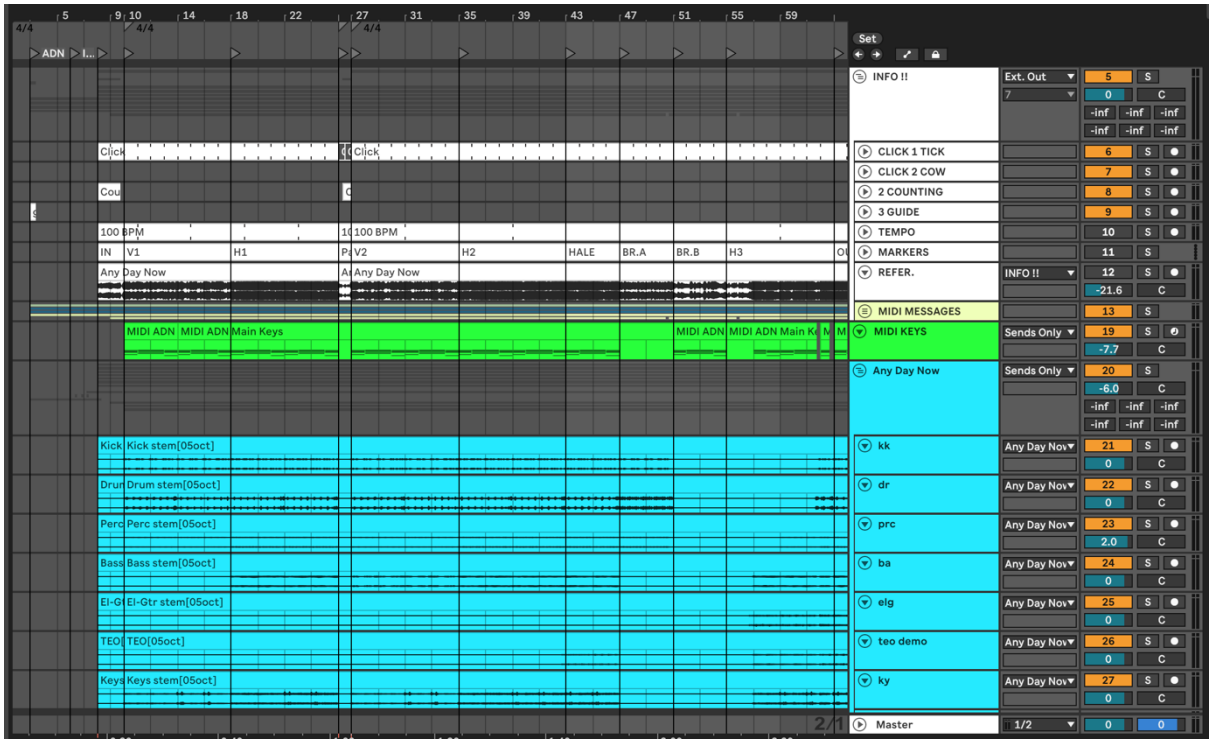

Figure 31. Arrangement View

While Arrangement View offers numerous benefits, it also comes with some limitations. Notably, it lacks some live performance features available in Session View, such as looping. Repeating sections can be challenging in Arrangement View, as there is no built-in function for seamless looping that avoids manual interaction with a mouse, keyboard, or screen, similar to what is required in setups like Gaaren's. Although loops can be pre-arranged before a performance (which will be discussed later), spontaneous looping during the show is not possible.

Another challenge arises when rearranging the order of songs in a Concert Live Set. Though very possible, it requires precision to ensure everything is managed as intended. Using Ableton Live's "Edit Time" feature, you can highlight a song's length in Arrangement View and use the "Cut Time" function to remove the song. Then, navigate to the desired location on the timeline and select "Paste Time" to insert the song back into place. It's important to note that when cutting and pasting time, Locators get lost and need to be reassigned (this is where having marker clips is beneficial). This process can be time-consuming and demands meticulous attention to avoid mistakes, making it less suited for quick adjustments to the song order during live performances.

Furthermore, Arrangement View lacks a built-in feature to automatically stop playback at the end of a song. Consequently, when songs are place back-to-back on the timeline, the next song will start playing as soon as the previous one finishes, unless it is manually stopped with the keyboard spacebar or mapped MIDI-controller. This can lead to problematic situations if neglected.

6.2.4.3 Comparing Views

To summarize the capabilities of both views, Session View provides the ability to record audio in real-time and offers significant flexibility in arranging the performed works mid-performance. This makes it exceptionally suited for improvisational and loop-based music. Managing and reordering songs is straightforward, and looping sections is a default feature. With some adjustments, it has been demonstrated that this view can also be used to play songs from start to finish automatically. However, it presents challenges with navigation and initiating playback between fixed grid points, as well as the unnecessary complexity in automating parameters across scenes, including switching patches. In contrast, Arrangement View offers a linear overview that facilitates detailed navigation within the Concert Live Set and individual songs. It simplifies the creation of detailed, finely-timed automation and allows for quick production of sections and elements directly on the timeline. Nonetheless, the main drawbacks of Arrangement View include the lack of essential live performance functions such as looping, rearranging songs and song sections, and the limitation of adjusting playback to only one song at a time.

The choice between Session View and Arrangement View in Ableton Live largely depends on the specific requirements of the the overall artistic ideal for the live performance. Ultimately, the decision should align with the music genre, the inherent style of performance, ensuring that the chosen view enhances the live experience and meets audience expectations. For example, as discussed in section **3.3 GAAREN'S GENRE AND PERFORMING STYLE**, certain inherent live performances based on improvisation and audience benefit more from. Acts like these would benefit from the flexibility and real-time capabilities of Session View. Conversely, genres that depend on precise timing and structured performances may find Arrangement View more appropriate, as it provides a linear, detailed overview that facilitates meticulous planning and execution. To recap, this section established that Gaaren's performance style is both song-based and participation-based. This approach involves presenting songs in their original arrangement to facilitate audience participation. By maintaining familiar structures, we enable the audience to recognize songs easily, anticipate high-energy moments like choruses, and engage more fully, whether through dancing or singing along. Concurrently, an essential aspect of designing live performances was to tailor the technical setup in advance, allowing musicians on stage to focus entirely on playing their instruments and interacting with the audience.

Given these considerations, Arrangement View in Ableton Live proved to be the most suitable option for us. Its timeline-based editing facilitates the precise placement of elements and detailed automation control, aligning seamlessly with our need for a meticulously planned, fixed arrangement. Additionally, we do not need the capability to rearrange song sections or base our performances on live looping—capabilities that are highlighted as the main strengths of Session View—to achieve the goals we set for our live performances. Another convincing argument for choosing Arrangement View is how much more user-friendly it makes the rehearsal process compared to Session View. It allows for precise adjustments of playback start points and simplifies making quick changes in arrangement and soundscape. Ultimately, the time dedicated to practicing and preparing for a live concert far exceeds the time actually spent performing. Thus, enhancing the efficiency of practice and preparation sessions carries significant weight, more than one might initially consider.

Following the decision to utilize Arrangement View, it became necessary to revisit and address its limitations to align with our specific live performance goals even further. The following

section explores practical workarounds that mitigate these challenges, enhancing its functionality our live performances.

6.2.5 Improving Arrangement View for Live Performance

6.2.5.1 Automating Stop Playback in Arrangement View

The most essential flaw to find a workaround for, is that Arrangement View has no built-in way to stop playback when a song is finished. Doggett suggests a workaround for this, utilizing the Mac's IAC Driver (the virtual MIDI interface that was used in section).[97] In the section **6.1.2.5.2** on automating guitar patches using MIDI clips, we demonstrated sending MIDI messages from one Mac to another instance of Ableton Live running on a separate computer. However, the IAC Driver technology can also be used to send MIDI out of an Ableton Live session and back into the same session on the same computer. In practice, this allows you to use MIDI clips inside Ableton Live to trigger functions that are mappable within that same Live Set. To automate stop playback in Arrangement View, you can utilize this concept by creating a track called "Stop Track" and making a MIDI clip containing a MIDI note (e.g., D#1) which can be mapped to the main Stop playback function. This allows you to trigger the "stop playback function" anywhere you place this "Stop Clip.". Note: If a MIDI-controller is mapped to control the stop button from before, it's crucial MIDI-clip use the exact same MIDI-note as the MIDI-controller button, or else one will overwrite the mapping of the other.

[97] *Ableton Live Hacks: Automatically Stop After Every Song*, 2022, https://www.youtube.com/watch?v=YSMozlFBiao.

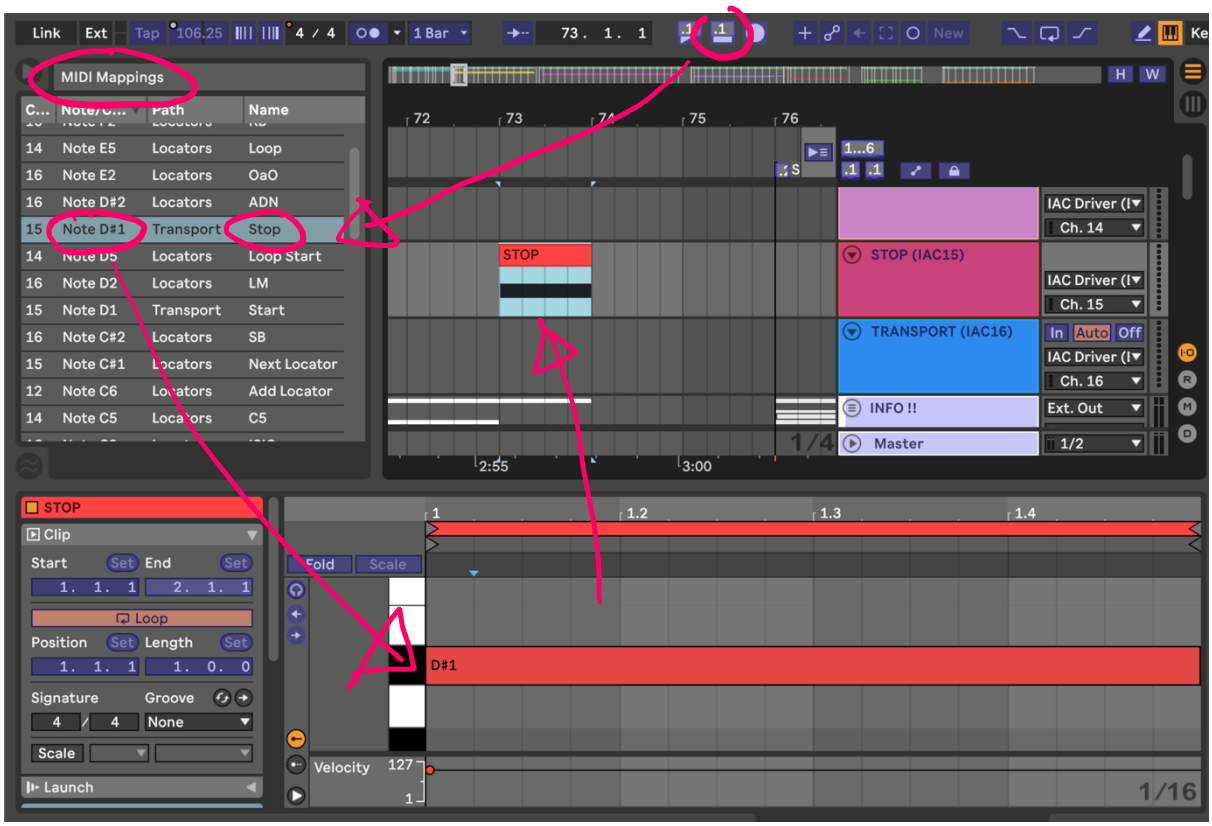

Figure 32. Automating Stop Playback in Arrangement View

6.2.5.2 Changing Order of Songs

Another scenario where Arrangement View is not as versatile as Session View is when you need to change the order of songs in your setlist. This can be worked around for this, utilizing Locators and Transport Clips. In this method, you place a Locator at the beginning of each song in the Arrangement View and assign a MIDI note to each one - for instance, use C2 for Song A, C#2 for Song B, D2 for Song C, and so forth. You can then create a separate track titled "Transport Track" and insert a MIDI clip with the corresponding note (e.g., C2 for Song A). This clip will trigger the next song in the setlist when played. Once your setlist order has been determined, you proceed placing transport clips so that they activate after each preceding song accordingly, ultimately allowing you to play back songs in your desired sequence instead of following the linear arrangement order. If you want the playhead to move to the next song without starting it, simply use the transport clip in combination with the stop clip. This transport function can also be used to make pre-planned loop in the arrangement, as described in the next section.

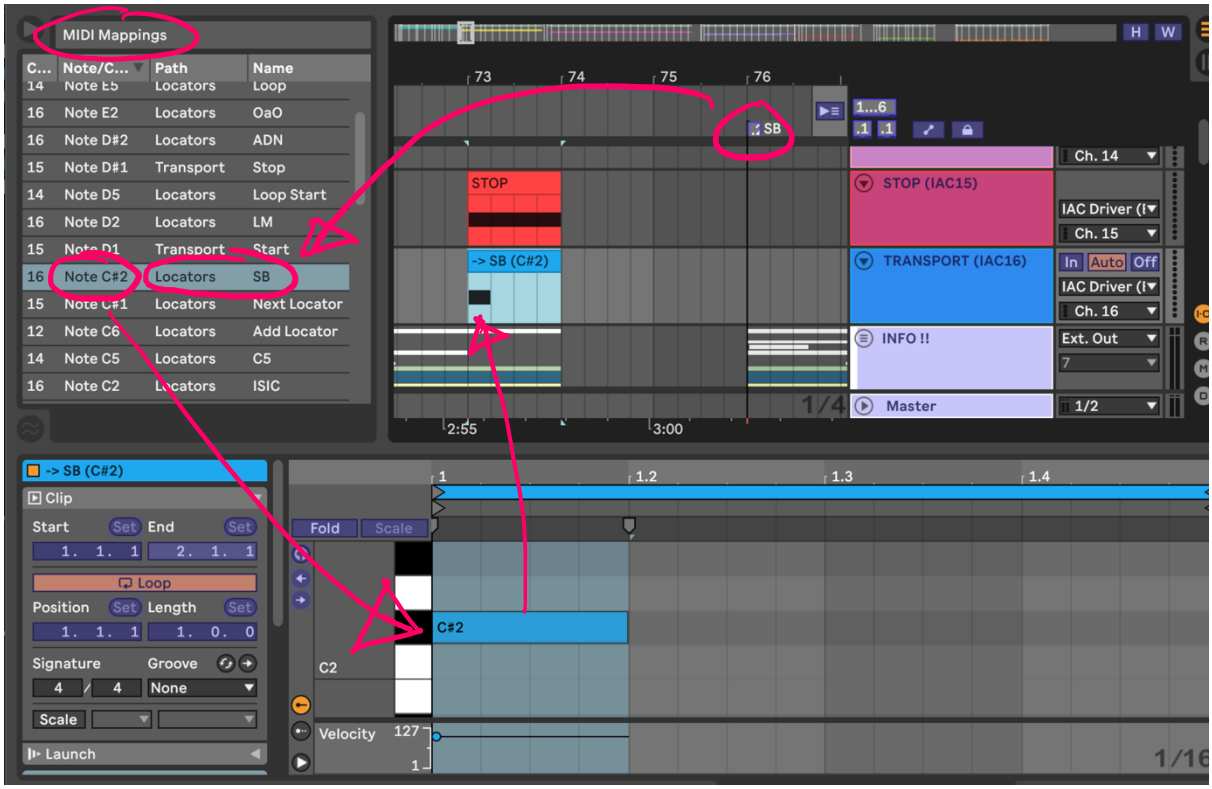

Figure 33. Transport Clips with note values mapped to first Locator of next song.

6.2.5.3 Looping Sections in Arrangement View

Even though Gaaren's Live Performances is not primarily based on live looping, the ability to loop some sections may be desirable. Arrangement View lacks built-in functions for creating loops. Fortunately, Jake Gosselin, creator of Worship based YouTube-channel *Churchfront* presents a workaround for this, again using the IAC-driver.[98] When setting up a section for looping, first an empty MIDI Track in the Concert Live Set is created and named "Loop Track." Next, a Locator is set at the start of the section to be looped and labeled "Loop Start." At the end of this section, a MIDI clip with a specified MIDI note (e.g., D#4) is inserted. As with the Transport function, the MIDI note is mapped to a Locator, but this time to the "Loop Start" Locator. As a result, each time the cursor reaches the end of the section and triggers the MIDI note, it will jump back to the loop start point—effectively creating a loop. Due to potential delays when using MIDI messages, one should avoid placing the MIDI note exactly at the loop end. Instead, place it one or two beats before and adjust Ableton Live's Global Launch Quantization to 1 whole bar. This ensures that the loop jumps occur precisely on the first beat

[98] *ABLETON LIVE WORSHIP TUTORIAL: How to Create a Looping Pad and Click in Arrangement View*, 2018, https://www.youtube.com/watch?v=vd6cto4mtjc.

of the next bar, resulting in a perfect loop. When the Loop Track is muted, the playhead will pass the MIDI note without triggering the transport back to the loop point, allowing the playhead to leave the loop seamlessly. In our setup, a specific pad on the Launchpad X is mapped to mute/unmute the loop track, providing quick and easy control over the looping functionality during live performance. This allows for planning looping sections in preparation for a live show. It is an effective solution for looping an intro, chorus, or something similar. Please note that this workaround is designed specifically for creating pre-prepared loops. I am yet to find an efficient way to create spontaneous loops in Arrangement View.

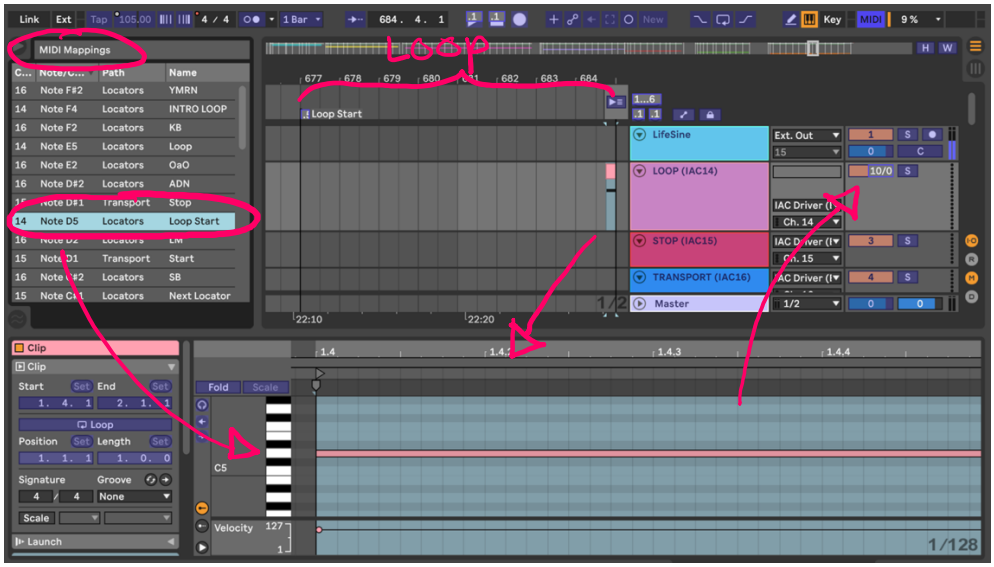

Figure 34: Pre-planned Loop setup in Arrangement View

6.3 REDUNDANCY

This thesis has so far dealt with the complexity required to create a Live Performance System that only preserves the song's sonic DNA without compromising perceived authenticity and liveness. The same complexity has inevitably led to a reliance on the flawless functioning of its technological aspects of the system. To mitigate any risks associated with technological failures and ensure that performances consistently meet expectations, I saw it as vital to implement robust redundancy measures. This section will thoroughly detail these safeguards and backup solutions, examining the measures in place for central technology like keyboards, guitars, and backing tracks. It will demonstrate how these redundancies protect against potential technical failures, aiming to maintain continuous, fault-free performances.

6.3.1 Keyboard Redundancy

If the keyboardist becomes ill or unable to participate in the concert for any reason, or if we encounter any technical challenges, we have ensured redundancy measures for the keyboardist. This includes two solutions: automated MIDI playback, and use of pre-recorded DEMO-stems as replacement. The first solution involves setting up Ableton Live to automatically play the keyboard part by changing the MIDI track from "IN" (monitoring on) to "Off", allowing Ableton Live to read a backup MIDI Clip positioned on the track that plays what the Keyboard is supposed to play. A MIDI pad on the Launchpad is then programmed to toggle between monitoring “IN” and “Off”.

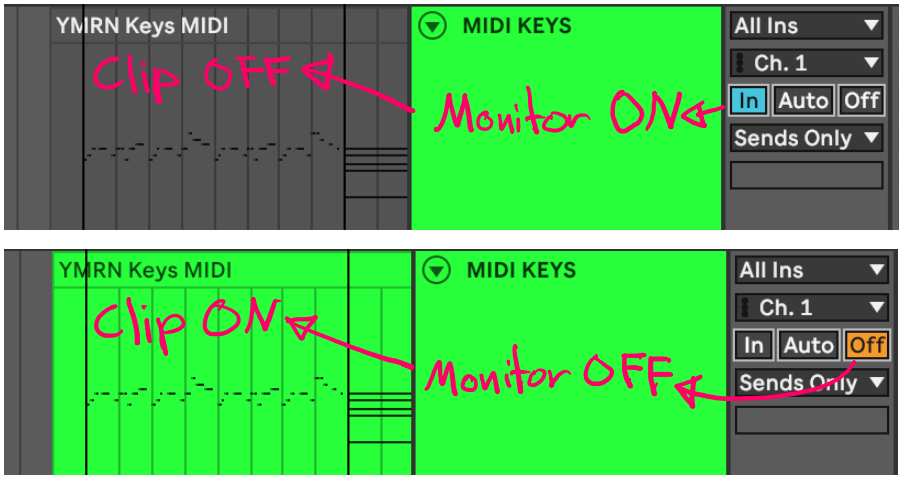

Figure 35. Keyboard Redundancy with MIDI Backup

The second solution entails utilizing the keyboardist DEMO track, described in section **6.2.2.1.** In the same way as other stems, each keyboardist DEMO track from every song is routed to a common the return track, called “KEYBOARD DEMO”. Another MIDI pad on the Launchpad is then programmed to toggle between activating the Keyboard Instrument Track (labeled MIDI KEYS in **Figure 36**) and the audio backup Return Track “KEYBOARD DEMO.” Additionally, two buttons on the MIDI keyboard are configured with the same MIDI messages as on the Launchpad, allowing both the drummer and the keyboardist to switch to the backup solutions seamlessly if technical issues are encountered.

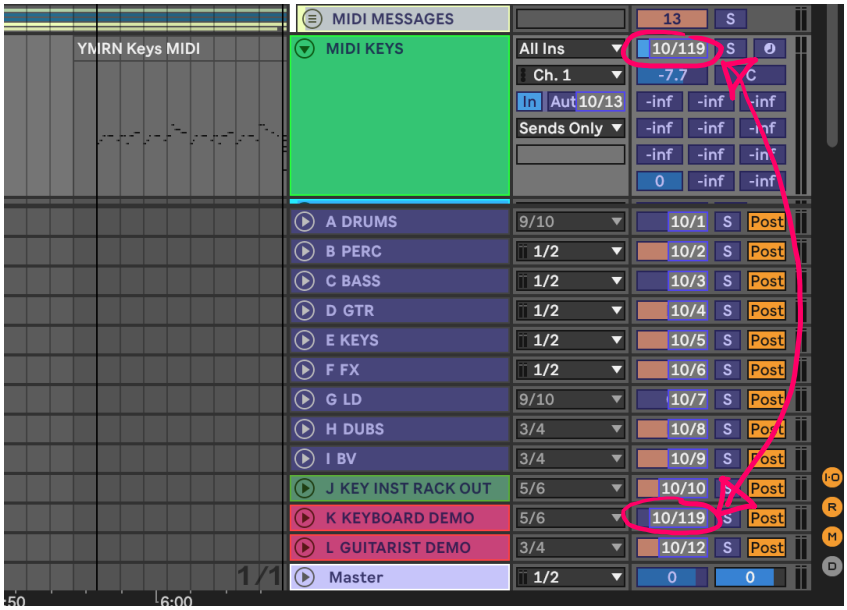

Figure 36. Keyboard Redundancy with Audio Backup. Here both the MIDI Keys Instrument Track and the Keyboard DEMO Return Track are mapped to CC 119, MIDI channel 10. When one toggles ON, the other toggles OFF.

6.3.2 Guitar Redundancy

Building on the redundancy measures discussed for the keyboard, similar safeguards were implemented for the guitar setup, which is highly automated. As covered in section **6.1.2.5**, both the guitar processing in Ableton Live and the external Helix hardware are configured to receive MIDI messages from the main computer for automatic patch changes. However, should these processors for some reason stop receiving messages, having backup solutions to manually change these patches is critical. This redundancy was achieved using physical foot pedals for manual patch changes. In the Ableton Live Setup, a MIDI controller with assignable footswitches was utilized to allow manual patch changes. Doing this, it is essential to configure these footswitches to transmit the exact same CC values as the MIDI Message Tracks, enabling the patch changing macros to be mapped to both sources simultaneously. The Line 6 Helix Floor hardware includes physical pedals as the standard method for changing patches, and therefore required no additional configuration for manual switching patches.

Figure 37. Behringer FCB1000 MIDI Foot Controller

If a guitar processor fails during a concert due to hardware or software issues, a backup system similar to the Keyboard audio backup solution is in place: Each song's backing tracks include a stem of the guitar parts on the records that the guitarist plays live, referred to as "Guitarist DEMO" tracks. These tracks are routed to a "Guitarist DEMO Return" track, which is muted by default. In the event a guitar processing malfunction, a MIDI map on the Launchpad can be pressed to activate the "Guitarist DEMO" Return track, allowing the performance to continue seamlessly with the backup guitar audio. These redundancy measures for both the guitarist and keyboardist ensure that, despite any unforeseen circumstances, their musical contributions remain intact through automated playback.

6.3.3 Backing Track Redundancy

The whole live performance system heavily relies on a single Ableton Live Set that integrates click tracks, backing tracks, and the Keyboard Instrument Rack. The failure of this session during a performance could be disastrous, emphasizing the critical need for robust safety measures, specifically redundancy. The most straightforward solution I developed to recover from a potential playback computer crash was to have a backup computer running in parallel, ready to take over playback as unnoticeably as possible in the event of a failure. This setup necessitates two identical Live Sets on two computers, each with the same tracks, VSTs, and MIDI configurations. Since the keyboard VSTs are run in the same session as the backing tracks, it was essential to mirror the instruments and effects on both Macs, ensuring they both had the necessary instruments and effects installed along with the corresponding licenses. Ideally, the keyboard would have operated independently on a third computer, separate from the backing tracks. However, this was impractical due to licensing limitations. After configuring two identical Live Sets on both computers, the next step in our redundancy setup is to synchronize the start and stop of playback to ensure both systems remain in sync at all

times. Initially, I tried using MIDI Clock Sync, but this method failed when the master computer crashed, causing the slave to stop as well. Moving away from this, I switched to a different approach; using a MIDI controller that sends transport commands—such as start, stop, and song selection—simultaneously to both computers, through a common MIDI interface. Connecting the Launchpad and MIDI keyboard to the MIDI-Interface enables us to send the same transport commands and MIDI notes to both Macs, maintaining synchronization between the main and backup computer. Consequently, MIDI messages from the main Live Set are transmitted through the common interface to receiving devices, such as the Mac running the Guitar Live Set or the Helix hardware. By ensuring both computers receive the same MIDI signals (play, stop, moving playback start position), we maintain consistent synchronization. The next steps include managing the audio output from the Macs and developing a method to switch between sources seamlessly as needed. The following sections will explore various alternatives for accomplishing this.

6.3.3.1 Alternative 1: Two Separate Audio Interfaces

One accessible method for outputting tracks from the Live Set is to use two separate audio interfaces, synchronizing playback across two computers. Many musicians, including the ones in our band, already possess an audio interface. This approach involves each computer sending duplicate analog signals through its respective external audio interface to the mixer, usually positioned at the front of house. To streamline this setup, I recommend using as few physical outputs as possible, as all cabling, routing, and patch space requirements are effectively doubled. At the live mixer, tracks can be organized by computer origin, enabling the live technician to manually switch between which computers to use as source for the backing tracks and info tracks. Relying on this approach assumes you have a dependable technician who is well-versed with your show's sound, and thereby quickly detect and address any discrepancies or disruptions in playback.

6.3.3.2 Alternative 2: Audio Interface with Dual USB Input and MIDI Interface

Another alternative for establishing playback redundancy is using an audio interface equipped with dual USB connections, allowing simultaneous connection of two computers. Opting for this solution generally involves a higher initial investment. We chose to invest in iConnectivity’s PlayAudio12, an audio interface featuring dual USB-C connections and 12

XLR outputs. Additionally, it includes a built-in MIDI interface, eliminating the need for an external MIDI interface to synchronize MIDI signals between the two computers, as was necessary with the setup described in section **6.3.3.1**. Furthermore, the PlayAudio12 includes an automatic failover function that continuously monitors a sine wave sent to a designated channel from the main computer. Should this sine wave disappear for a specified duration, the interface automatically activates the backup computer. This feature ensures continuity of the performance without noticeable interruptions, even in the event of a system failure.

Figure 38. iConnectivity PlayAudio1 Audio Interface with Dual USB Connection

6.3.3.3 Alternative 3: Redundancy with an Ethernet Based Playback System

This section introduces a third alternative for implementing redundancy in live performances, specifically focusing on audio over Ethernet using Dante Networking Technology. Although this method was not practically tested during the development of my thesis due to limitations in available equipment and expertise, its theoretical application demonstrates significant potential for robust live performance setups.

Dante allows audio signals to be routed across a standard Ethernet network. If a venue is equipped with a Dante-integrated audio system, playback computers can be connected to the Dante network using Cat-5/6 Ethernet cables through the Dante Virtual Soundcard (DVS). This facilitates audio output routing directly to the front-of-house mixing console, mirroring the manual redundancy setup described in section 8.3.1 but with reduced cabling requirements. Moreover, the Ethernet connections enable the creation of a Local Area Network (LAN) hub on stage, which can connect to a common MIDI interface if it supports MIDI over Ethernet using the RTP protocol. This setup not only streamlines physical connections but also enhances the system's flexibility by allowing the interconnection of various performance elements such as backing track computers, guitar processors, and keyboards into a unified network.

However, while Dante features an automatic failover function known as Dante Redundancy, it is unfortunately not compatible with the use of Dante Virtual Soundcard and cannot be implemented in the system I have described. It's clear that this aspect of the technology requires further investigation to fully understand its limitations and potential applications.[99]

Acknowledging that this discussion extends somewhat beyond my experience, I have included it to outline the practical and cost-effective possibilities it offers. As more venues integrate Dante into their sound systems, bands and artists can increasingly rely on existing infrastructure to run Dante audio, reducing the need to bring their own Dante-compatible devices. This trend enhances the feasibility of using Dante and other Ethernet-based audio solutions for live performance audio management. Given these considerations, further investigation and practical testing are essential to fully understand and effectively implement Dante technology as well as other Ethernet-based audio solutions.

[99] *08 Getting Started with Dante Dante Redundancy - YouTube* (YouTube), accessed May 13, 2024, https://www.youtube.com/watch?v=DN8McoHcY5c.

7 Evaluation, Reflection and Conclusion

7.1 EVALUATION OF SYSTEM

How did Gaaren's live performance system meet with the main goals set in **Chapter 4**?

7.1.1 Evaluation of Goal 1: Preserving sonic DNA

The first goal of our live performance system was to faithfully reproduce the sonic characteristics/DNA of our studio recordings on stage, ensuring our full artistic expression remained intact during live performances. This was achieved by carefully integrating pre-recorded tracks with live instrumentation.

For the instruments keyboard and guitar, our setup with Instrument Rack and Audio Effect Rack enabled the musicians to integrate the exact software instruments and processing used in the studio recordings. Compared to having these on backing tracks, this approach transformed what would have been static playback into dynamic elements that the musicians could play with the same expressiveness as physical instruments. It also surpasses just using similar sounding instruments because rather than mimicking the recordings, it allowed musicians to evoke the same sonic landscape using the original the studio technology and sounds.

The drums, on the other hand, were completely replaced with live acoustic drums, marking a departure from the studio recordings' sonic DNA. This decision, which we will discuss in the next section, was made intentionally to enhance the live experience. Moreover, many of our recordings used sampled acoustic drums, which meant that the sound of the live-played drums did not significantly deviate from the audience's expectations based on the recordings. Additionally, given the strong visual-auditory connection humans have with acoustic instruments, the drum sounds on the records would not necessarily translate well if played back from tracks or even re-triggered live. To better translate the songs in our catalog that feature more electronic-sounding drums, a potential improvement to our setup could have been processing the drums using Ableton Live. As described in Knowles and Hewitt's article "Drummer Christian Eigner used Ableton Live to process drum microphones from his acoustic kit during performances, applying equalization, compression, distortion, delay, and modulation

effects to emulate the drum sounds from the recorded versions of the songs in the set"[100]. Using a similar approach could have enhanced the fidelity to our recorded songs' sonic DNA. However, it would have required a higher CPU load, which our main computer—already handling the keyboard instrument and backing tracks—might not would have managed. Moreover, integrating this with our redundant setup, involving dual computers running backing tracks, would have been practically impossible (without starting to split analog audio signals). Adding a separate computer just for drums could have allowed us to either process the incoming audio signal or use the audio signal to trigger samples. Unfortunately, due to equipment and budget constraints, this was not feasible.

The vocals are performed live by the same vocalist as in the recording, naturally checking the boxes of both preserving sonic DNA and live authenticity. Background vocals, which play significant roles in several of our recordings, were included on the backing tracks, however, their volume level was carefully adjusted to ensure they did not overshadow the live vocals, maintaining a balance that respected the presence of the lead vocals while still enriching the overall sound texture.

The live bassist enabled us to authentically reproduce the sonic texture of the prominent electric bass lines in our studio recordings. Had there been more distinct synth bass parts in any of the songs, we might have considered incorporating a compact synthesizer on stage for the bassist to use on those specific tracks.

7.1.2 Evaluation of Goal 2: Authentic Performance Despite the Use of Playback

When considering starting using backing tracks in our live performances, an initial fear in our trio was that the audience would experience the concert as less ‘live’. In this thesis I therefore aimed to discover ways to achieve "liveness" and authenticity in our performances, beyond our physical and visible presence on stage.

As described by Danielsen and Helseth there must be harmony between what is heard and what is seen on stage, known as visual-auditory alignment. The key to achieving this is not necessarily to reproduce every sound from the recording live on stage, but rather that the "core

[100] Knowles and Hewitt, “Performance Recordivity,” 13.

sounds"—the most critical sounds in the soundscape—are properly represented visually, preferably by musicians. Selecting which musicians necessary to cover these "core sounds" thus became the primary step to achieve visual-auditory alignment.
Additionally, in line with theories from researchers like Jensenius, different instruments impact authenticity differently, choosing musicians involved more than just covering the "core sounds", it also involved enhancing the authenticity of the performance by incorporating instruments with the highest possible degree of authenticity. I termed these “core musicians”.
In relation to Brøvig-Hanssen's distinction between transparent and opaque mediation, it was crucial for us that "core sounds" were not placed on backing tracks, as this would make the playback technology more “opaque”, thus diminishing authenticity, according to Helseth's assertion to keeping technology transparent to maintain an authentic performance.

As detailed in section **6.1.2.4** and **6.1.2.5**, extensive automation was implemented within the technological system to reduce the need for musicians to perform tasks unrelated to playing their instruments on stage. This focus was driven by the goal of directing the audience's attention toward the "traditional" instruments, which, as discussed in the **Concepts** chapter, have the greatest impact on authenticating the performance as live. By automating many of the technical operations, such as activating buttons and pedals, the visible technology on stage was minimized. This shift not only redirected the audience's focus away from the technological aspects but also allowed the musicians to concentrate fully on their performance, thereby enhancing the overall authenticity and engagement of the live show.

Regarding authenticity, my biggest critique to our performance is that there can be heard backing vocals emitting from the backing tracks without there a backing vocalist present on stage. As highlighted in the section **3.2.6**, the human voice is recognized as the most sensitive element for causing logical sensorial ruptures due to its physical attributions. Therefore, the absence of a visible counterpart for the backing vocals may draw attention to the backing track technology, potentially diminishing the perceived authenticity of the live performance.

7.1.3 Evaluation of Goal 3: Flexible, User-Friendly and Robust System

To enhance the flexibility of our system, Will Doggett's “3-part framework”, was adopted. This framework uses universal formatting for individual Song Live Sets and Concert Live Sets, simplifying integration and the preparing of the Live Sets for concerts.

To find the best the most effective way to automate patch changes for guitars and keyboards, several methods were tested. MIDI Message clip automation was found to be the most effective, especially ones it was set up.

In my quest to find which of Ableton Live's two work views that fitted our desired performance style the best, both Arrangement View and Session View was tested, mapping out the advantages and disadvantages of each. For our needs, which prioritize efficient editing and playback during the preparation and practice phases over arranging and improvising with instruments during the performance, Arrangement View emerged as the superior choice. Despite lacking some essential functions for live concert play, we discovered several workarounds to mitigate its limitations.

To enhance the robustness of our system, several redundancy measures were implemented. For the keyboard, two backup methods were introduced: the first utilizes a backup MIDI clip that automatically feeds MIDI notes into the Keyboard Instrument Rack in case of issues with the keyboardist or MIDI keyboard. In case of a problem with the software instrument generating the keyboard sounds, a second backup solution is available. This involves pre-recorded keyboard stems that can be manually triggered via MIDI-mapped buttons, accessible from both the MIDI keyboard and the drummer's Launchpad. A similar audio backup solution was implemented for the guitar. Additionally, a backup system was set up to switch guitar patches using physical pedals in case the guitar processor lost connection with the main computer sending patch change messages. Since the keyboard patches were run in the same Concert Live, we deemed it unnecessary to implement a manual method to switch patches. This decision was based on the understanding that if the Live Set crashed, the keyboard Instrument Rack would crash with it anyway.

To achieve playback redundancy, several methods for synchronizing two computers were explored. Each effective method incorporated using a MIDI controller synced to manage Ableton Sessions on two separate computers, facilitating commands to start, stop, and designate playback initiation points. The first method involved using two separate audio interfaces connected by a common MIDI interface. The second method used a shared audio and MIDI interface allowing both computers to connect simultaneously. Although more costly,

this setup enables automatic failover, reducing the need for a permanent sound engineer who can identify and manually correct playback issues. This approach could potentially be more cost-effective over time. The third option discussed was using Dante Networking Technology for playback redundancy. While this method was not tested during our project, it is included in this thesis as it offers unique advantages in terms of physical practicalities and could serve as a low-cost alternative, particularly in venues already equipped with Dante systems.

7.2 ADDITIONAL REFLECTIONS

Incorporating a playback system into live performances can have several downsides besides the authenticity issue. As noted in Kjus and Danielsen's article "Ironically, these artists' efforts to preserve the danceability of their pre-produced music sometimes hurt their ability to adjust the performance to the festivity of the audience, for example by doing 'one more chorus', because the timeline of the live performance is fixed".[101] This was also a limitation we experienced in our own performances. The biggest weakness of our current live performance system, is that the drummer, occupied with two drumsticks, has the Launchpad as his only option to control Concert Live Set. This practically inhibited his ability to control the playback while drumming himself. In comparison, incorporating Drum Pads to trigger MIDI messages to Ableton Live would allow the drummer to control functions as start/stop playback, loop track on/off, and jumping to different locators within the Live Set. just with a hit of a drumstick. This type of device was not integrated to the system due to budget limitations but would be a great way to increase the flexibility of the performance, allowing for some spontaneous decisions like "doing one more chorus".

Kjus and Danielsen also highlights an interesting paradox. On the one hand, advancements in technology have minimized the need for a large number of musicians in the recording process. Yet, when it comes to live performances, there's a contrasting trend of increasing the number of musicians onstage. This suggests that while technology has streamlined the recording process, live performances demand a richer, more complex array of performers to deliver an energetic and visually engaging experience.[102] In this context, my concept of "core musicians" becomes especially relevant. It provides a strategic framework for bands to optimize their live

[101] Kjus and Danielsen, "Live Mediation," 14.
[102] Kjus and Danielsen, 15.

performance setups without compromising the quality of their musical delivery. By carefully selecting which instruments and performers deliver the most value—both in terms of sound and visual presence—bands can navigate the paradox described by Kjus and Danielsen more effectively.

7.3 REQUESTS FOR FURTHER RESEARCH

Given the constraints of this master's thesis, certain topics were either explored superficially or left untouched. Encouraging further investigation into these areas could yield valuable insights for future scholarly inquiry.

As previously discussed in sectio n **6.3.3.3**, the realm of audio and MIDI over IP presents promising opportunities for playback systems and live performance setups. This technology streamlines signal transmission by consolidating multiple channels into fewer cables, potentially offering simpler rigging and cost-effective alternatives. I urge scholars to delve deeper into this field.

Additionally, exploring alternative visual enhancements not addressed in this thesis, such as light shows, stage sets, and pyrotechnics, could provide fresh perspectives on compensating for limited musical stage activity, thereby enriching the discipline.

Investigating the transition of musical expression from recordings to live performances represents another compelling avenue for research. As observed in Ball's interview with Kjus and Danielsen, live renditions often demand heightened emotional intensity compared to studio recordings.[103] In our case, we noticed a slight incline towards a more rock-inspired artistic expression when our songs were performed on stage. This suggests potential for further exploration in this area. As an extension of this, exploring the reciprocal relationship between live performance and studio production could facilitate a dynamic exchange between the two spheres of practice, articulated by Knowles and Hewitt as a “flow in the reverse direction (from performance back into recording studio)”.[104]

[103] Kjus and Danielsen, 9.
[104] Knowles and Hewitt, “Performance Recordivity,” 23.

7.4 FINAL THOUGHTS

This thesis presents a method for translating complex studio recordings into credible live performances while preserving both sonic characteristics and authenticity. Although based on Gaaren's specific situation, members, and equipment, I believe it can benefit other bands and the broader field of music technology, serving both practical solutions and inspiration for further research in this area.

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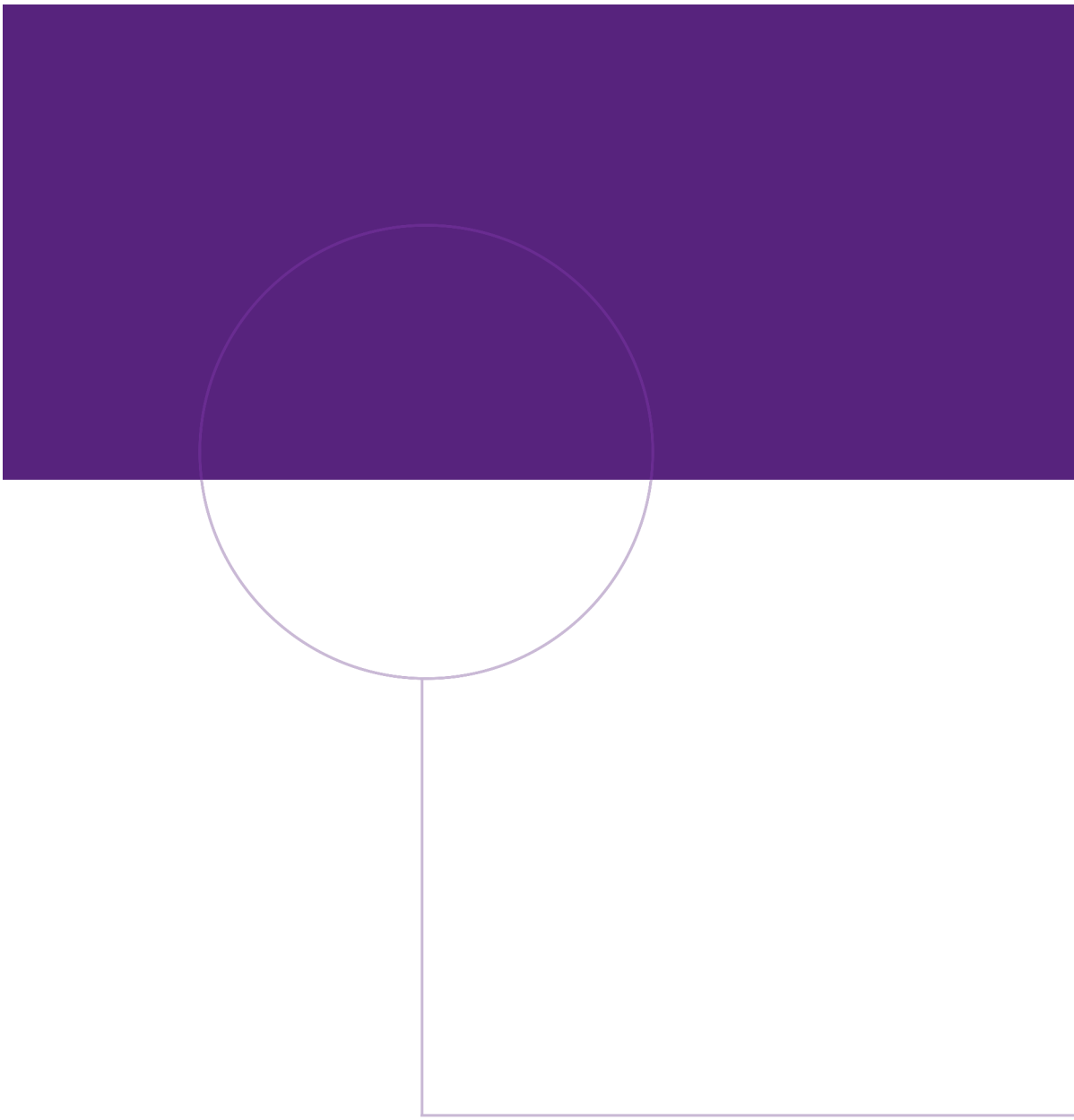

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