Historically informed recording: Early Recordings Association's violin case-study

Inja STANOVIĆ (University of Surrey)

INTRODUCTION

Recordings have gained increased attention as research sources in academic research for the past two decades, prompted by both the growing presence of popular music in university curricula and the renewed interest in early (pre-1945) recordings as sources for historical performance practice. Indeed, historical recordings have been in use as exemplars of past performance styles since 1980s, and they remain in the centre of diverse topic span, including historical performance practices in context of violin playing. Various insights in the late nineteenth- and early twentieth-centuries, in terms of traditions, musical approaches and different performance-based aspects of early recordings in context of violin performance have all been well documented[1]. The methodologies used in this body of work span from contextual, critical, cultural approaches, computational methodologies, and practice-led research. The latest explorations of violin playing styles by David Milsom[2] presented early sound recordings as research tools in historical performance practice. Milsom, in his previous work, combined early recordings with range of other sources such as treatises and editions to research romantic performance practices, while his 2023 chapter explores the issues of emulation and expressive playing during mechanical recording sessions. Milsom's focal point are Joseph Joachim's recordings, and methodological paths he developed in order to further understand how Joachim played. A different methodological avenue was very recently taken by Vollmer and Bolles[3], who digitally simulated violin recordings basing them on Fritz Kreisler's recording of *Liebesleid* (1911), in search of a way to modify modern recordings to sound like historical ones. The current state of research is indeed promising, with authors approaching the same historical sources though different avenues, bringing fresh and compelling results.

The present chapter seeks to explore the primary challenge in studies of historical violin playing styles captured on early acoustic recordings: what do these recordings actually capture? The chapter begins by presenting a case study conducted at the University of Surrey in October 2023. Using the historically-informed recording method that we developed in 2021[4], this case study expanded the investigation into the relationship between performer and mechanical technologies, and the differences between what was played, recorded, and heard by the audience. By placing violinists in carefully controlled acoustic conditions, the researchers were able to observe the players' reactions, draw conclusions about the mechanical recording process, and identify aspects of early recordings that can be reliably studied as well as those that remain speculative. Through analytical comparison of the recordings made in this study, as well as audience questionnaires and discussions, the case study sheds light on the use of mechanical recording technologies and their impact on performers. The chapter notes that early sound recordings offer abundant evidence of performance styles from the turn of the 20th century, including sparing use of *vibrato*, prominent *portamento*, *tempo rubato*, and other

[1] See notably: BROWN 1999; FABIAN 2003; LEECH WILKINSON 2006; KATZ 2006; GEBAUER 2017; MILSOM 2003; MILSOM 2020 ; WILLIAMS 2019.
[2] MILSOM 2023.
[3] VOLLMER – BOLLES 2024.
[4] STANOVIĆ – STANOVIĆ 2021.

stylistic elements. However, this case study represents just a first step towards understanding the historical recording technologies and their influence on violinists. The results bring us closer to comprehending how we interpret historical recordings and the capabilities and limitations of the recording machines themselves. Due to the scope of the study, the chapter focuses on wax cylinder recordings, leaving discussion of acoustic discs for another time. Given the small sample size of participating violinists, this study should be considered a pilot investigation, underscoring the need for further research in this area.

MECHANICAL RECORDING WORKSHOP: VIOLIN STUDY

Team

Participating violinists were David Adams (Welsh National Opera Orchestra, Royal Welsh College of Music & Drama), Philippe Graffin (Paris Conservatoire National Supérieur de Musique, and Brussels Royal Conservatoire), Dr. David Milsom (University of Huddersfield), and Joanna Staruch Smolec (Université Libre de Bruxelles and Conservatoire Royal de Bruxelles. In October 2023, all the violinists were asked to record the same repertoire in front of the audience of collectors, enthusiasts, students and musicologists who all participated in filling out a questionnaire about their experience. Participating musicologists were Drs. Barbara Gentili (University of Surrey), George Kennaway (University of Huddersfield), Eva Moreda Rodriguez (University of Glasgow), Inja Stanović (University of Surrey), Laura Tunbridge (University of Oxford), and Sean Williams (Open University). Mechanical recording engineer was Duncan Miller (Vulcan Records), and digital recording engineer was John Warburton (University of Surrey). All video recordings were done by Sam Sarjudeen (University of Surrey). This case study was conducted in Studio 1 at Department of Music and Media, at the University of Surrey.

Repertoire

The violinists were approached with suggestion that they all record J. S. Bach's *Adagio*, BWV 1001, and a series of exercises written by David Milsom **(see Image 1)** who also wrote a set of instructions for the performers. The exercises were given to the violinists, in order to explore *vibrato* (defined here in modern, general parlance) and *portamento* (defined as a deliberately expressive slide between positions), and to begin experiments to deduce audibility of different *vibrato* speeds and *portamento* types. These exercises show different types of *vibrato*, with varying speeds, and changes within long notes. The bow directions were not specified, but, implicitly, *crescendi* are up-bow and *decrescendi* are down-bow, and down-bow otherwise as a default. The three notes are easy *vibrato* notes in first position on 2nd fingers, given that 2nd and 3rd fingers are most physically conducive. The three pitches reflect the fact that the device is differently applied at different tessitura: the moderate range represents one in which the frequencies are comfortably captured by acoustic technologies. These are loosely based on Louis Spohr's four *vibrato* types. Regarding the *portamenti*, Milsom illustrated different applications of a single-finger slide, and two slides on the same string between two notes ascending, based on Flesch's 'B' and 'L' types, which are widely understood as such. The options reflected different speeds and stresses, although it was pointed out by Milsom that the full list of options worked most convincingly only on B-*portamenti*, which were the most common, and almost universal amongst players of the Austro-German traditions. The little 8-bar melody was Milsom's original composition, designed to reflect some wide-spaced leaps. The melody has chromatic nature and thus seeks to be vaguely historically idiomatic and naturally giving rise to some tonal elements of expressivity. These exercises were composed with basic indications to assess the degree to which the recording reveals the various attempted

types. Of course, all expressivity is highly dependent upon very specific context, and all performances even of specific contexts are likely to vary between themselves. To obviate some of the obvious shortcomings of specific instances, Milsom included a very brief expressive exercise for illustrative purposes.

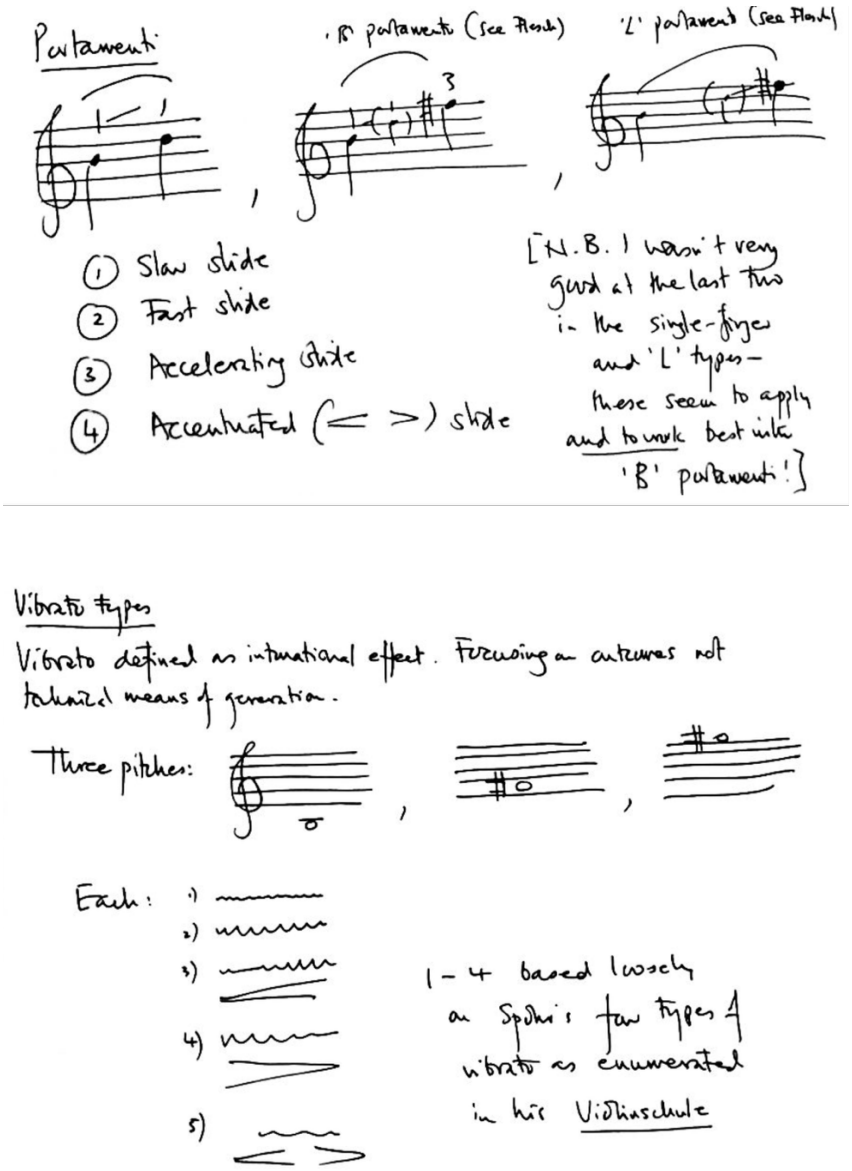


Image 1 – David Milsom's score and instructions for the *vibrato* and *portamento* exercises.

Technologies

The performances heard on early recordings are necessarily and understandably shaped by the recording machinery of their time. As Taruskin has noted, recordings have an ambiguous relationship with performance, as the technologies involved and their potential influence on performer behaviour must be accounted for[5]. Furthermore, recording technologies are rarely transparent; factors such as durational limitations, microphone or recording horn placement, background noise, and the ability to retake recordings could all potentially influence the final

[5] TARUSKIN 1995, p. 89.

recording. Any study of early recordings should therefore attempt to consider the various factors that impacted the recording process, even if the specifics are not always known. Examining the recording technologies themselves can shed light on the potential affordances and constraints that may have informed interpretational and performance decisions. With this in mind, the current case study was divided into two segments, each focusing on different mechanical technologies.

As mentioned, this chapter presents the first part of the study, which focused on phonograph recordings. The violinists recorded set exercises and Bach's *Adagio* using an original c. 1903 Standard Edison Phonograph, a copper and string wound horn (660mm by 190 mm) and a standard recorder. All cylinders[6] were recorded on 160 rpm, which was again measured when playing back. The major strength of observing the phonograph recording session is to be able to play the cylinders back, presenting differences in played and recorded very blatantly. The audience was therefore able to grasp the various ways in which violinists needed to change their practice to register their interpretational ideas on the wax. The recorded cylinders were two minutes long and were played back on Fireside Edison Phonograph; built around 1910. Because of the duration of the cylinders, Bach's Adagio needed cutting, and the violinists were asked to cut the piece as they seem appropriate. It is a difficult piece to shorten, as there are no obvious places in which to do this in order to maintain the architecture of the movement, other than, after the initial G minor chord first quarter note to skip to the 2nd thirty-second note of bar 10, which resulted in an extract about 1 minute and 40 seconds in length. Series of tests were conducted to determine the most appropriate ways in which the violinists might be recorded. This process revealed many of the challenges that lay ahead: the limited recording durations, the restricted dynamic and frequency ranges, and the physical positioning of instruments in proximity to the recording machinery, which all made the recording process demanding and complicated.

Methodology

Reference recordings of 1) J. S. Bach's BWV 1001, *Adagio*; and 2) a series of *vibrato* and *portamento* exercises, were recorded by David Milsom in September 2023. The recording was produced in the University of Surrey PATS Studio 1, using the same equipment and space which was consequently used in October 2023. This was also the space which was used to record all the digital transfers. All recording sessions were digitally recorded and filmed, and these sources are hosted on the Early Recordings Association website[7]. The digital transfers of Milsom's discs were offered to David Adams, Philippe Graffin, and Joanna Staruch Smolec. They were asked to listen to Milsom's playing, understand his technique as well as his use of historically informed style in this particular recording. Following this, the violinists attended the recording session of their own, where they recorded the same piece and exercises. The recording session was observed by a number of musicologists and performers, as mentioned above. They observed what they can hear in terms in *vibrato* and answered questionnaires about their experience.

The simple questionnaire included the following questions, about each recording made:

From a scale of 0 to 10, how much *vibrato* does the performance feature?

0 1 2 3 4 5 6 7 8 9 10

[6] Duncan Miller supplied the wax cylinders blanks. These closely resemble the original cylinder blanks, though the materials used are not identical to the originals. Many of the original materials had to be substituted due to toxicity concerns or limited natural sources.

[7] The case study videos are hosted under 'Resources' and 'Projects' section. URL: https://www.surrey.ac.uk/early-recordings-association

From a scale of 0 to 10, how much *tempo* modification does the performance feature?

0 1 2 3 4 5 6 7 8 9 10

From a scale of 0 to 10, how much dynamic contrast does the performance feature?

0 1 2 3 4 5 6 7 8 9 10

For recorded performances, what are the three most striking differences with respect to the live performance? Any other comments?

The audience responses are discussed below. Following the transfer of production, the digital transfers of wax cylinders were explored as waveforms using the Audacity program. While visualisation tools have limitations, and certain aspects of recordings will always evade assessment and analysis due to the nature of the recording process and unknown variables, the visualiser method offers numerous advantages. Although such tools do not constitute a form of analysis in their own right, the output may provide a platform for making significant observations and enabling comparative analysis. In this way, observations are supported by quantitative evidence presented in an accessible and understandable form.

Transfers

The digital transfers of discs provide valuable research evidence. Once in a digital format, the researchers can enjoy repeated playbacks without the deterioration that affects physical media like gramophone records and cylinders. They can also observe the transfers through various sound analysis programs using computer technologies and make clear comparisons between new and old digital transfers. The process of transferring audio recordings from discs and cylinders can be challenging, often resulting in a distorted sound image and a misleading representation of the original audio evidence. In context of acoustic discs, prior to the widespread adoption of long-playing records, disc production was not standardized, with Beardsley noting that many acoustic discs were recorded at speeds ranging from 68-70 rpm[8]. Playing these discs at an incorrect speed, such as assuming a standard 78 rpm, can lead to significant distortion of the audio, particularly the human voice. To illustrate this point, Columbia records specified a playback speed of 80 rpm but could be played anywhere between 76 and 83 rpm. The appropriate playback speed for a record can be determined by establishing the pitch. However, a standard pitch of A=440 Hz was not universally adopted until it was officially designated as the International Concert Pitch at a 1939 conference in London. Prior to this, pitch varied between approximately 425 and 445 Hz.

Transposed material further complicates the process of determining the correct pitch, especially in ensemble performances. Additionally, the two sides of a record may require different playback speeds, even if they were recorded in the same manner. Unfortunately, there is no simple solution to these issues; the playback speed must be carefully examined and adjusted until the right speed is identified. For this case study detailed rpm notes were taken, in order to reproduce all the recordings on correct speeds. The transfers were recorded in the same space, using the same digital equipment which was used in the recording sessions. Further to this, videos of recording sessions were produced using two cameras. One camera focusing on the recording process and the posture of the violinist, while the other one focused on the violinists' left hand and amount of *vibrato* they are using. The videos of this study can be accessed at the Early Recordings Association website.

[8] BEARDSLEY 1999.

Exercises

The recording session revealed several insights about the relationship between the performance and the recording process. Exposing the recording process allowed the researchers to observe how the musicians negotiated various performance elements – such as touch, balance, speed, and technique – in response to the recording medium itself. The musicians' responses varied, and overall, the musicians adapted quickly to the recording process but highlighted its demanding nature. Everybody involved felt the workshop and mechanical recording experience would change how they listen to early recorded music going forward. The participants filled out the questionnaire during the performances, which started with exercises being recorded on wax cylinders. As soon as the recording was done, it was played back, and the audience had to answer the same range of questions and add their observations. The audience was varied and included performers, students, musicologists, collectors and enthusiasts.

In table 1, we can see the mean value of *vibrato* (live and recorded), *tempo* modification (live and recorded), and dynamic contrast (live and recorded). Various comments clarify the numbers given to each performer, and some of mean values are low (such as *tempo* modification) as several participants left this field blank as the material was an eight bar long melodic line. Observations regarding Milsom's (D.M.) playing were that he had very integrated *portamenti*, and more noticeable *vibrato* when changing dynamics. Some participants noticed that he possessed warm tone in the recording, and that his *vibrato* was less obvious in recording than live. Several participants noted that even though there was not much of a dynamic contrast in recorded cylinders, there were some overloading notes and distortion. Regarding the *vibrato* style, it was noticed that his *vibrato* is much wider in recording than live. Observations about David Adams' (D.A.) *vibrato* were that it was more realistic than the other players, and it resembled what was heard in the room more. Several participants noted that his *vibrato* was clear but recorded less pronounced than played live. Observers noticed the loss of dynamic range, and that subtle differences in sound production in live performance got lost in the recording. Quiet phrases towards the end almost disappeared, as they were so quiet. However, several audience members noted that they heard loaded overtones, and even though the recording had a solid mid-range, that higher tones seemed not to be registering well by the machine. Finally, it was noted that wider *vibrato* almost distorts on wax cylinder, and that a slow *portamento* almost sounds like a *glissando*.

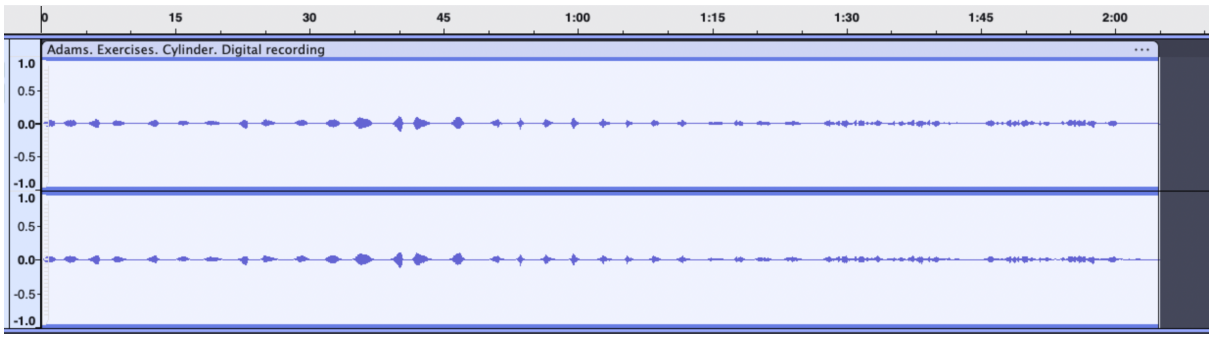
Some participants stated that due to limitations of the recording equipment, Joanna Staruch Smolec's (J. S. S.) dynamics were not captured well, and that richness of her sound did not come through. Her *vibrato* came through more than with other violinists, and one member of audience noted that recorded *vibrato* sounded strange, while another noted that the amount of *vibrato* was the same between live and recorded performance, but that *vibrato* sounded different on the cylinder. Several audience members noted that *vibrato* was more prominent on the recording than in live performance, and that the *portamento* was also more noticeable in the recording. It was mentioned that the recording exaggerated some features of Joanna's playing, making it very exciting with pronounced *tempo* changes. Philippe Graffin (P. G.) on the other hand did not use many *portamenti*, but when he did – more slowly – it was more noticeable on recording, and it was noted that this sounded even more charming. Comments about dynamics were contrasting, and it was noted that the recording had a larger dynamic range than live performance, as well as a complete opposite – that the recording did not capture all the dynamic changes. All participants agreed that there was evident *vibrato* in the recording, but that the phonograph changed the quality of *vibrato* and that the recorded *vibrato* sounded narrower than live. Some noted that *vibrato* turned into a shimmer and that it became more of

a timbre. In the table 1 below, it is obvious that what was performed and what was recorded differ. The *vibrato* figures regarding Philippe Graffin are misleading from the table, as all the numbers changed between live and recorded, however from the table it seems like they remained the same. Also, as the *tempo* modification was not flagged up by a majority of observers, these numbers are very low.

	Vibrato live	*Vibrato* recorded	*Tempo* modification live	*Tempo* modification recorded	Dynamic contrast live	Dynamic contrast recorded
D.A.	7.7	7.3	2.7	2.8	5.6	4.2
D. M.	7.2	5.3	3.6	3.6	4.9	3.8
P. G.	6.6	6.6	2	2.3	6.1	4.6
J. S. S.	7.2	7.5	3.7	3.8	4.6	4.7

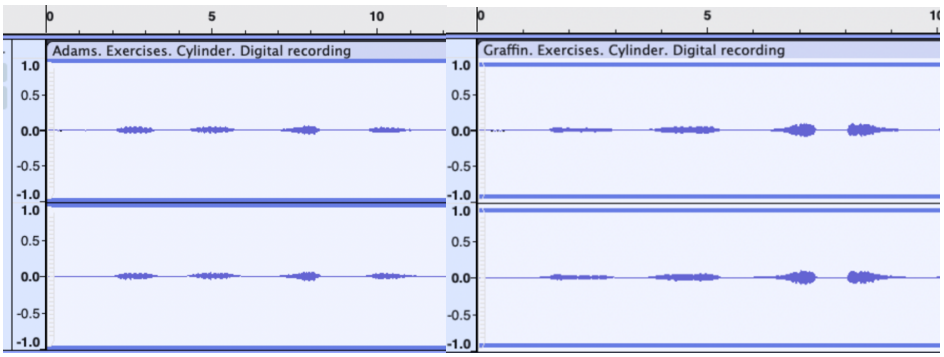
Table 1. Mean average for David Adams (D. A.), David Milsom (D. M.), Philippe Graffin (P. G) and Joanna Staruch Smolec (J. S. S.), for the set of exercises.

The digital recordings of four violinists, simultaneously observed in Audacity, reveal distinct differences in their *tempo* and execution, despite all performers receiving the same musical score and instructions **(Image 2)**. This variability is unsurprising, as the subjective interpretation of a musical score inherently manifests in any performance. As shown in **Image 3**, the first four notes starkly illustrate these distinctions. Within the context of these exercises, we can also observe differences in volume and attack. Notably, the same types of *vibrato* exhibit large variances in shape and execution across the violinists. Additionally, the various approaches to *portamento* – a key expressive technique in 19th-century string and vocal playing[9] – demonstrate differing prominence between notes as well as divergent *vibrato* on starting and ending notes. The use of both analogue and digital recording technologies enables us to precisely document what was played and registered on produced cylinders and discs. This, in turn, provides insights into the specific actions recording performers had to undertake. Furthermore, digital recordings reveal multiple variables associated with the mechanical technologies themselves, as the makes, models, and components of phonographs, cutting lathes, horns, recorders, and reproducers differ. By testing multiple violinists using the same mechanical and digital systems, we can observe substantial discrepancies in tone, spectrum, amplitude, and duration. When comparing the digital transfers to the original wax cylinder recordings **(Image 3)**, the *vibrato* and *portamento* unique to each performer become evident.



[9] For discussion on *portamento*, see: PHILIP 1992, pp. 143-178; BROWN 1988, pp. 97-128; STOWELL 1992, pp. 122-142.

Image 2 – Differences in violinists' performances. Digital recording.



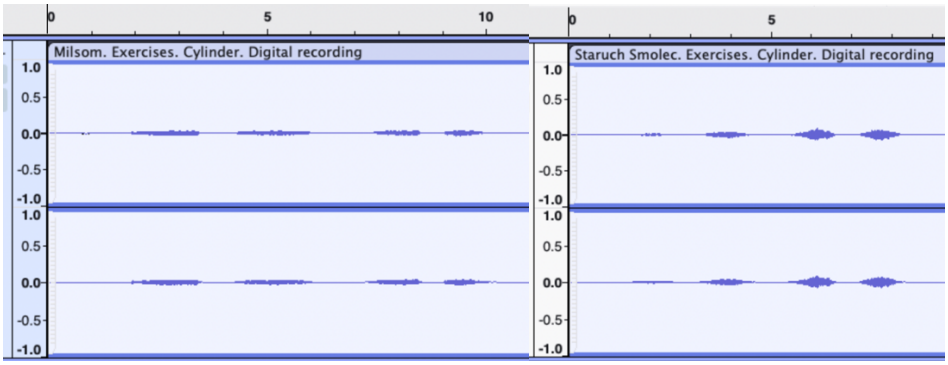
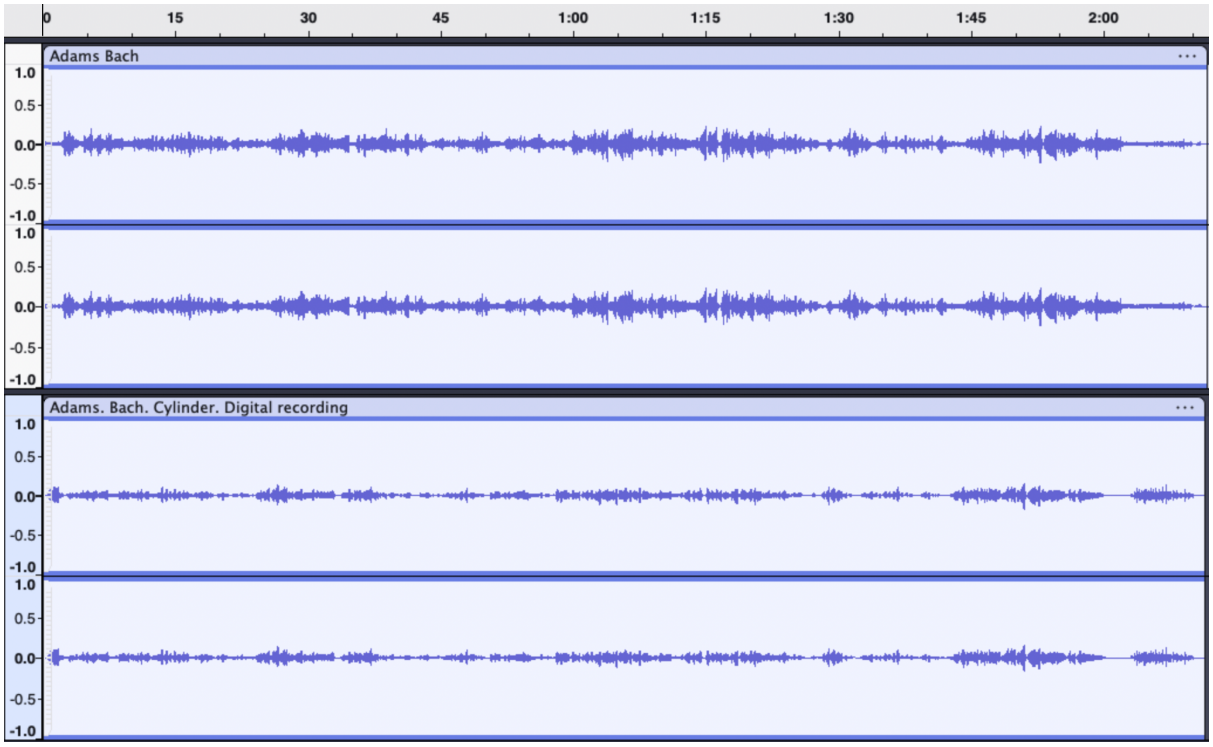


Image 3 – Differences in *vibrato* types, all violinists. Digital recording.



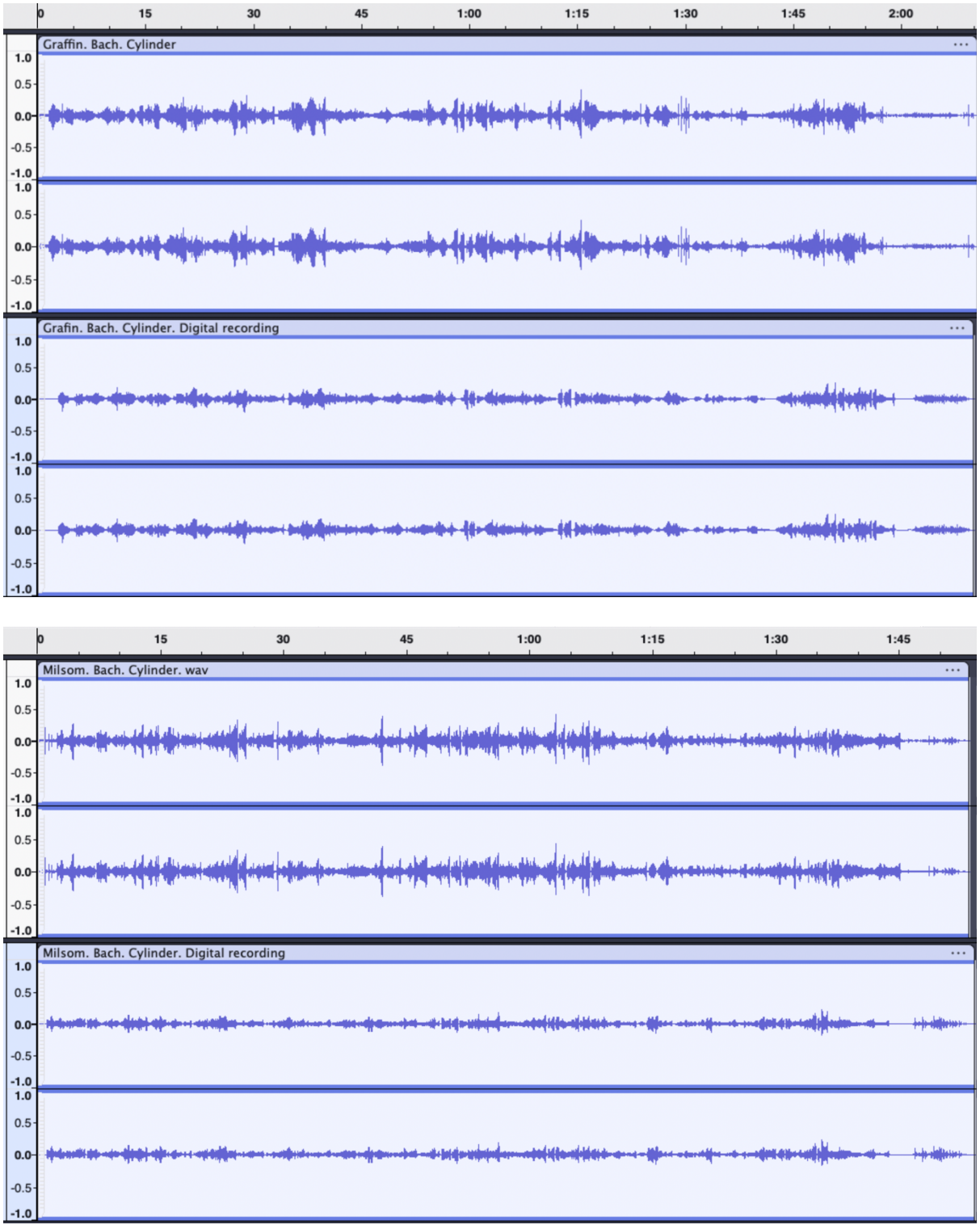


Image 4 – Differences in *vibrato* types, all violinists. Wax cylinder transfer.

J. S. Bach: Adagio BWV 1001

The study continued in the same tone, and violinists recorded Bach's *Adagio* on a two-minute wax cylinder. There were again two minutes long, which meant that the piece had to be cut, as previously discussed. Mean averages were calculated again for *vibrato* (live and recorded), *tempo* modification (live and recorded) and dynamic contrast (live and recorded), as

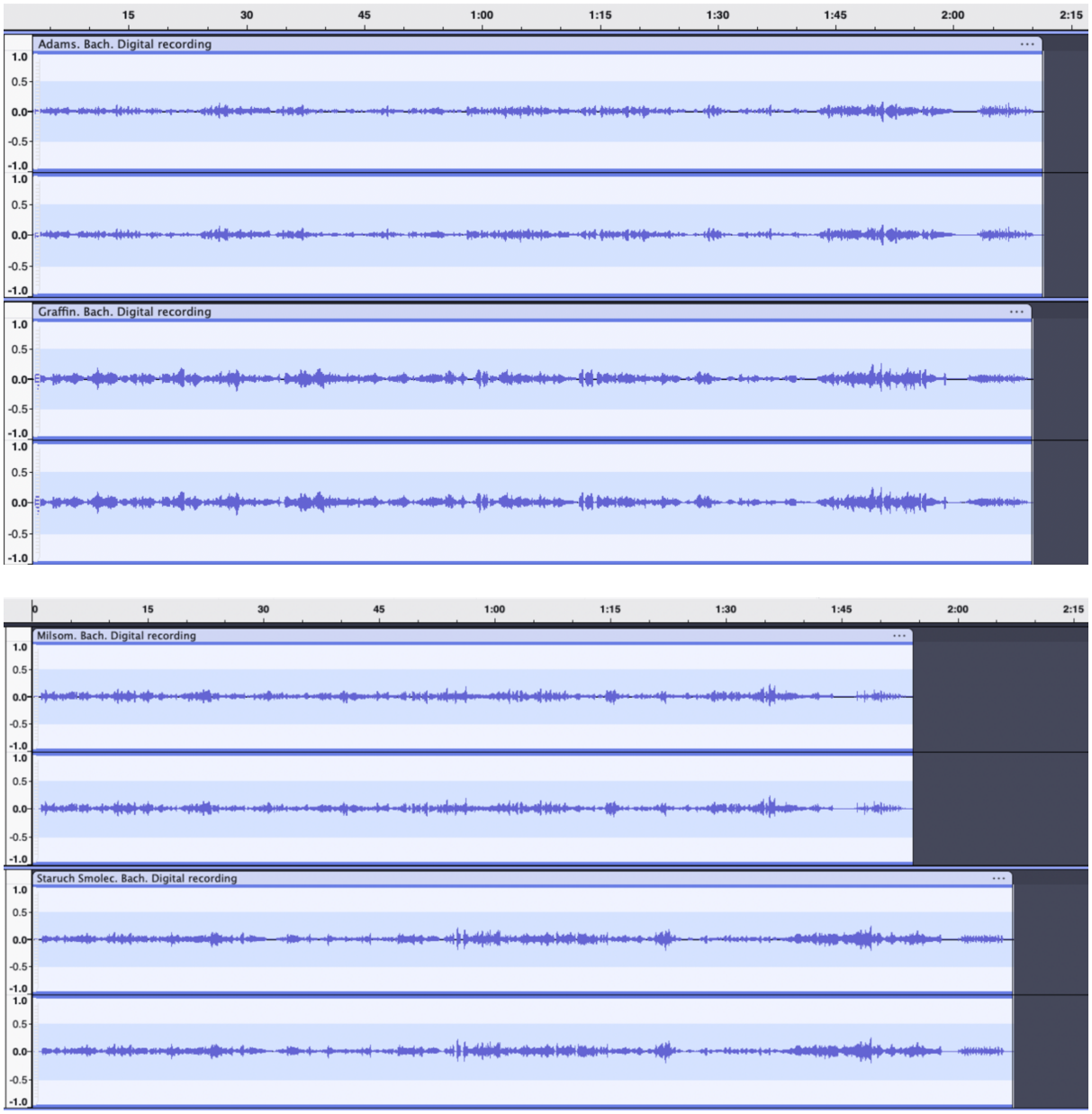
presented in Table 2. The audience observations on Milsom's performance noted several recording considerations. The gut strings he used sounded slightly muffled on the recordings, while they were really powerful and clear in live performance. The recording also exhibited some distortion, and the double stops occasionally overloaded the recording horn. One of the participants noted that playing into the string gives a consistent tone, but one is also in danger of distorting the sound. Further to this, broken chords seemed less separated in recording as they were connected with some degree of distortion. The recording captured a diminished brightness and body in Milsom's tone, with accented notes sounding softer than in live performance. The phonograph used was more successful in recording mellow, darker tones. Finally, the integration of *portamento* into the timbre due to noise, as well as the reduced *vibrato* expression, gave the recording a more muted character compared to the live performance.

Adams' violin sound was overall depicted as beautiful, delicate, not overly loud, nevertheless with distinctive dynamic contrasts. He showed a consistent tone with less distinctive *vibrato* in his live performance. Adams was asked to stand very precisely in front of the recording horn, not to move and to point the violin towards the horn more. A few audience members noted that the *tempo* modifications were more pronounced his recording, but that the tone colour changes were not as evident as in the live performance. Finally, recording seemed to have compressed dynamics, making *vibrato* more integral to the timbre, and less of an expressive feature.

Staruch Smolec showcased a different playing style from Adams' and Milsom, she emphasized the dynamic contrasts, but this unfortunately failed to be captured on cylinder exactly. One of the participants observed that with Staruch Smolec we had the biggest contrasts between live and recorded performance in context of richness of sound. The recording exhibited some pitch warble due to some minor temporal issues with the phonograph. Additionally, certain types of *vibrato* were lost in the recording, which flattened the performer's expressiveness. This was also evident in Graffin's performance, which was recorded with significantly less dynamic contrast than his live performance. One audience member noted that the recording failed to capture the nuances in dynamics present in the live performance, particularly in the context of registral differences and compromised tonal uniformity. Furthermore, the recording diminished the dramatic impact of the *vibrato*, rendering it less audible overall. Occasional distortion of the cylinders also introduced a very slow *vibrato* that blended with the performed *vibrato*. One participant observed that the recording obscured bow speed, though the metal strings sounded clear. Several listeners reported closing their eyes while listening, as this helped them better discern the *vibrato*. Table 2 shows that Graffin had the least *vibrato* in his live performance, and is the only violinist whose recording has an increase in *vibrato* presence. While *tempo* modifications received polarised views, dynamic contrasts were all significantly less prominent recorded than live. In **Image 5** below, waveforms from both digital recordings and digital transfers of Bach's *Adagio* are presented, revealing that all violinists used varied *vibrato* and *portamento*. In recorded wax cylinders, *vibrato* took on an ornamental character, appearing only at selected moments. All four recordings have a clearly expressed momentum, and long phrases with *vibrato* and non-*vibrato* on specific notes creating internal phrasing and enhancing tone colour.

	Vibrato live	*Vibrato* recorded	*Tempo* modification live	*Tempo* modification recorded	Dynamic contrast live	Dynamic contrast recorded
D. A.	5.5	5.1	4.1	4.1	5.9	3.7
D. M.	4.7	3	4.3	3.8	4.5	3.6
P. G.	3.6	4.2	4.7	4.7	5.1	4.4
J. S. S.	5.5	4.5	5.1	5.3	5.1	4

Table 2. Mean average for David Adams (D. A.), David Milsom (D. M.), Philippe Graffin (P. G) and Joanna Staruch Smolec (J. S. S.), for J. S. Bach: *Adagio* BWV 1001.



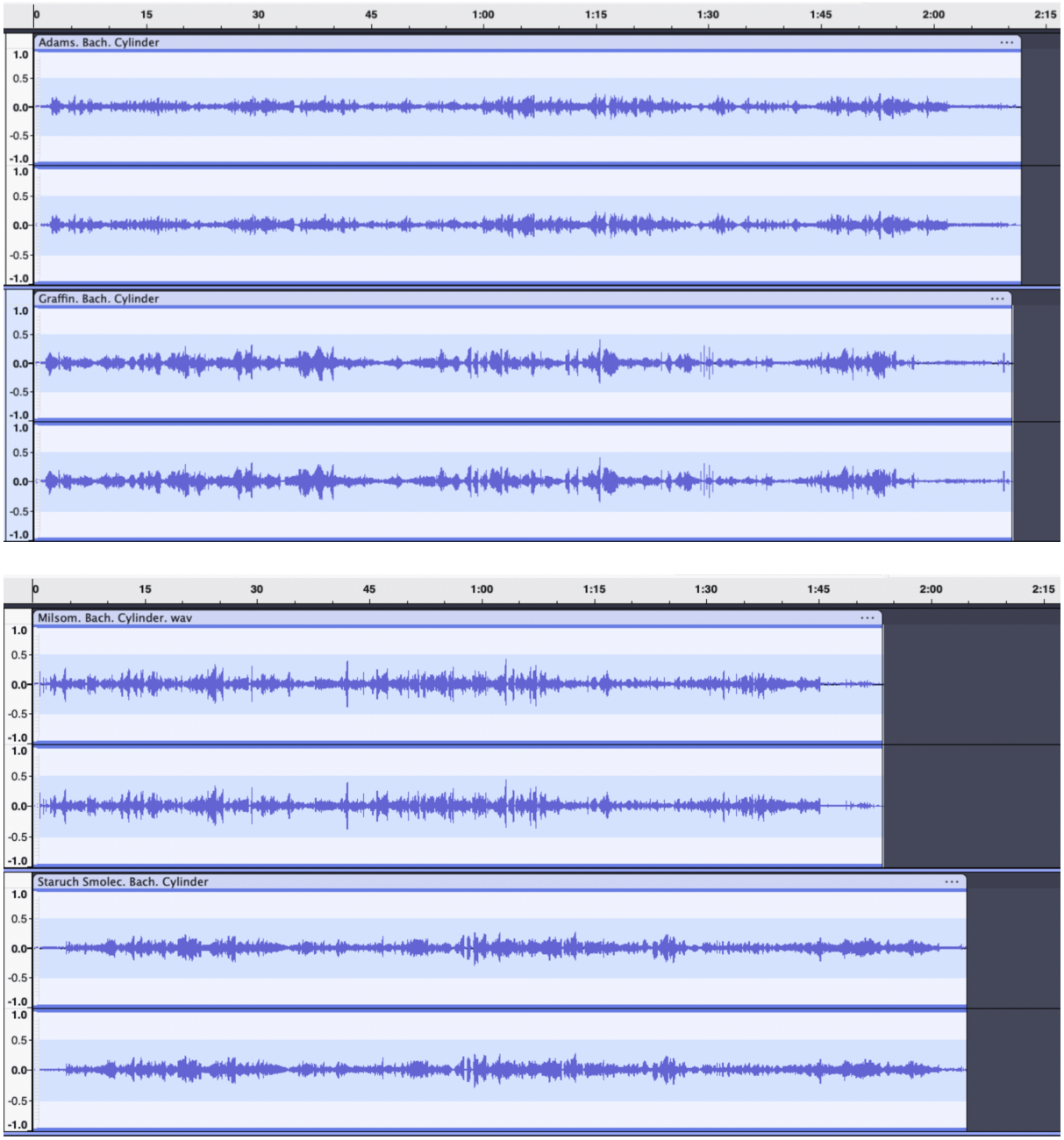


Image 5 – Johann Sebastian BACH, *Adagio*, BWV 1001, waveform of digital recordings and wax cylinder transfers.

CONCLUSION

This chapter examined the considerable uncertainties surrounding early recording technologies, and how they are perceived and heard by contemporary audiences. Violin recordings from the late 19th and early 20th centuries are frequently used as exemplars of past performance practices in current historically informed performance research. This study emphasises the critical importance of examining the diverse contextual factors associated with historical recordings. Researchers and performers interested in historical performance practices will undoubtedly continue to investigate written and audio sources, treatises, and other forms of documentary evidence. This study suggested that practical experiments involving

mechanical recording technologies should be incorporated into this research, as the process of creating such recordings holds valuable insights. Ultimately, this chapter, presented alongside the recordings and videos generated, aims to serve as a stepping-stone towards a more comprehensive understanding of historical performance practices.

The phonograph recording sessions presented unique challenges for the musicians involved. They had to adjust their playing to accommodate the limitations of the wax recording medium, which resulted in significant disparities between the live performance and the recorded version. All participants agreed that this historical recording experience transformed their understanding of early recordings more broadly. The mechanical recording process compelled musicians to perform in specific ways to ensure the sound was properly captured.

Overall, the experience of recording on a phonograph offered two major benefits. First, it allowed performers to explore and experiment with various approaches to interpreting and expressing their musical ideas on the wax. Second, it enabled both observers and performers to access and experience the recorded sound in ways that would not have been possible otherwise. Given the limitations of the technology at the time, it seems highly likely that performing musicians faced significant challenges when making recordings[10]. Observing audience responses clarifies that individual recordings do not represent an entire musical tradition, but rather a performance by a single musician or ensemble. This point is especially significant when considering the interpretive and improvisatory aspects of 19th-century performance practices. Recordings capture specific interpretations that may vary considerably, as notations and performance markings were often suggestive rather than prescriptive.

The participants discussed how musicians adapted their performance, and the differences are between what they heard in the room and what was recorded on the cylinder. This revealed potential for researchers to interweave discussions of performance practices and technologies with broader contextual considerations. The Early Recordings Association's mechanical recording sessions, including the presented case study, became a platform for knowledge exchange, experience sharing, and learning. By allowing the audience to engage with the recording process in real-time, the sessions enable musicians to discuss specific musical and technological contexts with the audience and each other. This creates a fruitful learning environment for the exchange of experiences and ideas. The mechanical recording workshops introduced a new methodology that works on deepening the collective knowledge and insight into early recordings. These workshops, including the discussed case study, highlighted the significant work that remains in early recording research and identified it as a promising avenue for further study. The combination of introspective examination of internal experiences and empirical presentation of external evidence in musicological and historical contexts is ushering researchers into a new era of recording research. Embracing the inherent context sensitivity and subjectivity as strengths, rather than weaknesses, opens the door to diverse perspectives and productive dialogue.

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