

# **The Electric Guitar in Rock Music Guitar Playing, Technology, and Culture**

**Kumulative Habilitationsschrift zur Erlangung der  
akademischen Qualifikation der Habilitation im Fachgebiet  
„Musikwissenschaften“**

Von

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geb. am 28.10.1984 in Büren

vorgelegt dem

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Eingereicht am 22. Dezember 2023

Wissenschaftlicher Vortrag am 29. Januar 2025

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1. Herbst, J.-P. (2016). *Die Gitarrenverzerrung in der Rockmusik: Studien zu Spielweise und Ästhetik* [*Guitar Distortion in Rock Music: Studies on Playability and Aesthetics*]. Münster: LIT.  
<https://www.lit-verlag.de/isbn/978-3-643-13553-7>
2. Herbst, J.-P. (2017a). Historical Development, Sound Aesthetics and Production Techniques of Metal's Distorted Electric Guitar. *Metal Music Studies*, 3(1), pp. 24–46.  
[https://doi.org/10.1386/mms.3.1.23\\_1](https://doi.org/10.1386/mms.3.1.23_1)
3. Herbst, J.-P. (2017b). Influence of Distortion on Guitar Chord Structures: Acoustic Effects and Perceptual Correlates. In W. Auhagen, C. Bullerjahn, & C. Louven (Eds.). *Akustik und musikalische Hörwahrnehmung*. Göttingen: Hogrefe, pp. 26–47.  
<https://dx.doi.org/10.23668/psycharchives.2805>
4. Herbst, J.-P. (2019a). Distortion and Rock Guitar Harmony: The Influence of Distortion Level and Structural Complexity on Acoustic Features and Perceived Pleasantness of Guitar Chords. *Music Perception*, 36(4), pp. 335–352.  
<https://doi.org/10.1525/mp.2019.36.4.335>
5. Herbst, J.-P. & Vallejo, A. P. (2023). *Guitar Virtuosos: Advances in Electric Guitar Playing, Technology and Culture*. Cambridge: Cambridge University Press.  
<https://doi.org/10.1017/9781009052962>
6. Vallejo, A. P. & Herbst, J.-P. (2024). Thumping, Glitch, and Butterfly Tapping: Innovations in Guitar Technique in the New Millennium. In J.-P. Herbst & S. Waksman (Eds.). *The Cambridge Companion to the Electric Guitar*. Cambridge: Cambridge University Press, pp. 165–188.  
<https://doi.org/10.1017/9781009224420.010>
7. Herbst, J.-P.; Czedik-Eysenberg, I., & Reuter, C. (2018). Guitar Profiling Technology in Metal Music Production: Public Reception, Capability, Consequences and Perspectives. *Metal Music Studies*, 4(3), pp. 481–506. [https://doi.org/10.1386/mms.4.3.481\\_1](https://doi.org/10.1386/mms.4.3.481_1)
8. Herbst, J.-P. (2019b). Old Sounds with New Technologies? Examining the Creative Potential of Guitar 'Profiling' Technology and the Future of Metal Music from Producers' Perspectives. *Metal Music Studies*, 5(1), pp. 53–69.  
[https://doi.org/10.1386/mms.5.1.53\\_1](https://doi.org/10.1386/mms.5.1.53_1)
9. Herbst, J.-P. (2023). 'It Just Is My Inner Refusal': Innovation and Conservatism in Guitar Amplification Technology. In A. Moore & G. Bromham (Eds.). *Distortion in Music Production: The Soul of Sonics*. London: Routledge, pp. 174–184.  
<https://doi.org/10.4324/9780429356841>
10. Herbst, J.-P. & Menze, J. (2021). *Gear Acquisition Syndrome: Consumption of Instruments and Technology in Popular Music*. Huddersfield: Huddersfield University Press.  
<https://doi.org/10.5920/GearAcquisition.fulltext>

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Ich verpflichte mich hiermit des Weiteren zur Einhaltung der „Richtlinie zur Sicherung guter wissenschaftlicher Praxis und zum Verfahren zum Umgang mit wissenschaftlichem Fehlverhalten der Leuphana Universität Lüneburg“ (Leuphana Gazette Nr. 56/22; 22. Juli 2022) und der Grundsätze guter wissenschaftlicher Praxis.

*Jan-Peter Herbst* (elektronisch unterschrieben)

Huddersfield, Dezember 2023

## **Abstract**

This research examines the role and practices of the electric guitar in rock music in terms of playing styles and techniques, technologies, and various relevant cultures. With a portfolio of three books, four articles, and three chapters, the research analyses the affordances and limitations of harmonic distortion for solo and rhythm guitar playing in rock music from its beginnings to contemporary practices, with a particular focus on virtuosity and ‘shredding’—the (often) ostentatious display of technical prowess. Concerning technology, the research explores the musical, sociological, and psychological dimensions of equipment choice and acquisition (including the so-called ‘gear acquisition syndrome’), advances in guitar and amplification technologies, and the creation of an effective and expressive guitar sound in record production. Finally, the research documents how playing practices and equipment use are negotiated in mainstream and niche cultures, focusing on more recent scenes prevalent on the internet. The portfolio, as a whole, fills significant gaps in current (electric) guitar scholarship by examining topics relevant to practising guitarists from a musicological perspective, as opposed to 1) common approaches in popular/cultural studies that tend to ignore issues of playing and technologies in favour of issues related to identity, society, and the environment, and 2) computer science and engineering approaches that quantify the material reality of the instrument with little regard to playing and guitar culture.

**KEYWORDS:** electric guitar; distortion; rock music; performance; music technology; equipment

## Portfolio of Published Works

11. Herbst, J.-P. (2016). *Die Gitarrenverzerrung in der Rockmusik: Studien zu Spielweise und Ästhetik* [*Guitar Distortion in Rock Music: Studies on Playability and Aesthetics*]. Münster: LIT. <https://www.lit-verlag.de/isbn/978-3-643-13553-7>
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15. Herbst, J.-P. & Vallejo, A. P. (2023). *Guitar Virtuosos: Advances in Electric Guitar Playing, Technology and Culture*. Cambridge: Cambridge University Press. <https://doi.org/10.1017/9781009052962>
16. Vallejo, A. P. & Herbst, J.-P. (2024). Thumping, Glitch, and Butterfly Tapping: Innovations in Guitar Technique in the New Millennium. In J.-P. Herbst & S. Waksman (Eds.). *The Cambridge Companion to the Electric Guitar*. Cambridge: Cambridge University Press, pp. 165–188. <https://doi.org/10.1017/9781009224420.010>
17. Herbst, J.-P.; Czedik-Eysenberg, I., & Reuter, C. (2018). Guitar Profiling Technology in Metal Music Production: Public Reception, Capability, Consequences and Perspectives. *Metal Music Studies*, 4(3), pp. 481–506. [https://doi.org/10.1386/mms.4.3.481\\_1](https://doi.org/10.1386/mms.4.3.481_1)
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20. Herbst, J.-P. & Menze, J. (2021). *Gear Acquisition Syndrome: Consumption of Instruments and Technology in Popular Music*. Huddersfield: Huddersfield University Press. <https://doi.org/10.5920/GearAcquisition.fulltext>

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## 1. Introduction

The electric guitar has been at the centre of many genres of popular music (Evans & Evans, 1977: 13; Everett, 2003; Dawe, 2010: 19ff). For over half a century, from rhythm and blues in the 1940s and rock and roll in the 1950s, the electric guitar has written popular music history (see, e.g., Wicke, 1990; Brown, 1992; Palmer, 1995; Meinard, 2004; Covach, 2012). The 1960s and 1970s saw the rise of hard rock and heavy metal, psychedelic rock, and punk. Despite the growing popularity of electronic music in the 1980s, this was the decade of the proliferation of virtuoso guitar playing in heavy metal and other forms of mainstream rock music, such as ‘adult-oriented rock’ (AOR). Furthermore, the guitar and ‘guitar music’ faced competition from the diversification of popular music and the democratisation of digital music-making through affordable computer software. Rumours that the guitar’s heyday is over have come and gone (e.g., Rotundi, 1997). In 2017, guitar icon Eric Clapton added weight to such speculation when he said that “maybe the guitar is over” (Bliss, 2017). *The Washington Post* put it more bleakly, predicting the “slow, secret death of the six-string electric” (Edgers, 2017).

A closer look at relevant statistics and cursory observations of electric guitar-related music reveals that media and communities paint a different picture, one that does not indicate a decline in popularity. According to a representative study by the German Music Information Centre (MIZ, 2014), 32% of German households owned a guitar or a bass in 2012, surpassed only by keyboard instruments with 43%. In 2019, the number of students learning the guitar at music schools run by the VdM (Verband deutscher Musikschulen / Association of German Music Schools) was only exceeded by those learning the piano (140,000 vs 163,000).<sup>1</sup> An even clearer picture emerges when one compares the growth of students in these music schools between 2000 and 2019—43% guitarists compared to 19% pianists (MIZ, 2020a). Taking into account the unregistered guitarists at private music schools and the incalculable number of self-taught guitarists, it is relatively safe to assume that the guitar has not lost its popularity. The popularity of genres traditionally associated with electric guitars is correspondingly high: ‘Rock and pop music’ (72%) is still the most popular music genre across all age groups in 2022, while ‘hard rock and heavy metal’ (26%) is the favourite genre of a quarter of the population (MIZ, 2022b). In fact, its popularity has grown in recent years: ‘Rock and pop music’ has increased by 10% since 2005 and ‘hard rock and heavy metal’ by 5% since 2010 (MIZ, 2020b).

In his *Guitarscape*, Kevin Dawe (2010: 20) defines fundamental indicators of the guitar’s global popularity as the number of guitars sold and the instrument’s presence in people’s everyday lives and in popular media and culture. Dawe lists the following reasons: portability; versatility; affordability; expressivity; playability; usable for solo and ensemble styles; different tunings; tonal qualities and range; feel; durability; iconicity; a growing number of

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<sup>1</sup> The number of guitar students has declined due to the Covid-19 pandemic. Nevertheless, the guitar remains the second most popular instrument by a wide margin (MIZ, 2022a).



great masters; historical relevance (Dawe, 2010: 21–22). This is probably not all that accounts for the guitar’s widespread recognition as a cultural icon of the 20<sup>th</sup> and 21<sup>st</sup> centuries (Bennett & Dawe, 2001; Carfoot, 2006; Millard, 2004a; Dawe, 2010; Ostberg & Hartmann, 2015). Clear evidence of the guitar’s growing popularity worldwide is provided by the fact that international guitar sales have more than doubled in the last decade, reaching the highest number in history (Copsey, 2019; see also Wang, 2018). Indeed, there is evidence that the disruption to everyday social life caused by the Covid-19 pandemic has led to a surge in sales of musical instruments—newcomers and re-entrants—led by the guitar as a popular, affordable, versatile, and relatively easy-to-learn instrument, especially given the wealth of learning resources available online (Pamir & Herbst, 2021).

The internet is likely the place where the guitar’s popularity is most evident. A search for the guitar on YouTube returns over half a billion hits, not only from professional performances and instructional videos but also from countless amateurs demonstrating their skills and development on the instrument, asking for feedback, or giving advice. In Germany, more than three million posts in the electric guitar forum of *Musikerboard*<sup>2</sup> and no less than 350,000 posts by around thirty thousand registered members in *Gitarrenboard*<sup>3</sup> are strong indicators of the pronounced interest in the guitar among amateur, semi-professional, and professional musicians. Globally, the community’s size is illustrated by the *Ultimate Guitar Forum*<sup>4</sup>, which has nearly thirty million posts in over one million threads, offering song recommendations and buying advice, and discussing instruments, effects, and amplifiers, as well as playing techniques. The virtual conversations between visitors to these forums suggest that many players see their instrument as more than a hobby; the guitar is part of their identity.

Surprisingly, given the popularity of the guitar over the last half-century, not only because of the music it is admired for but also as an instrument played by laypeople, the body of research explicitly dedicated to the guitar is relatively small. The publication dates of significant compendia and edited volumes (e.g., Evans & Evans, 1977; Wheeler, 1992; Bennett & Dawe, 2001; Coelho, 2003; Millard, 2004) and the few academic monographs available (Einbrodt, 1997; Waksman, 1999a; Dawe, 2010) suggest that the electric guitar has become somewhat unfashionable as a research topic. A notable exception is the forthcoming *Cambridge Companion to the Electric Guitar* (Herbst & Waksman, 2024). Most of the progress since 2000 has been made by early career researchers in the form of master’s (Gil, 2014; Vallejo, 2021) and doctoral (Mahon, 2007; Hill, 2014; Matabane, 2014; Turner, 2015; Lewis, 2018) dissertations and corresponding publications.

The following is a brief overview of the relevant corpus of electric guitar literature. It is divided into the overarching areas of *playing*, *technology*, and *culture*, although they overlap considerably. More detailed literature reviews are included in the three books of the portfolio

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<sup>2</sup> <https://www.musiker-board.de/forum/e-gitarren-forum.75>; accessed April 2022.

<sup>3</sup> <http://gitarrenboard.de>; accessed April 2022.

<sup>4</sup> <https://www.ultimate-guitar.com/forum>; accessed April 2022.

submission (Herbst, 2016; Herbst & Menze, 2021; Herbst & Vallejo, 2023), which contain in-depth discussions and evaluations of the respective topics.

### *Electric Guitar Playing*

Some research on genre aesthetics, particularly in the rock and metal genres, takes the electric guitar into account. In defining rock music, Peter Wicke (1990), Bruce Baugh (1993), Theodore Gracyk (1996), and Stephen Davies (1999) emphasise the fundamental role of the guitar, highlighting its distorted timbre as essential to the genre's aesthetics, emotion, and transgression. For Andrew L. Cope (2010), the distinctive way in which hard rockers Led Zeppelin and heavy metal pioneers Black Sabbath played the electric guitar distinguished hard rock from the emerging metal genre. Early research on metal music (Weinstein, 1991; Walser, 1993) also stresses the importance of the distorted guitar timbre, with Robert Walser (1993: 41–43) declaring it the sonic signature of the genre itself. Subsequent metal scholarship (Moore, 2001; Berger & Fales, 2005; Elflein, 2010; Hagen, 2011; Reyes, 2013; Mynett, 2016) reinforces the central role of distortion in the genre and in genre distinctions within and beyond metal. More recent research has approached modern metal genres, such as djent, with identifiable guitar tones. Robert Strachan (2017) and Mark Marrington (2017, 2019) see djent's popularity in its digitally generated guitar sounds, while Matthew T. Shelvock (2014) further emphasises the distinct signal chain. Similarly, Victor Gil (2014) investigates djent's typical percussive and low-pitched sound by focusing on the history of extended-range electric guitars and their production requirements and challenges. Outside of popular music, Giacomo Fiore (2012, 2014, 2018) studies alternative tunings and intonation in the use of the guitar in classical and experimental music.

In the context of virtuosity, research has tended to focus on rock and metal in the 1970s and 1980s. That was the time when classically inspired electric guitarists such as Ritchie Blackmore, Edward Van Halen, Randy Rhoads, Yngwie Malmsteen, and Tony MacAlpine set new standards in terms of playing technique, virtuosity, and speed, pioneering the 'shred' or neoclassical genre (Walser, 1992; Waksman, 2003b; Heritage, 2016; Fellezs, 2018). Increased playing speed has been empirically investigated (Slaven & Krout, 2016). Other studies concentrate on the showmanship of electric guitar virtuosos (Custodis, 2011; Lehmann & Kopiez, 2013), yet only a few studies go beyond the obvious areas of playing technique and showmanship. Dirk Stederoth (2017) is an exception, proposing an alternative framework for thinking about (guitar) virtuosity by distinguishing between sound, groove, and performance virtuosity, similar to Steve Waksman's (2003b, 2004) notion of the "virtuosity of sound".

Several authors writing about virtuosity discuss playing techniques on the electric guitar in passing (Walser, 1992; Waksman, 2003b). Systematic and detailed studies of playing styles, including the instrument's mechanics and expressive potential, are rare. George Turner's (2015) doctoral thesis analyses playing techniques and related technologies, showing the

historical origins and evolution of the techniques that have formed the standard repertoire since the 1980s. Where Turner's examination ends, Alexander Vallejo's (2021) master's thesis begins. Examining the mechanics of playing techniques, Vallejo considers not only the established standard techniques but also most of those developed in the last ten to twenty years, including advanced legato techniques such as 'butterfly' and 'glitch tapping', as well as emerging percussive adaptations of the bass guitar like 'thumping'. Apart from 'glitch tapping' described in Kristof Neyens's (2020) guitar manual, these recent developments in established playing techniques are rarely covered in guitar instruction books. Other insightful educational sources are offered by virtuosos of varying prominence, from accomplished virtuosos Steve Vai (2013, 2019) and Guthrie Govan (2002a, 2002b) to Berklee College of Music instructor Joe Stump (2014, 2017) and solo artist and educator German Schauss (2012, 2017). All provide information on their practice routines, playing mechanics, and stylistic approaches to the instrument. Furthermore, there is a wide array of guitar instructional books (see Herbst & Vallejo, 2023), complemented by instrument-specific magazines such as *Guitar*, *Guitar World*, *Guitar Player*, *Guitarist*, and *Interactive Guitar* with interviews, cover stories, and special issue features that provide insights into the playing, technologies, and aesthetics of the instrument from a practitioner's perspective.

A considerable body of work has been dedicated to the rhythm guitar, especially in relation to rock music's harmonic structures. With their corpus analysis of one hundred songs between 1950 and 1990, Trevor De Clercq and David Temperley (2011) provide evidence that rock music takes an alternative approach to common harmony, which is consistent with Ken Stephenson's (2002) stylistic analysis of rock and Chris McDonald's (2000) study of modal subversions in rock music. Rock and metal harmony is associated with the guitar not only because it is a central harmonic instrument but also due to the effect of distortion on perceived consonance. In his spectral analysis of the signal's harmonic content and the partials' relationship to the fundamental frequency, Esa Lilja (2005, 2015) investigates how distorting guitar chords alters perception. Following Walser's (1993) assertion that the electric guitar's common 'power chord', a pure fifth interval, derives its power from the strengthened overtones by adding lower residual tones, Lilja (2005, 2015) argues that the major chord sounds indistinguishable from the power chord due to their similar overtone structure. In contrast, as per Lilja (2005, 2015), minor and more complex chords sound dissonant because the fretted notes do not coincide with their overtone series and cause sensory beatings. Other auditory studies have found that power chords at the end of a chord progression tend to be perceived as major chords when the guitar tone is distorted (Juchniewicz, 2009; Juchniewicz & Silverman, 2011). Based on Lilja's (2005, 2015) reasoning, this impression is caused by the harmonic series. However, a recent electroencephalogram (EEG) study refutes the hypothesis that the auditory system treats distorted power chords like major chords. It also suggests that participants respond more strongly to tonal qualities than to harmonic structures (Virtala et al., 2018). Compared to these psychological and music-theoretical studies, cultural readings of

rhythm guitar are relatively rare. Ulrich Adelt (2022) draws attention to the rhythm guitar as a neglected practice compared to the lead guitar. He further argues that in terms of racialised identity and gender, rhythm guitar allows for a more fluid understanding of sound and genre than solo guitar (Adelt, 2020). Likewise, Kate Lewis (2018) explores gender and racialised identity in her doctoral dissertation.

### *Electric Guitar Technology*

The number of publications on electric guitar technology is relatively small, and what little exists usually lacks a musicological perspective. The few sources available on the electric guitar and its amplification take an engineering perspective, noting influential innovators and companies. Some introduce instruments and amplifiers (Meinel, 1987; Schiffner, 1994; Bacon, 1996; Zollner, 2014), others only the instrument (Lemme, 2009; French, 2012) or the amplifier (Brosnac, 1987; Lemme, 1995). Common to all these sources is that they explain the components that shape tone, from the strings to the loudspeaker. There are also publications dedicated to specific companies and devices, such as Fender and Gibson guitars (Millard, 2004c; Port, 2019) and Fender (Morrish, 1999) and Marshall amplifiers (Doyle, 1993; Maloof, 2004), or those documenting the ‘invention’ of the electric guitar with its notable innovators, engineers, and entrepreneurs such as George Beauchamp, Paul Bigsby, Paul Barth, Adolph Rickenbacker, Leo Fender, and Lester William Polsfuss (Millard, 2004b). In addition to these technical or academic writings, several books introduce beginners to the instrument, its amplification, and its effects (Brewster, 2003; Speed, 2010; Hurwitz, 2013; Fornandley, 2015; Carter, 2016). Still other publications are dedicated to the equipment of popular artists such as The Beatles (Babiuk, 2016), The Rolling Stones (Babiuk & Prevost, 2014), the Grateful Dead (Jackson, 2006), Jimi Hendrix (Heatley & Shapiro, 2009), Frank Zappa (Ekers, 2020), and Free’s Paul Kossoff (James, 2017), supplemented by collections of technical reports on the gear of well-known guitarists (Bruck, 2005).

The electric guitar’s signature distorted sound has also been the focus of several studies, the most comprehensive of which has been presented by Ulrich Dieter Einbrodt. In his doctoral thesis (Einbrodt, 1997) and several related publications (Einbrodt, 1988, 1998; Einbrodt & Pape, 1992), Einbrodt examines the variables that influence the sound of amplifiers, guitar models, pickups, playing, picking techniques, and recording approaches of the undistorted and distorted guitar sound. Although providing a systematic overview of what guitar sounds exist in rock music, what variables contribute to their creation, and how these sounds developed from 1960 to the late 1980s, auditory and aesthetic considerations are not part of Einbrodt’s study, nor is the influence of guitar tone on playing and composition. These aspects are explored by Harris M. Berger and Cornelia Fales (2005), who conclude that the guitar sound in heavy metal became heavier between the 1970s and the 1990s due to increasing levels of

harmonic distortion associated with an expanded frequency spectrum resulting from strengthened overtones and down-tuned guitars.

A small amount of recent research concentrates on alternative forms of amplification to the analogue valve and to the instrument. With the guitar synthesiser, a stringed instrument that does not directly translate physical gestures into sound but acts as an interface to trigger synthesised sounds, Waksman (2018) investigates the intersection of the electric guitar and keyboard synthesiser. From a computing and science perspective, the affordances of digital signal processing for emulating or simulating guitar amplifiers have been studied (see, for example, Eichas & Zölzer, 2018). Psychological and perceptual studies on the quality of amplifier emulation technologies are still rare (Düvel, Kopiez, Wolf, & Weihe, 2020).

Paul Théberge (1997: 159–160) claims that “musical instruments are not ‘completed’” at the stage of design and manufacture” because musicians adapt equipment to their needs, either by making modifications themselves or by collaborating with engineers and manufacturers. Even though the musicians’ continued drive for innovation has been instrumental in the advancement of the electric guitar, research on ‘tinkering’ has been relatively scarce. Walser (1992) and Waksman (2004) take the example of Eddie Van Halen, explaining how he innovated the now popular ‘superstrat’ guitar shape with his self-built “Frankenstrat” (Obrecht, 1978) and tweaked his amplifier to create his known “brown sound”, a sound that supported his virtuoso playing style. From a different perspective, Leslie C. Gay (1998) explores how the average electric guitarist responds to technological innovation by analysing metaphors of technology. Gay finds that most guitarists gravitate towards simple, traditional setups because these have a pure sound and are easy to maintain and customise.

The final technological area of guitar-related research takes an audio engineering and recording perspective. While some of the relevant literature tends to be scientific (French 2008) with a focus on specific genres such as metal (Mynett, 2016, 2017), others, mainly in the form of manuals, are more accessible to a general audience and practitioners (Chappell, 2010). Literature that focuses on research-oriented content instead of practice is rare. Susan Schmidt-Horning (2004) provides one of the few available texts that traces early guitar recordings from the 1920s to the 1960s.

### *Electric Guitar Culture*

In keeping with the well-established tradition of cultural studies in popular music studies, most research on the electric guitar has been predominantly situated in the field of culture and society. One line of research concerns the study of influential players. Sheila Whiteley (1990) analyses the psychedelic coding in Jimi Hendrix’s work, tracing the hallucinatory effects of the drug LSD in “Purple Haze” (The Jimi Hendrix Experience, 1967). Most other work focuses on the ‘guitar hero’ (Bitoun, 2018). Waksman (2001) examines the rise of the guitar hero, arguing that it began with Eddie Van Halen in the 1970s and declined with the advent of grunge music

in the 1990s. André J. Millard (2004d) also studies the guitar hero phenomenon in the late 1960s and 1970s, but with a focus on electric guitar technology fused with an English interpretation of African American blues traditions and Western notions of masculinity. With the spectacular live performances of heavy metal in the 1980s, Millard (2004e) argues that the guitar hero ascended to the ‘guitar god’. Deena Weinstein (2013) agrees with Millard’s reading and explains it with the guitar’s electrification, which puts the instrument in competition with the rock vocalist regarding sonic expression and dramatic stage performance. According to the authors, players like Eric Clapton, Pete Townshend, and Jimi Hendrix were the driving forces behind the emergence of the guitar god.

A larger research area, mostly outside of music disciplines, concerns the electric guitar’s materiality. Heikki Uimonen (2018) examines how mass-produced electric guitars became luxury items and celebrity-related collectables, resulting in high market values for instruments played by guitar heroes and their replicas. Similarly, Karen V. Fernandez and John L. Lastovicka (2011) investigate fetishes in contemporary consumer practices based on interviews with guitarists about their affinity for celebrity players and their attitudes towards replica instruments. Jacob Ostberg and Benjamin J. Hartmann (2015) outline how the guitar’s development in playing and technology has been fetishised for its loud and rough sonic signature and its rebellious live performance tradition. Ulrich Adelt (2017) focuses on a different setting, that of guitar-related heritage, by studying its representation in rock and pop museums, demonstrating how the guitar in the rock and roll genre represents racialised and gendered traditions. Within the multidisciplinary field of consumption studies, a few works concentrate on the electric guitar or use guitarists as case studies. Hartmann (2016) examines the concept of the “prosumer”, a professional consumer, by proposing the concept of “facilitation”, i.e., the guitarist’s investment in gear to advance as a player. Steven J. Cole (2018) also focuses on the guitarist’s often technologically deterministic approach to the instrument, but unlike Hartmann, he addresses the notion of “use-value” as a countermeasure to the over-commodified habits of many players. Will Gibson (2022) examines the communicative practices of guitar pedal review videos on YouTube to understand the structures of consumer cultures on the video platform.

In recent years, a new strand has emerged in the field of (musical) consumption studies that considers the ecological systems and consequences of manufacture and consumption. Jose Martinez-Reyes (2015) examines the Gibson Les Paul guitar’s production from the theoretical viewpoint of “enviromateriality”. This global ethnography combines considerations of material culture (in this case, tree species, specifically mahogany) with political ecology in relation to forest conservation. Chris Gibson and Andrew Warren (2016, 2021) investigate how global production networks of acoustic guitars are shaped by resource materiality, scarcity, and environmental regulation. By tracing guitars back to the tree, Gibson (2019) adopts an anthropocentric perspective to highlight the musicians’ responsibility to conserve ecosystems.

One of the focal points of guitar research is gender. Simon Frith and Angela McRobbie (1978) introduced the term “cock rock” (see also Waksman, 1996). Building on this idea, Waksman (1999a) discusses the concept of the “technophallus” (see also Hochman, 2016), the overly aggressive demonstration of male sexuality through the instrument’s figurative display on stage with its characteristic loud and distorted sound. Another form of displaying masculine virility Waksman (2003b) and Walser (1992) see in ‘shredding’ as the extravagant demonstration of technical prowess on the electric guitar. Waksman (2003b) and Monique Bourdage (2010) discuss why women tend to play acoustic guitars and why fewer than men become visible as electric guitarists and virtuosos. While for Waksman (2003b), the main reason is the male connotation of technical virtuosity (see also Strohm, 2004), Bourdage (2010) cites mainly institutional reasons. For Bourdage, the key factor is women’s acquired aversion to technology, which has led to a profound lack of female role models (see also Carson et al., 2004). These two studies coincide with Mavis Bayton’s (1997, 1998) earlier extensive interview study of over a hundred musicians. Related to the lack of role models are the barriers women face in joining mixed-gender bands (Clawson, 1999) and the uninviting atmosphere of one of the central sites of musical culture, music stores (Sargent, 2009; Berkers & Schaap, 2018). Other research looks at the criteria of the historiography of the electric guitar in rock music as a means of cultural reproduction of traditional gender hierarchies (Schauberger, 2013) or examines how traditional binary gender distinctions are reproduced and challenged by “media makers” using the example of Daisy Rock guitars for girls (Kearney, 2010). Not focusing explicitly on gender but on media, Kiri Miller (2012) explores play, performance, and participatory culture in the digital age, looking at phenomena such as *Guitar Hero* and the impact of online video lessons on amateur musicianship.

Race and ethnicity are two other areas of study. Mashadi Matabane’s (2014) PhD thesis investigates the cultural history of Black female guitarists in the USA. Matabane documents the challenges Black women face in playing the guitar as a creative endeavour and as a means of defining their identities beyond the racial and gender restrictions imposed by the wider society. Matabane argues that Black women, in their quest for their own identity, intrude on the dominant social meanings of the electric guitar as a culturally white and masculine instrument and culture. Similarly, Kevin Fellezs (2018) analyses how the African American virtuoso Tony MacAlpine adopts electric guitar virtuosity in a white European concert tradition. With such a style, MacAlpine defies the expectation of intuitive and emotionally expressive Black music, instead demonstrating, according to the author, a comprehensive skill developed through diligent practice in the classical sense of playing and music theory. Waksman studies ethnicity and race in his monograph *Instruments of Desire* (1999a) and several related articles and chapters (Waksman, 1998, 1999b). In addition to aspects of the early development of guitar culture and instrumental and playing techniques in blues, country, and swing, Waksman addresses issues of cultural identity and ethnicity created by the

electrification of the guitar sound and the resulting processes of musical change (Waksman, 1999a, 1999b, 2003a).

Although journalistic literature cannot be considered research in the strict sense, it is a resource that contributes to a detailed knowledge of the electric guitar, its culture, and its players. (Auto-)biographies are particularly valuable. Early rock history is documented in autoethnographic accounts by Eric Clapton (2007), the Who's Pete Townshend (2012), Toni Iommi (2013) of Black Sabbath, Slash (2007) of Guns'n'Roses, Jimmy Page of Led Zeppelin (2020), Andy Summers (2006) of the Police, Iron Maiden's Adrian Smith (2020), and Lita Ford (2016) of the first major all-female rock group, the Runaways (see also Waksman, 2009), and one of the early electric guitar heroines. Further insights into rock culture from a female perspective are provided by Viv Albertine (2014), guitarist of the all-female punk band the Slits; June Millington (2015), guitarist of the all-female rock band Fanny; and Carrie Brownstein (2015) of Excuse 17 and Sleater-Kinney. Insights from other perspectives come from collaborative works between well-known players and journalists who provide in-depth knowledge of musical careers, such as those of B. B. King (Sawyer, 1980), Keith Richards (Michael, 1994), Jimmy Page (Tolinski, 2012), and Jeff Beck (Power, 2014). Authorised and unauthorised biographies are dedicated to the lives of influential guitarists such as Jimi Hendrix (Cross, 2006; Murray, 2012; Alleyne, 2020; Norman, 2020), John Lee Hooker (Murray, 2011), Muddy Waters (Rooney, 2012; Gordon, 2013), Keith Richards (Bockris, 1993), and Brian May (Jackson, 1995, 2008). Compendia on the greatest guitarists of all time (Kitts & Tolinski, 2002; Rensen & Stösser, 2011; Bitoun, 2018; Rubin, 2018) or specific genres like metal (McIver, 2008) complement these biographies.

### ***Summary***

The literature review reveals a wealth of cultural, sociological, historical, technological, and applied sciences research, accompanied by valuable journalistic accounts of the electric guitar and its players. Areas of popular music research include issues of identity, gender and race, media and instrument technologies, tinkering, environmentalism, consumptive practices, musical heritage, genre aesthetics, music theory, virtuosity, and the greatest guitarists. If, however, the perspectives of musicology and practising players are underrepresented or even disregarded (see also Jauk, 2007), research runs the risk of losing touch with music and its culture, understood from a broad understanding of the musical demands of playing styles and genres, which includes insider knowledge of the scene. Apart from disciplinary bias, which tends to disproportionately favour research from perspectives outside music(ology), researchers such as Waksman (2003c: 252) criticise popular music research for largely neglecting musical instruments:

Given the vast complexity of musical instruments as cultural artifacts, and their fundamental importance to the making of music, it is worth pondering why they have been given relatively little attention in the study of music, and of popular music in particular [...] For all too many popular



music scholars, musical activity does not exist for all intents and purposes before the moment of recording. Such an assumption, whether explicit or unspoken, leaves scholars to concentrate upon a range of issues that, while of key importance, tend to exclude the ways in which instruments figure into musical practice and production. (Waksman, 2003c: 252)

The popularity of the electric guitar and its continuing relevance to many forms of popular music contrasts with the instrument's relative underrepresentation in research. That could be explained by the dominance of research traditions within popular music studies that are outside of 'music' in the strictest sense (see Tagg, 2011), which is likely to explain why the instrument has received relatively little attention. Unsurprisingly, many of the authors cited, including those not necessarily affiliated with a music department, are performers with an interest in the instrument. Little progress has been made in the twenty years since Waksman's (2003c) critique. Research theses, chapters, and articles have contributed to our understanding of the instrument, but overall, there have been few comprehensive monographs, anthologies, and collected volumes published in the last decade. Approaches to studying the instrument are scattered, focusing on the various interrelated but separately examined aspects of the electric guitar, its culture, players, and technologies. To fill the gaps, a practice-informed musicological perspective is needed that recognises the "complex relationship between musical and extramusical factors in the cultural life of musical instruments" (Waksman, 2003c: 252). The current research project, the overarching research objectives of which are outlined next, was motivated and justified by the gaps in knowledge outlined above.

## 2. Overarching Research Objectives and Designs

This chapter provides an overview of the overarching research objectives and the project's methodological design. The objectives are derived from the previously summarised state of the art, explained in more detail in the relevant publications. The specific research questions and hypothetical assumptions can be found in the respective published works and are therefore not cited again. Not all three areas—guitar playing, technology, and culture—and their sub-areas are given the same priority and volume; some are the subject of monographs, while others are dealt with in narrowly focused chapters or articles. Likewise, the publications cover more aspects than those summarised here; the areas highlight the main themes studied and the project's overall coherence.

### 2.1 Electric Guitar Playing

Research on guitar playing has typically concentrated on the instrument's representation or role in wider society and musical culture, often neglecting the mechanical, ergonomic, and perceptual aspects of playing (see Jauk, 2007). Playing techniques have received marginal attention (see Turner, 2015), and novel approaches to the instrument in the 21<sup>st</sup> century have been largely overlooked (see Vallejo, 2021). This research project fills two significant gaps in the current literature by investigating: 1) The effect of harmonic distortion on lead and rhythm guitar playing; 2) how established playing techniques have been modified and extended into new approaches to the instrument.

#### *Harmonic Distortion*

Distorted timbre is one of the primary distinguishing features between acoustic and electric guitars, significantly affecting the electric guitar's playability and expressiveness. Ulrich Dieter Einbrodt's (1997) and Manfred Zollner's (2014) research are among the few comprehensive studies investigating the electric guitar's tone-producing components. Despite making a significant contribution to our understanding of the instrument's acoustics, neither work examines the effect of tone quality on expressive lead guitar playing, rhythm guitar, songwriting, and aesthetics.

The current research project sought to determine the effects of overdriven and distorted timbres on electric guitar playing technique, melodic phrasing, and expression, as well as their implications on rhythm guitar playing. It also examined how harmonic distortion alters the playability of melodic playing techniques in terms of expressiveness and difficulty. Regarding rhythm guitar, the studies investigate how distortion changes the guitar signal's physical properties in relation to its harmonic structures and how these changes correlate with perceived pleasantness.

**RELEVANT PUBLICATIONS:** Herbst 2016, 2017b, 2017d, 2017e, 2017f, 2018, 2019a.

### ***Contemporary Rock Guitar Playing Techniques and Virtuosity***

Vallejo (2021) is one of the few researchers to have analysed the guitar's evolving playing styles and techniques since the 1980s (for earlier ones, see Turner, 2015). James E. Slaven and Jody L. Krout's (2016: 246) assertion that "general techniques of guitar soloing have changed very little since the beginnings of the rock era in the 1950s" serves as a starting point for investigating the development of electric guitar techniques over the past four decades in mainstream and niche virtuoso instrumental guitar music. The instrument's restricted ergonomics had to be overcome to raise the bar for existing playing techniques in terms of precision, speed, and expressiveness, as well as exploring modified or novel playing techniques. The project aimed to explore how increasingly demanding technical skills could be utilised musically, compositionally, and aesthetically.

**RELEVANT PUBLICATION:** Herbst & Vallejo 2023; Vallejo & Herbst 2024.

## **2.2 Electric Guitar Technology**

Electric guitar technology has received little attention outside of engineering and journalistic publications. This project focused on the following three areas to fill the respective gaps: 1) The guitarist's acquisition of equipment; 2) recent advances in instrument and amplification technologies; 3) the capture and shaping of the guitar sound in record production.

### ***Equipment Acquisition and Preference***

According to Frith (1986), Théberge (1997), and Waksman (2003c), musical instruments are a rich symbolic terrain. Music equipment is inextricably linked to genre aesthetics, playing styles, musical identities, and personas, alongside factors concerning musical cultures such as attitudes and values, including themes like tradition, experimentalism, or technophilia. So far, questions around instrument technology have been explored theoretically through small-scale analyses of well-known players and their equipment, such as Jimi Hendrix's 'misuse' of distortion and effects (Whiteley, 1990; Weinstein, 2003) or Eddie Van Halen's modified amplifier and self-made guitar (Walser, 1992; Waksman, 2004). Little attention has been paid to the considerable number and variety of amateur, semi-professional, and professional guitarists who make up the majority of today's players.

This research project was concerned with the motivations why electric guitarists acquire equipment, seeking to understand the underlying musical, personal, and social motives for their choices and parallels to other instruments. Two aspects were of particular interest: 1) The relevance of the distorted tone, given that traditional setups have their strengths in either clean or distorted sounds; 2) the so-called 'Gear Acquisition Syndrome' as a widespread phenomenon among musicians acquiring and accumulating musical equipment, especially

among electric guitarists, according to the instrument's discourses and stereotypes (Becker, 1996; Wright, 2006).

**RELEVANT PUBLICATIONS:** Herbst 2016, 2017c; Herbst & Menze 2021.

### *Advances in Electric Guitar and Amplification Technologies*

Traditional equipment is a particularly interesting topic covered in academic and journalistic guitar literature and common guitar culture. Frequently discussed are established instrument manufacturers (e.g., Fender or Gibson), specific instrument models (e.g., Fender Stratocaster and Gibson Les Paul), amplifiers (Fender Bassman or Marshall 'Plexi'), and effects (Ibanez Tubescreamer or Dunlop Crybaby)—all of which were developed between the 1950s and 1970s, suggesting that they are still the most popular (e.g., Doyle, 1993; Morrish, 1999; Maloof, 2004; Millard, 2004b, 2004c; Port, 2019). Despite the introduction of vastly different guitar designs and amplification technologies since the 1980s, many players and researchers have stuck with the established technologies.

Covering all technological developments was beyond the scope of this research project, so the primary focus was on advances in modern amplification technologies, especially 'profiling' and digital simulation, which challenge traditional technologies and popular devices. This project aimed to evaluate the quality of these new technologies and to understand their gradual integration into guitar culture with its obstacles. Also considered were the development of guitar designs, especially extended-range guitars with additional strings, the players' musical intentions in adopting them, and the affordances these instruments offer to modern forms of popular music such as djent and other progressive styles of guitar-centred music.

**RELEVANT PUBLICATIONS:** Herbst 2016, 2017a, 2019b, 2021; Herbst, Czedik-Eysenberg, & Reuter 2018; Herbst & Vallejo 2023; Vallejo & Herbst 2024.

### *Capturing and Shaping the Electric Guitar in Record Production*

The instrument, amplifier, and effects create the guitar sound that must be shaped by audio engineering on the live stage or in the recording studio. Currently, research on engineering guitar sounds is scarce except for practical manuals on guitar recording (e.g., Chappell, 2010; Mynett, 2017) or general recording manuals (Huber & Runstein, 2005; Rumsey & McCormick, 2006; Bartlett & Bartlett, 2009). This research project was interested in the interaction between different guitars and amplifiers, tunings, distortion generators and levels, layering of guitar tracks, microphone placements, equaliser settings and playing techniques, and how effectively each of these variables shapes the final sound.

**RELEVANT PUBLICATIONS:** Herbst 2016, 2017a.

## 2.3 Electric Guitar Culture

Electric guitar culture presents a vast field for research. From the previous literature review, it is clear that several issues, such as gender, race, and the most influential players, have already been relatively well explored in academic and journalistic writings. This research project focused on three relatively understudied areas: 1) The evolution of guitar tone aesthetics in rock music and the role of distorted sound; 2) the canons of the greatest electric guitarists; 3) virtual communities of practice.

### *Canons in Electric Guitar Playing*

While canons of the greatest guitar players of all time and various other canons are ubiquitous in journalistic media (e.g., Kitts & Tolinski, 2002; McIver, 2008; Rensen & Stösser, 2011; Bitoun, 2018; Rubin, 2018), related research has only just begun (Lee, 2015, 2016) or considers canonical players to be merely worthy of marginal mention (Bannister, 2006). This research project set out to examine attributes that allow electric guitarists to enter the various canons of the greatest players. It also sought to explore what causes these criteria to change over time, depending on the evolving musical landscape and guitar culture.

**RELEVANT PUBLICATION:** Herbst & Vallejo 2023.

### *(Virtual) Communities of Practice*

To date, relatively little research has addressed electric guitar cultures from a community perspective, with notable exceptions including Jay Wright's (2006) journalistic account of 'Gear Acquisition Syndrome' among guitarists, Fernandez and Lastovicka's (2011) investigation of celebrity and replica instrument fetishes, Hartman's (2016) examination of the guitarist's investment in gear as an anticipated catalyst for musical progress, and Cole's (2018) analysis of the equipment's use-value. Jean Lave and Etienne Wenger (1991) and Wenger (1998) proposed the influential theoretical concept of 'Communities of Practice'. With the advent and proliferation of Web 2.0 and its potential for worldwide social interaction, the concept has been extended to 'Virtual Communities of Practice' (Dubé et al., 2005; Von Wartburg et al., 2006; Hara et al., 2009). However, studies of virtual communities of guitarists are still few and far between, a rare example being a conference paper examining gender disparity among guitar students in Australian tertiary popular music programs (Lee, 2020).

In this project, two virtual communities of practice were studied, one on equipment and one on playing. Regarding equipment, the research aim was twofold: To explore guitarists' hopes and aspirations for their gear, which is believed to be widespread among guitarists (Wright, 2006; Hartmann, 2016; Cole, 2018), and to examine how this desire is nurtured and negotiated within online communities. In terms of playing, the project explores what forms of virtuosity exist today and what impact global connectivity via the internet has on players, concerning expectations and as a way for professional guitarists to make a living.

**RELEVANT PUBLICATIONS:** Herbst & Menze 2021; Herbst & Vallejo 2023; Vallejo & Herbst 2024.<sup>5</sup>

## 2.4 Research Design

The specific research designs are described and justified in the portfolio's individual outputs, but it is pertinent to outline the project's overarching methodological considerations. The literature review concluded that research from the perspective of music experts—musicologists and practitioners—is far less prevalent than an outsider perspective common in the cultural studies tradition of popular music studies. As a result of this tradition and disciplinary approach, research designs and methods tend to favour theoretical and hermeneutic approaches. Empirical studies are rare, and the few that exist are primarily qualitative and conducted by social scientists (Fernandez & Lastovicka, 2011; Hartmann, 2016; Cole, 2018) rather than music scholars. Other empirical investigations are based on music analysis and acoustics (Einbrodt, 1997; Berger & Fales, 2005; Lilja, 2005, 2015; Cope, 2010; Elflein, 2010; Zollner, 2014), although many of the works are on rock and metal music and not specifically on the guitar. Quantitative studies have only been provided by music psychologists (Juchniewicz, 2009; Juchniewicz & Silverman, 2011; Lehmann & Kopiez, 2013; Virtala et al., 2018) and not by popular music scholars.<sup>6</sup>

The breadth and scope of the publications provided should not obscure the project's underlying motivation to empirically investigate electric guitar playing, technology, and culture by using a comprehensive and coherent mixture of various qualitative and quantitative methods. In terms of qualitative designs, the research includes the following:

- oral and written interviews with amateur and professional musicians and producers (Arksey & Knight, 1999)<sup>7</sup>;
- a systematic investigation of online message board discussions with netnography (Kozinets, 2020) and content analysis (Mayring, 2014)<sup>8</sup>;
- document analyses of handbooks, manuals, magazines, biographies, and manufacturers' websites (Bowen, 2009; Frey, 2018)<sup>9</sup>;
- canon research of guitar literature and guitarists (Jones, 2017)<sup>10</sup>;

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<sup>5</sup> While not particularly analysing communities of practice, Herbst, Czedik-Eysenberg, & Reuter 2018 and Herbst 2021 include analyses of online discussions and representations. Herbst 2016 contains an online survey of guitarists on message boards.

<sup>6</sup> The study on the speed of electric guitar solos by Slaven and Krout (2016) is the only empirical study on lead guitar playing; the authors are computer scientists and communication studies scholars.

<sup>7</sup> See Herbst 2016, 2019b and Herbst & Menze 2021.

<sup>8</sup> See Herbst & Menze 2021 and, although the method is not explicitly mentioned, Herbst 2021, Herbst, Czedik-Eysenberg, & Reuter 2018, and Herbst & Vallejo 2023.

<sup>9</sup> See Herbst 2016, 2021; Herbst & Menze 2021; Herbst & Vallejo 2023. The method of document analysis is not explained explicitly so as not to overburden the average reader, academic and interested layperson, with unnecessary methodological digressions, but methodical considerations guided the research approach.

<sup>10</sup> See Herbst & Vallejo 2023.

- spectrographic analysis of real-world musical artefacts and original experimental recordings (Cook, 2009; Cook & Leech-Wilkinson, 2009; McAdams, Depalle, & Clarke, 2004)<sup>11</sup>;
- analytical (Clarke, 2005; Moore, 2008, 2012) and critical (Corey, 2017; Moylan, 2020) listening.

The quantitative designs comprise:

- surveys of guitar players (Groves et al., 2009; Mohr, 2010)<sup>12</sup>;
- experiments with statistical analyses of acoustic parameters derived from music information retrieval algorithms (Lartillot, Toiviainen, & Eerola, 2008; Müller, 2015) and listening tests (Bech & Zacharov, 2006)<sup>13</sup>.

Triangulation was used to relate the otherwise limited individual methods and datasets to each other, thus corroborating their respective limitations and enabling a deeper and more comprehensive understanding (Denzin, 1978; Flick, 2017).

In addition to the empirical approach to studying the electric guitar, which offers a broader perspective to the body of literature and popular music studies, the portfolio contributes to our understanding of guitar playing, technology, and culture from a multidisciplinary perspective rarely found in other relevant publications. Alongside the obvious disciplinary perspectives of musicology, acoustics, popular music studies, and music technology, the project drew on theories and empirical findings from culture and leisure studies, sociology, consumption research, psychology, and psychiatry to offer a multifaceted view of the electric guitar.

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<sup>11</sup> See Herbst 2016, 2017a, 2017d, 2017e, 2017f; Herbst, Czedik-Eysenberg, & Reuter 2018.

<sup>12</sup> See Herbst 2016, 2017c, 2019c; Herbst & Menze 2021.

<sup>13</sup> See Herbst 2016, 2017b, 2017e, 2018, 2019a; Herbst, Czedik-Eysenberg, & Reuter 2018.

### **3. Synopsis of the Research Findings**

This chapter summarises the main research findings and themes categorised according to the three overarching areas of electric guitar playing, technology, and culture. It should be noted that most publications cover more than one area because they are interrelated. The detailed methodological approach, individual results, and in-depth discussions can be found in the respective published studies.

#### **3.1 Electric Guitar Playing**

##### **3.1.1 Distortion**

###### ***Solo Guitar Playing***

The guitar's electrification introduced and expanded affordances (see Gibson, 1979) that led to changes in playing styles. Guitarists explored new forms of expression facilitated by using distortion. In his influential work, Paul Théberge (1997) suggests that distortion has "reinvented" the electric guitar. In line with this argument, Robert Walser (1993), Chris Cutler (1995), and Theodore Gracyk (1996) emphasise that the electric guitar must be distinguished from the acoustic guitar.

There are numerous historical examples of guitarists harnessing the effects of electrification. As early as the 1940s, blues guitarist Muddy Waters played the slide and vibrato techniques of acoustic Delta blues on the electric guitar (Waksman, 1999: 119–120). The exploration of the distorted sound's expressive potential reached its first peak in the 1950s when Clarence 'Gatemouth' Brown began using techniques characteristic of the electric guitar, notably feedback, two-handed tapping, and artificial harmonics (Palmer, 1995: 200ff). The 1960s and 1970s saw various creative misuses of technology: Dick Dale's creation of a roaring 'surf sound' through overloaded valve amplifiers (Compo, 1998: 187); Pete Townshend's interaction with feedback resulting from amplifiers at full volume (Waksman 2003a); Jimmy Page's appropriation of the violin bow (Waksman, 2003b: 125–126); Jimi Hendrix's psychedelic uses of distortion, feedback, fuzz, wah-wah, and various kinds of modulation effects (Whiteley, 1990; Waksman, 2001, 2003a, 2003b); Eddie Van Halen's characteristic legato playing in combination with his amplifier modified for higher gain (Walser, 1993: 67ff). Inspired by the affordances of the distorted sound, rock and metal players such as Ritchie Blackmore, Randy Rhoads, and Yngwie Malmsteen appropriated classical virtuosity while developing ways to overcome playing challenges through techniques like 'sweeping' (Walser, 1992).

The research project experimentally and analytically investigated the acoustic effects of non-linear harmonic distortion on guitar tone, as well as its influence on playability and expressiveness (Herbst, 2016, 2017a, 2017d, 2017f), extending Ulrich Dieter Einbrodt's (1997)



and Manfred Zollner's (2014) studies, which only tangentially consider aspects of playing. While the acoustic effects of distortion can be summarised in a few words—compression and 'sustain', extended frequency and harmonic spectrum, and greater noisiness (Berger & Fales, 2005; Zollner, 2014; Herbst, 2016: 25–43, 115–142)—its impact on playing is profound and ambivalent in terms of benefits and drawbacks. Distortion equalises the sound of individual guitar and amplifier models so that subtleties of picking, such as the position or angle of the plectrum, are easily lost (Herbst, 2016: 115–150). A more fluid sound is achieved by sustaining the notes, regardless of technique. An extended attack time, accompanied by noise, results in a less articulated note onset. Distortion can easily mask sloppy playing, which occurs when the hands fail to synchronise at fast tempi. By obscuring the lack of precision, playing with a distorted tone might go beyond technical ability, especially in terms of performance speed and accuracy (Herbst, 2017d: 239). For this reason, instrumental educational literature, journalistic publications, and discussions in guitar forums sometimes refer to the facilitating effect of guitar distortion as 'cheating' (Govan, 2002b: 18; Herbst, 2016: 245–255, 2017f). Professional metal guitar players express such criticism as 'fooling' or 'hiding behind' (Herbst, 2016: 314–321, 2017d: 242). A survey of electric guitarists (Herbst, 2016: 257–351) provided empirical evidence for the conclusions drawn from the experimental analyses (Herbst, 2016: 143–185, 2017a, 2017d, 2017f). When asked whether distortion facilitates or hinders specific playing techniques, the guitarists tended to confirm the facilitating effect in that it did *not* facilitate faster playing but masked inaccurate playing. Responses varied depending on whether the guitarists played different genres or were at various stages of their amateur or professional careers (Herbst, 2016: 257–351).

Playing fast is a constant theme in the electric guitar world (see Kitts & Tolinski, 2002; McIver, 2008; Rensen & Stösser, 2011), but there is more to it in terms of expressiveness. What is impossible on the acoustic guitar is possible on the electric guitar because distortion supports expression or even enables new ways of playing. Double stops, playing two notes on adjacent strings, is a standard technique in rhythm and blues and rock music, both of which benefit from the 'raw' effect of distortion due to the friction (sensory beating) created by the intensified overtone series (Herbst, 2016: 150–156). This rough sound is part of these genres' aesthetic, similar to African American soul music, which features "roughened up" vocal styles (Pfleiderer, 2010). However, the overdriven guitar does not rely solely on simultaneously fretted notes to achieve roughness and, thus, vocal qualities. Similarities between the overdriven guitar and the human voice have been asserted theoretically (Walser 1993; Jauk 2009). The present research (Herbst, 2016: 173–185) provides empirical evidence based on musical analysis. The desired tonal effect can be achieved by modifying guitar playing techniques and tone, much as a singer might modulate vocal timbre. As it is possible to influence tones in the attack on the guitar, vocal articulations are achieved in the sustain and decay phases, for example by sliding between pitches, 'blue notes', and controlled vibrato (Herbst, 2017d: 244). These means of expression resemble slide guitar playing with a

bottleneck common in blues but, in contrast, emphasise the melodic rather than harmonic qualities of the playing (Obrecht, 2003). The equivalent of a vocal falsetto sound can be produced through artificial harmonics and feedback (Herbst, 2016: 173–185). Switching between pickups facilitates the emulation of consonants and vowels (Traube & Depalle, 2004). Creating these effects is supported by the volume control potentiometer, which allows adjusting the gain level while playing the guitar through a distorted amplifier (Herbst, 2017d: 244). How the tone changes depends on the picking position, which is similar to an equaliser (see also Jauk, 2009: 268). Using a wah-wah pedal amplifies this effect, which, on the one side, helps to imitate different vowels and vocal expressions but, on the other side, makes the filter modulation less effective as the distortion level increases (Herbst, 2016: 181–185).

A technique more common on the electric than on the acoustic guitar is the playing of artificial harmonics (Herbst, 2016: 164–170), created by simultaneously striking the string with the plectrum and thumb. What is perceived as the root note is subject to the picking position because it determines which harmonics are cancelled out and which are not. Depending on how they are picked, the artificial harmonics either have no fundamental frequency or have a modified harmonic structure based on the fundamental frequency. Although the harmonic structure does not differ between clean and distorted guitar tones, higher distortion levels enhance the physical and perceptible presence of the distinct partials, making artificial harmonics a common means of expression in rock and metal music genres.

One technique not available on the acoustic guitar—unless amplified—is feedback (Gracyk, 1996: 110ff). It occurs when the instrument's output feeds back to the input, causing an oscillation between strings, pickups, and speakers (Herbst, 2016: 170–173). Increased distortion carries the risk of producing unwanted feedback, perceived as noise. However, when controlled, feedback opens up creative potential by increasing sustain to infinity. Jimi Hendrix popularised feedback with expressive techniques such as tapping on the guitar body and glissandi with the vibrato bar—techniques many guitarists have copied since their inception.

According to Waksman, what makes the electric guitar similar to its acoustic counterpart is that physical gestures are authentically translated into the sound produced (see also Moore, 2001: 157):

However much the electric guitar has involved the distortion or more general manipulation of sound via technological means, it remains at root very much a hands-on instrument out of which the sounds produced bear a more or less distinct relationship to the physical efforts of the musician. (Waksman, 2003b: 130)

The research (Herbst, 2016, 2017a, 2017d, 2017f) highlights distortion's significant impact on how the instrument responds to physical gestures. Technical challenges are reduced by the facilitating effects of frequency-specific compression, which likely contributed to the shred guitar style of the 1980s (Walser, 1992; see also Herbst & Vallejo, 2023) and the increasingly faster speeds in rock and metal solos (Slaven & Krout, 2016). Another advantage of distortion is that it offers affordances that enhance the guitar's potential as a solo instrument. In the

assimilation of the guitar with bowed string instruments and the singing voice, distortion brings out the melodic and expressive qualities of the guitar (Middleton, 1990; Walser, 1993; Cutler, 1995; Gracyk, 1996; Théberge, 1997). But there are also challenges unique to distorted guitar playing that do not exist for other instruments (Herbst, 2016: 239–255). The problem with distortion is that while it makes guitar models sound similar, it also reduces the sonic identity of playing techniques. That requires players to control noise, compensate for reduced dynamics, and put more effort into phrasing. To overcome these limitations and maintain control over tonal subtleties, guitarists must adapt their skills to the qualities of their overdriven or distorted tone. Hence, Waksman's (2003b) assertion that the distorted guitar has a definite relationship to the musician's physical exertion is only partially correct; acoustically, there is no perfect correlation. Some aspects of playing are amplified, others attenuated. The research (Herbst, 2016: 239–255) argues that players must learn to intentionally set distortion levels and deal with the effects of distortion in real musical situations. In these situations, distortion may need to be controlled during performance to meet technical needs (e.g., fast picking or phrases with picking and legato articulation) and to support expression. Playing with distortion requires considerable practice to gain full control of the instrument and harness its expressive potential. A sensible way to do this is to adjust the gain setting to suit each song's aesthetic, considering its effect on playability and expressiveness. Indeed, each song section or phrase may require adjusting the gain level via a footswitch or volume control. Another crucial step is coordinating note choice and articulation with the deliberate use of music technology because their interplay influences how the instrument responds to the player's gestures (Herbst, 2017d: 245).

### ***Rhythm Guitar, Distortion, and Chord Complexity***

Previous research has studied the harmonic structures of rock (Winkler, 1978; Baugh, 1993; Covach & Boone, 1997; Holm-Hudson, 2002; Stephenson, 2002; Everett, 2008; De Clercq & Temperley, 2011) and metal music (Lilja, 2005, 2015; Berger & Fales, 2005; Elflein, 2010). These studies pointed out that the music differs from the common practice of harmony based on the tonal syntax of 18<sup>th</sup>- and 19<sup>th</sup>-century European music in terms of chord progressions, voice leading, and harmonic complexity. Due to the powerful sensation (Walser, 1993) and dissonance created by distortion (Lilja, 2005, 2015), harmonic complexity has been claimed to be comparatively low because of the guitar's standard practice of playing 'power chords', pure fifth intervals. Some research has drawn on Hermann von Helmholtz's (1877/1954) tradition, arguing thus from a theoretical perspective that harmonic structures, more complex than a power chord, cause significant dissonance when played on a distorted guitar (Lilja, 2005, 2015). That line of thinking would explain why few other chords in rock and metal are played as often as the power chord (De Clercq & Temperley, 2011). Also commonly used are two triad chords:

1) Major chords are almost identical to power chords in their overtone structure, and because they produce pleasant sonority (i.e., consonance), they are frequently used in hard rock and power metal. Regarding power chords, Juchniewicz and Silverman (2011) have provided evidence that they tend to be perceived as major at the end of chord progressions. However, the auditory system's treatment of power chords as major chords is not supported by the findings of the only neurological study on that issue (Virtala et al., 2018). This study sees a "change in the distortedness of the chord (distorted vs. nondistorted) elicited larger and earlier change-related responses than a change in the harmonic structure (dyad vs. triad)" (Virtala et al., 2018: 325), indicating that it is not the harmonic structure but the sound quality to which listeners respond most strongly (see Herbst, 2019a).

2) Minor chords are often used in black metal because this harmonic structure creates a rough and dissonant effect when combined with distortion (Hagen, 2011; Reyes, 2013). Possibly due to generating too much dissonance (Lilja, 2005, 2015), minor chords are rarely played on the distorted guitar in rock music (De Clercq & Temperley, 2011).

The current project approached dissonance from several analytical and empirical perspectives, both qualitative and quantitative. What began as a theoretical and spectrographic analysis of a small sample (Herbst, 2016: 185–218, 2017e) was eventually extended by quantitative acoustic analyses and listening tests and published in further articles (Herbst, 2017b, 2018, 2019a), tailored to different audiences such as music psychologists (Herbst, 2017b, 2019a) and popular music and metal scholars (Herbst, 2018).

Building on the theoretical approach of Walser (1993) and Lilja (2005, 2015) and findings from music psychology on the "critical bandwidth" (Plomp & Levelt, 1965), spectral analysis (Herbst, 2016, 2017e) suggested that chord recognition in the higher overtones might not function as theorised in previous research because the human auditory system cannot fully discriminate higher-order harmonics. Furthermore, although the harmonic structures of power and major chords appear identical, the overtones' relative volumes are different and are likely to result in slightly distinct tonal qualities but with a similar degree of perceived consonance.

Drawing on the conceptual and empirical work of Ernst Terhardt (1984) and Wolfgang Aures (1985) on "sensory pleasantness", the project investigated the acoustic changes of increasing levels of overdrive and distortion in relation to harmonic structures and the correlation of these acoustic changes with listeners' perceptions (Herbst, 2017b, 2018, 2019a). These studies suggest that as gain levels increase, whether from clean to overdrive or from overdrive to distortion, there is a significant decrease in the parameters of sensory pleasantness: roughness, spectral flux, sharpness, loudness, and tonalness (Terhardt, 1984; Aures, 1985). Tonal quality has a greater impact on these parameters than harmonic complexity in acoustic terms. Loudness can be explained by the limited waveform resulting from distortion's characteristic compression effect. Increased sharpness likely arises from distortion's characteristic feature of strengthened higher harmonics (Berger & Fales, 2005), which tends to produce roughness (MacCallum & Einbond, 2008) and harshness (Grey & Gordon, 1978;

Zwicker & Fastl, 2007). The research found spectral fluctuation to be the parameter with the strongest interaction between guitar tone and chord structure. Responsible for this could be interval changes influencing the beatings of adjacent bands in the auditory system (Helmholtz, 1877/1954; Plomp & Levelt, 1965) and the enriched spectrum with extended harmonic and non-harmonic components enhancing this effect (Aures, 1985) (see Herbst, 2019b: 346). Again, in acoustic terms, tonal quality seems to have a greater effect on expected sensory pleasantness than chord structure, with spectral fluctuation, sharpness, and loudness enhanced by distortion causing the most dissonance. In auditory perception, structural complexity was found to be slightly more effective. Although the acoustic and perceptual results differed to some extent, both results confirmed the interaction between distortion level and structural complexity in relation to sensory pleasantness, providing an empirical foundation for the previous theoretical considerations (Walser, 1993; Lilja, 2005, 2015) and shedding light on the acoustic changes introduced by distortion with their perceptual responses.

The studies provide empirical evidence for the theoretical claim that power and major chords are perceived as significantly more pleasant—or less unpleasant—than minor and altered dominant chords (Herbst, 2017b, 2018, 2019a). The more distortion is added, the further perception drifts apart, concurring with Lilja (2005, 2015). Besides, a major chord played with a clean tone was perceived as more pleasant than the power chord. The perception, however, changes with an overdriven tone and even more so when distortion is added. In this case, the power chord is favoured over the major chord. These findings are consistent with musical practice in rock genres, showing that major chords dominate in less distorted rock styles (Cope, 2010; De Clercq & Temperley, 2011; Lilja, 2015). In contrast, power chords are mainly played in metal genres featuring heavily distorted guitars. Minor chords only play a significant role (De Clercq & Temperley, 2011; Lilja, 2005) in genres deliberately seeking unpleasant sounds, such as black metal. Listeners may still be captivated by such sounds for whatever reason— aesthetic, musical, or social (Berger, 1999; Hagen, 2011; Reyes, 2013) (see Herbst, 2019b: 347).

### **3.1.2 Contemporary Rock Guitar Playing Techniques and Virtuosity**

Research examining guitar virtuosity in rock and metal music (Walser, 1992; Waksman, 2003b; Heritage, 2016; Slaven & Krout, 2016; Fellezs, 2018) argued that playing became increasingly faster. However, such research narrows down developments up to the 1980s, the decade in which ‘shred guitar’ playing flourished the most. Apart from Vallejo (2021), next to no research examines the modification of existing playing techniques, the invention of new ones, or how electric guitar playing has evolved technically. This project contributes to knowledge by examining how the ‘shred practices’ in the 1980s developed further and, with them, the different ways of playing the instrument (Herbst & Vallejo, 2023; Vallejo & Herbst, 2024). As the 1980s have not yet been extensively researched either, this period has also been included in the analysis.

### ***The Rise and Development of the ‘Shred Guitar’***

In the 1980s, a new genre category emerged for fast and virtuosic electric guitar playing (in rock music): ‘shred’. Virtuosity had previously been associated mainly with the fusion of rock and classical music (Walser, 1992). However, since not all guitarists were classically oriented enough to be subsumed under the neoclassical label, ‘shred’ became synonymous with the virtuoso guitar genre (Waksman, 2003b). The research (Herbst & Vallejo, 2023: 28–34) argues that the US record label Shrapnel was crucial to this development because it supported promising virtuosos by producing and releasing instrumental albums. As is shown, Shrapnel Records was a major force in popularising virtuosic electric guitar playing. It was founded as a record company dedicated exclusively to metal, primarily intending to help the US guitar scene catch up with the burgeoning European hard rock and metal scene. Through its ‘Spotlight’ column in the *Guitar Player* magazine, Shrapnel quickly became the “American Idol for the chops-intensive guitar sect” (Lalaina, 2008: 70), laying the foundations for the careers of Yngwie Malmsteen, Paul Gilbert, Vinnie Moore, Shawn Lane, Scott Henderson, and bassist Billy Sheehan. Malmsteen is recognised in the research (Herbst & Vallejo, 2023: 29–31) for his influential role in the emerging shred scene (see also Walser, 1992; Heritage, 2016). His music may be controversial, and some reduce it to an uninspired copy of baroque and classical idioms (Walser, 1992; Heritage, 2016), but the research highlights Malmsteen’s contribution to the development of a classically inspired playing technique that allowed him to join the canons of the greatest guitarists (Herbst & Vallejo, 2023: 8–16).

Consistent with Slaven and Krout (2016), the research finds that few of the playing techniques virtuosos used in the 1980s and 1990s were entirely new (Herbst & Vallejo, 2023: 28–45). However, the virtuosos achieved higher speed levels by combining playing styles in various ways, which would become a crucial component of musical compositions in the ‘shred’ genre. The concentration on technical ability marked this ‘age of shred’ and distinguished the players from the earlier virtuosos. Alternate picking was further developed by transferring the 1970s ‘trick’ of repeating short pentatonic phrases to increase excitement to ergonomic three-note-per-string patterns for a dramatic effect and significantly higher playing speed (Basener, 2011: 12). Economy picking, also known as ‘speed picking’, is another technique that existed before the 1980s but was popularised by fusion player Frank Gambale in his instructional videos, influencing other virtuosos from the late 1980s onwards (George, 2020: 57). As shown (Herbst & Vallejo, 2023: 36–37), economy picking not only allowed for higher speeds, but it was also a way of avoiding the overly linear three-note-per-string lines characteristic of Shrapnel-style playing. Regarding sweeping, the research discusses several ways of applying the technique, including alternatives such as string skipping and chicken picking, which, unlike sweeping arpeggios, allow for even wider intervals and have therefore been considered more musical by some critics, musicians, and instructors such as Chris Zoupa (2018: 39). In terms of legato, palm-muted legato was explored for its more ‘percussive’ legato quality (Brooks,

2018: 105), using the picking hand like a tonal equaliser while retaining some of the features of legato. Other legato innovations discussed include ‘hammer-ons from nowhere’ (George, 2020) and Allan Holdsworth’s ‘descending hammer-ons’ as a non-guitarist way of playing melodic lines like a horn player (Brooks, 2018), all of which gave new impetus to the instrument.

### *The 21<sup>st</sup> Century*

The research (Herbst & Vallejo, 2023: 45–68; Vallejo & Herbst, 2024) proposes that developments over the last two decades have affected many areas of the guitar, from mechanical playing approaches to instrument and amplification technologies and their impact on playing. According to Slaven and Krout (2016), guitar-playing styles have remained unchanged since the 1950s. The research argues otherwise, pointing to advances in techniques for both hands concerning picking, legato, and percussive techniques like ‘thumping’.

Alternate picking has remained more or less the same; what has changed is that guitarists have found ways to improve the economy of motion, resulting in greater speeds and precision. The research (Herbst & Vallejo, 2023: 49–51) discusses some of these improvements, specifically how the pick is held for specific playing purposes. In line with Slaven and Krout (2016), it is suggested that playing has most likely become faster over time. More important, though, is that cleanliness and precision have increased, along with a shift towards less ergonomic melodic lines, reflected in an increased level of difficulty. Sweep picking is the most widely recognised technique to emerge from this development. It is argued that players have moved away from the long sweep-picking passages that were common in the 1980s (Heritage, 2016) towards special effects and as a means of connecting melodic lines or sections. In addition, sweeping patterns have continuously expanded the number of strings, beginning with two, three, and five in the 1970s and 1980s (Stump, 2017: 1), seven in the 2000s, and eight, nine, or more since the 2010s. One consequence of more strings has been adjustments to the technique, such as palm-muting the lower strings to improve note definition in the lower registers.

The most significant development in legato playing concerns tapping. Contrary to the ‘shred tapping’ approach of the 1980s to maximise playing speed on one string (Walser, 1992), contemporary guitars use tapping for large intervallic leaps in a melodic context or as a riff. The research (Herbst & Vallejo, 2023: 53–58; Vallejo & Herbst, 2024) shows that while multi-finger tapping has been performed for a long time (Walser, 1992; Waksman, 2001, 2003b), the mechanical and musical approach to the technique has broadened. First, the research introduces ‘linear multi-finger tapping’, which involves playing arpeggios, melodies, and complex textural passages using both hands in synchrony to achieve piano-like chord voicings and cascading scale runs. Second, the research sheds light on even more complex tapping techniques, best described as ‘multi-role’ or ‘pianistic’ tapping, where both hands share

harmony and melody. The research illustrates how this technique is applied to extended-range and standard six-string guitars, how open and alternate tunings facilitate it, and how it is no longer just associated with the shred metal solo. Finally, it demonstrates how guitarists like Josh Martin continue to develop novel approaches to tapping, such as ‘butterfly tapping’, ‘glitch tapping’, and a related technique called ‘under-strumming’.

The most innovative players in guitar history have drawn inspiration from other instruments, including bass and percussive instruments (Govan, 2002a; Thorpe, 2016). A prominent example is guitarist Eddie Van Halen, who already used tapped harmonics by percussive ‘slap-tapping’ on the fret-wire (see Waksman, 2003b). However, despite their relevance for lead playing, percussive techniques have hardly been systematically researched. The 21<sup>st</sup> century saw the emergence of a new percussive approach: ‘thumping’. In its short history, thumping has had a significant impact on guitar playing. The research (Herbst & Vallejo, 2023: 58–60; Vallejo & Herbst, 2024) discusses its emergence and spread along with the gear and tonal settings required to perform it. Thumping facilitates various approaches, allowing for rhythmic foundations, layering voices, bridging melodic and percussive parts, and being used as a textural tool. By offering new expressive qualities, thumping has quickly become a widespread technique within the guitar scene (Herbst & Vallejo, 2023: 58–60; Vallejo & Herbst, 2024).

Virtuosity has generally been discussed in relation to solo playing and performance (Walser, 1992; Waksman, 2003b; Heritage, 2016; Slaven & Krout, 2016; Fellezs, 2018) but less so regarding accompaniment and composition. The research (Herbst & Vallejo, 2023: 60–64) extends the existing literature by considering virtuosity in the broader context of creativity and songwriting. The main argument is that artists in the contemporary guitar domain are no longer mere virtuoso performers. Instead, today’s virtuosos should be understood as musicians with a wide range of skills: Technical ability if they want to be considered virtuosic; creativity in their compositions; and the ability to record, mix, master, and produce music. Contemporary guitarists tend to view their virtuosity as an interconnected combination of playing skills used for traditional lead and song-oriented rhythm playing. They must be masters of rhythmic virtuosity, not just in progressive metal in the tradition of Meshuggah (see also Hannan, 2018) or djent following successful artists like Periphery (see Marrington, 2019).

The research (Herbst & Vallejo, 2023; Vallejo & Herbst, 2024) concludes that contemporary virtuoso and instrumental guitarists are increasingly independent artists, exploring novel ways of playing the guitar and writing progressive music, likely with little regard for genre restrictions and commercial considerations. They gain recognition through originality, pushing the instrument’s boundaries, creativity, and technical command. With expanding virtuosity, creative achievements in composition and improvisation are crucial to gaining recognition. The research argues that the standard of the contemporary virtuosic guitar scene is high, with the bar of expected technical ability rising ever higher. In addition to solo techniques, these guitarists master rhythm, expressive tone, and technology in much the same



way as the first-generation guitar heroes, with one distinct difference: They require skills far beyond playing the instrument. Contemporary guitarists write, arrange, record, and produce their music in a DIY fashion, often adding electronic beats, live electronics, and other forms of modern sound design.

## **3.2 Electric Guitar Technology**

### **3.2.1 Equipment Acquisition and Preference**

Special-interest books for guitar players, journalistic magazines, and books (Wright, 2006), (auto-)biographies, and research (Fernandez & Lastovicka, 2011; Hartmann, 2016; Cole, 2018) all point to a technologically deterministic tendency among many electric guitarists. Musical practice is shaped by broader cultural, social, and psychological motivations (Waksman, 2003c). It necessarily involves associated attitudes as part of a player's identity like technophilia (Coulthard & Keller, 2012) or, conversely, technophobia (Bayton, 1998), or more generally, openness to innovation as opposed to a sense of tradition (Gay, 1998; Pinch & Reinecke, 2009). Empirical research has also suggested that personality traits differ between musicians of various instruments (Bell & Cresswell, 1984; Cameron et al., 2015; Rötter, 2018).

The current project approaches the area of equipment acquisition and preference from two angles: 1) A mixed-methods study (survey and interviews) of guitarists about their rigs and the unique role of the distorted sound (Herbst, 2016, 2019c); 2) a mixed-methods study (survey and netnography) on the 'Gear Acquisition Syndrome', comparing guitarists, bassists, drummers, keyboardists, saxophonists, and trumpeters (Herbst & Menze, 2021; see also Herbst, 2017c).

#### ***The Guitar Rig and the Role of the Distorted Sound***

The survey of electric guitarists (Herbst, 2016: 257–351, 2019c) demonstrates that these musicians value high-quality guitar sounds. That shows in an extensive equipment collection comprising, on average, four instruments and three amplifiers, and in some cases, considerably more. The results suggest that specific tones, playing requirements, or mere interest in musical gear account for sizeable collections (see also Herbst & Menze, 2021: 133–226). Particularly in the case of amplifiers, there are robust indications that players own several devices to achieve different sounds suited to specific genres. Genre-specific models also seem to be preferred for guitars and pedals, albeit the genre's influence is less pronounced than for amplifiers. Experimentation with sounds and tinkering was found to vary between players. Beginners experiment with various guitar shapes and pedals, while more experienced players carefully select amplifiers, cabinets, and loudspeakers, suggesting a shift in focus from instrument to amplification. Novice players may develop a preference for a distinct sound and feel for an instrument through direct contact but are unlikely to notice or pay as much attention to the

nuances of amplification chains as more experienced players do. Overall, the desire for an individual, innovative sound seems to increase with expertise.

The results (Herbst, 2016: 257–351) further suggest that the relevance of an individual tone increases with growing experience and expertise, which is accompanied by increasing awareness of tonal subtleties and the technical skills to utilise them in playing. The study, therefore, contributes empirical evidence to the literature's theoretical claims (Walser, 1993; Gracyk, 1996; Th  berge, 1997; Waksman, 1999, 2003b) that a close connection exists between equipment choice, tone, and individual playing style.

Lawrence Grossberg (1992), Theodore Gracyk (1996), and Allan F. Moore (2001) have argued that rock music and its culture are tradition-conscious. In this regard, several studies have pointed to the popularity of vintage equipment among guitarists (Fernandez & Lastovicka, 2011; Uimonen, 2018), in line with special interest magazines like *Vintage Guitar*. General guitar magazines such as *Guitar* and *Guitar Player* reinforce this impression by regularly featuring vintage gear (see also Herbst & Menze, 2021). Overall, the results (Herbst, 2016: 257–351) confirm the assumption of vintage-minded guitarists, but not for all players due to genre preferences. Blues and rock players were expected to be more tradition-conscious than metal guitarists, which is supported by the types of guitars, amplifiers, and pedals they chose and the rationales for their choices. Most blues and rock players seem to adhere to established conventions of electric guitar culture. Openness to innovations and modern technologies is most evident in newer and progressive forms of metal.

Given the profound influence of distortion on the guitar's playability (Herbst, 2016, 2017a, 2017d, 2017f) and aesthetics (Ostberg & Hartmann, 2015; Herbst, 2016), it was also assumed that the quality of the distorted tone would be of considerable relevance to guitarists, especially those playing genres known for a distorted guitar sound, such as the various subgenres of blues, rock, and metal. The two parts of the study (Herbst, 2016: 257–351) only partly coincide. On the one hand, distortion is confirmed as a relevant criterion for amplifier selection by most players surveyed, from amateurs to professionals. Conversely, the notion that distortion is the only important tone is not widely shared. As might be expected, genre preference is a key factor in this result. Metal and hard rock players value the distorted tone the most, and blues musicians and players of styles other than rock and metal value it the least. Many players believe distortion hinders the instrument's expressive potential and reject to limit themselves to the distorted sound. Others see the problem of distortion as leading to an undesirable sound aesthetic. The qualitative interviews indicate that professional musicians are free from such concerns. They are not forced to choose a sound quality because custom-made equipment gives them access to a wide range of tones, from clean and overdrive to various distorted tones for lead and rhythm playing. All the professionals interviewed need to have the right tones, including distorted ones, so they go to great lengths to achieve them. Besides, the right sounds are perceived as necessary for their playing and artistic visions.

### ***Gear Acquisition Syndrome***

In his influential work, *Any Sound You Can Imagine: Making Music/Consuming Technology*, Paul Théberge (1997: 245) argues that consumption has become an integral part of musical practice. In the twenty years since, the consumption behaviours and motivations of instruments and related gear have rarely been studied, with the exception of music production equipment (Cole, 2011; Carvalho, 2012; Crowdy, 2013; Williams, 2015; Kaiser, 2017; O’Grady, 2019). Consumption research offers many concepts, allowing us to understand why musicians might want to invest in equipment. Motivations include viewing possessions as part of the ‘extended self’ (Belk, 1988), treating instruments with ‘desire’ (Belk et al., 2003) or as a ‘fetish’ (Fernandez & Lastovicka, 2011), or viewing them as a ‘necessity’ (Braun et al., 2016). Other fruitful approaches include ‘serious leisure’ (Stebbins, 2009) and ‘nostalgia’ (Davis, 1979; Boym, 2001; Taylor, 2001; Pinch & Reinecke, 2009; Williams, 2015). This project was particularly interested in the role of sociodemographic variables and other personal, social, and musical motivations in instrument consumption and whether players of various instruments differ in their purchasing behaviour.

The research (Herbst & Menze, 2021) suggests that the ‘Gear Acquisition Syndrome’ is prevalent among a considerable proportion of popular music players (in the sample population). That shows in their purchases of unneeded equipment, with more money likely to be spent on gear than is musically necessary in order to satisfy the urge to own something new, believing that another piece of gear will make them a better musician. Evidence of such behaviour can be found in analysed musicians’ message boards, online blogs, special-interest books, and the conducted survey (Herbst & Menze, 2021).

There are several musical reasons why players may wish to upgrade their gear (Herbst & Menze, 2021: 23–36), be it to maximise expressiveness and adhere to genre expectations or for stylistic flexibility. Musical preferences, role models, and developing expertise may require changes or upgrades to a musician’s equipment. Customising a sound to create a unique personal sound (Théberge, 1997) becomes relevant for many musicians as they progress.

The research (Herbst & Menze, 2021) also identifies personal motivations that shape a musician’s use of gear. In line with Russel W. Belk (1988), the findings suggest that musicians perceive their rig as part of their ‘extended self’. The rig serves multiple purposes, representing dreams and aspirations, characterising lifestyles, and facilitating memberships. It may be a prerequisite for a musician to join communities where the equipment is part of the discourse and is needed to build bonds and determine their position in the social hierarchy (Herbst & Menze, 2021: 75–131). For this reason, instruments often have a broader meaning than just being tools for making music.

Sociodemographic factors are also found to be relevant (Herbst & Menze, 2021: 133–226). The research suggests that middle-aged musicians tend to own the most equipment, that younger musicians often lack the budget to afford the gear they want, that the desire to acquire

new instruments diminishes with age, and that romantic relationships and family responsibilities limit the time, money, and emotional investment in researching and buying gear. Musicians with more playing experience also own more equipment. As might be expected, collecting as a hobby is also associated with a higher number of items owned. Regarding gender, the results are inconclusive yet indicate that female and non-binary musicians, who have not previously been considered to be affected by GAS (Becker, 1996; Wright, 2006), do not substantially differ from male musicians. GAS seems to be less overt in women but just as pronounced as in men (see also Shuker, 2010).

Due to the original term '*Guitar Acquisition Syndrome*' (Becker, 1996; Wright, 2006), guitarists, especially those favouring the electric guitar, were perceived as the musicians most susceptible to GAS. The research (Herbst & Menze, 2021: 56–59) confirms that the discourse in special-interest books is much more equipment-centred for the electric guitar than for most other instruments, including the acoustic guitar, except for the synthesiser. This impression fits well with theoretical considerations in the music technology literature that suggest technological determinism (Gay, 1998; Pinch & Reinecke, 2009). Nevertheless, both studies—the musicians' survey and the netnographic analysis of musicians' message boards—provide evidence of relatively small differences between instruments (Herbst & Menze, 2021: 133–226).

Roy Shuker (2010) concludes his book-length study of record collecting with the insight that no single definition holds for the 'record collector' because of the diversity of motivations and practices. This conclusion can be applied to GAS, which does not allow for a simplistic definition or theory. There is too much to it, the wide range of practices, intentions, and opinions observed among musicians, alongside discourses and data on equipment. The research (Herbst & Menze, 2021) suggests that GAS has become a convenient and, therefore, widely used term that encompasses various practices related to musicians thinking about and using their equipment. As gear accompanies musical learning processes, exploring its creative and expressive affordances may thus be understood as part of musical expertise. Making music requires adaptation as personal circumstances and ambitions change and interest in gear fluctuates throughout life. However, this has little effect on GAS, which is the seemingly constant companion of many musicians at all levels of their amateur or professional careers.

### **3.2.2 Advances in Electric Guitar and Amplification Technologies**

Electric guitar communities and cultures (Herbst, 2016; Herbst & Menze, 2021) tend to stick to tradition, but this attitude has not prevented the instrument's technologies and playing styles from evolving. The research shows how musical and technological progress have gone hand in hand (Herbst, 2016: 51–67) and how the guitar sound in rock music has evolved over time (Herbst, 2016: 68–105, 2017a), from imitating horn players and singers to establishing a unique sonic signature of the distorted electric guitar as an instrument (Ostberg & Hartmann, 2015) and for various subgenres of rock and metal (e.g., Cope, 2010; Elflein, 2010; Mynett, 2017). It

also demonstrates how the instrument's frequency spectrum gradually expanded in the higher and lower ranges (Herbst, 2016: 78–84, 2017a), how guitarists acquired engineering skills and became producers to be able to shape their sound according to their intentions (Herbst, 2016: 84–95), and how the appreciation of 'classic' or vintage sounds of the 1960s and 1970s competed with the artistic pursuit of new expressive forms afforded by technological innovation (Herbst, 2016: 95–106, 2019b, 2023; Herbst & Vallejo, 2023).

Relatively little research exists on the electric guitar's technological developments, apart from popular historians, journalists, and biographers writing for an audience of collectors and guitar enthusiasts (see Waksman, 2015). The only source covering the more recent extended-range guitar is a master's thesis (Gil, 2014). Building on this work, the current project (Herbst & Vallejo, 2023: 45–49) explores milestones in the development, appropriation, and use of extended-range guitars. It highlights that creative exploration of guitar gear has been prevalent from the 1960s to the 1980s, culminating in collaborations between influential guitarists and international manufacturers. As a result of these collaborative explorations, equipment became accessible to ordinary guitarists. Eddie Van Halen was involved in the development of the Floyd Rose tremolo system (Tolinski, 2017: 252–253), the 'superstrat' guitar design, and his high-gain 'brown sound' (Waksman, 2004). Collaboration with manufacturer Ibanez led to an increase in the number of frets from 22 to 24, the introduction of the humbucker-single coil-humbucker configuration, the innovation of the tremolo system to modulate pitch up and down, and the release of the first mass-produced seven-string guitar, all credited to Steve Vai (Tolinski, 2017: 261–262). The research (Herbst & Vallejo, 2023: 46) shows how the seven-string guitar inspired industrial and nu metal in the 1990s after an initial lack of popularity (see also Gil, 2014). The guitars were utilised by progressive bands such as Meshuggah, Periphery, Animals As Leaders, and Tesseract, who took advantage of the new affordances by developing the rhythmic 'thumping' technique, playing complex chords, multi-finger tapping, eight-string sweep picking, and forms of soloing that crossed genre boundaries. These bands popularised extended-range guitars with eight, nine, and ten strings. The research (Herbst & Vallejo, 2023: 45–49) further addresses how contemporary guitarists continue to collaborate with guitar manufacturers to advance instrument design and how some set up businesses to offer other "visionary players the creative tools to break boundaries", "new realms of sound, responsiveness, or ergonomics", and "exceptional sonic depth and playability" (Abasi Concepts, 2020). Moreover, the research (Herbst & Vallejo, 2023: 45–68) studies the performative and compositional affordances of these innovations in guitar technology, as described in Chapter 3.1.2.

In terms of amplifiers, the research documents the general reluctance of many guitarists to accept technologies other than the traditional valve. It explores the novel 'profiling technology' that produces authentic valve sound with a digital design (Herbst, 2016, 2019b, 2023; Herbst, Czedik-Eysenberg, & Reuter, 2018), as well as the current trend of young virtuosos adopting digital amplifiers and simulations for their playing (Herbst & Vallejo, 2023).

As the research shows (Herbst, 2016, 2019b, 2023; Herbst, Czedik-Eysenberg, & Reuter, 2018), guitarists have traditionally rejected innovations in amplifier technology such as transistor designs and hybrid systems of valve pre-amplifier and transistor power amplifier due to believed inferior sound quality or merely for ideological reasons. In 2011, profiling technology was introduced, promising to retain all the benefits of digital devices while authentically capturing and recreating a valve amplifier's sound. This project pioneers a study that examined the technology's discourse and acoustically tested its quality (Herbst, Czedik-Eysenberg, & Reuter, 2018). The quantitative and qualitative analyses find robust evidence of similarity between the original valve sound and its digital copy. A listening experiment has recently confirmed this finding (Düvel, Kopiez, Wolf, & Weihe, 2020). Other research in this project (Herbst, 2019b, 2023) explores why the technology still faces rejection. It finds a mixture of ideological, economic, and workflow reasons alongside claims of inferior audio quality (Herbst, 2019b). However, the practical and acoustic benefits confirmed by other guitarists and producers have led many sceptics to embrace the technology as a supplement or replacement for the traditional recording setup (Herbst, 2023).

In today's world of guitar virtuosos and among many younger players, the old valve technology has lost much of its relevance because it is inflexible, expensive, and cumbersome to maintain, the findings suggest (Herbst & Vallejo, 2023: 47–49). Many contemporary guitarists appreciate the benefits of digital technologies in the form of physical hardware amplifiers or digital simulations within the computer, which allow them to record their guitar at a professional level, independent of access to traditional recording studios. There are strong indications that digital technology is being adopted to provide greater control over tone and produce cleaner results, yet players must achieve a new level of technical precision (see also Shelvock, 2014). While guitar simulations used to be meticulously modelled after analogue hardware devices, such as Line 6 Helix and Fractal Audio's Axe-FX, there are increasing attempts to bring digital sounds to hardware amplifiers. It is argued (Herbst & Vallejo, 2023: 48–49) that Neural DSP's Quad-Cortex is one of the first devices to bring original plugin simulations to the live stage. By embracing a postmodern openness and collaborating with smaller enterprises, the research (Herbst & Vallejo, 2023: 45–49) suggests that virtuoso guitarists of the 21<sup>st</sup> century are innovating electric guitar technology without the ideological constraints that have long dominated the guitar community. The complexity of digital signal processing prevents many guitarists from developing technological innovations on their own. With futuristic visions that follow their long-standing DIY spirit, they make a significant contribution to the new ideas adopted by equipment manufacturers.

### **3.2.3 Capturing and Shaping the Electric Guitar in Record Production**

No study of the electric guitar sound can avoid considering the role of engineering, as the instrument is usually captured by a microphone (or direct injection) and audio-processed on stage and in the studio. This project focuses on the engineering of the (distorted) electric guitar

in the recording studio (Herbst, 2016, 2017a, 2018, 2019b, 2023). It extends general, genre or instrument-specific recording manuals (Huber & Runstein, 2005; Rumsey & McCormick, 2006; Bartlett & Bartlett, 2009; Chappell, 2010; Mynett, 2017) by gathering acoustic evidence of common practices in terms of microphone placement, equaliser settings, and playing techniques, as well as ideological and aesthetic considerations in recording the instrument.

The experimental research into production techniques (Herbst, 2016: 218–232, 2017a) investigates the effectiveness and effect of various standard production techniques. Density is key to producing a ‘full’ guitar sound, which is most effectively achieved through spectral density. The research (Herbst, 2017a) suggests that recording and combining guitars with different timbres is one of the most typical approaches, albeit the least effective. Much greater variance can be achieved by combining different sounding amplifiers and adjusting or varying the playing technique. Equalisers make it possible to shape the sound far beyond the tonal nuances of individual guitar models. Overdrive pedals and distortion levels proved to be the best equipment-based choices for shaping the sound, spectral variety, and density. Although not too effective, an important variable is the microphone’s position, the technical aspect most emphasised in audio engineering manuals. Microphone direction and distance seem to have the same influence on the frequency spectrum, although with different effectiveness in the frequency bands.

Layering guitar tracks is a standard recording technique in rock and metal to maximise sonic density and fullness of sound (Mynett, 2017). However, it is challenging to examine layered tracks acoustically (Herbst, 2016: 218–232, 2017a) because different guitars, amplifiers, and amplifier settings result in predominantly small measurable spectral differences, with most effects in the mid-bass, high mids, lower highs, and highs, and a gradual shift towards a ‘scooped sound’ characterised by reduced power in the mid-frequency spectrum (Berger & Fales, 2005). Concerning the use of the same or different sounds on both stereo channels, the research (Herbst, 2017a) concludes that similar sounds seem to create a balanced impression beneficial for the wall of sound. In contrast, different sounds add a vertical dimension to the stereo width.

### **3.3 Electric Guitar Culture**

#### **3.3.1 Canons in Electric Guitar Playing**

Research on the canons of the greatest guitarists is still rare, not focused on the topic, or not included in peer-reviewed publications (Bannister, 2006; Lee, 2015, 2016). This project aimed to explore how guitarists enter a canon and what artistic attributes they require. The findings (Herbst & Vallejo, 2023: 6–8) suggest that there are similar criteria to literary works and other popular music: Originality, timelessness, complexity, positive virtuosity in the form of creativity and innovation, expressiveness, and artists being ahead of their time (Kermode, 1985; Talbot, 2000; Heister, 2004; von Appen & Doehring, 2006; Jones, 2017).

The analysis of thirty manuals (Herbst & Vallejo, 2023: 8–9), representative of the educational curriculum and a canon in itself, shows the frequency with which specific guitarists are mentioned, acknowledging the players' exceptional technique and creative use of it. The list contains mainly rock and metal players, with fusion being a notable exception. Most guitarists listed rose to fame in the 1980s as members of popular bands or as solo artists, some with continued success in the 1990s and beyond. Of those active since the 2000s, only two more recent players are on the list. The results suggest that long-established guitarists are favoured and that guitar handbooks focus on their approaches to technique. On the other hand, contemporary guitarists who are influencing the current scenes are largely ignored.

Greatest lists are a simplified and condensed form of a canon, providing useful information about the core values and notable contributions of specific players to guitar communities. The research (Herbst & Vallejo, 2023: 9–16) finds that the various canons sometimes overlap, as demonstrated by: The greatest and most influential players of all time; the greatest metal players; the greatest virtuosos and shredders; and the greatest newcomers of the last decade. Such lists offer aesthetic guidance by naming “who deserves to be in the pantheon and what is worthy to emulate” (Weinstein, 2013: 149). Analysis of the thirty lists of the greatest guitarists suggests that they differ from manuals in that they are less restricted to technical ability and instead set broader selection criteria (Herbst & Vallejo, 2023: 8–16). Influence, originality, and technique are essential criteria, with influence carrying the most weight. Influence is determined by reference to innovation; pushing the boundaries; stimulating the imagination; igniting the flame to pick up and change the approach to the instrument; the overall impact on the guitar scene, and the level of success. Several sources acknowledge the development of guitar playing over the last two decades, speaking of a “golden age in the guitar world” and emphasising that young players emerging from the underground are ahead of their “elders and betters” (McIver, 2008: 9). In popular music and beyond, virtuosity has often had negative connotations (Walser, 1992; Fellezs, 2018); in the electric guitar domain, however, it tends to be seen as a hallmark of playing and thus important for musical progress (Herbst & Vallejo, 2023: 8–16).

The research (Herbst & Vallejo, 2023: 28–45) contends that the 1980s and 1990s were the two decades when guitarists needed only a few qualities, such as mastery of a particular playing technique, to become known. Many of them were shred guitarists of the so-called ‘golden age’. In contrast, the first generation of guitar heroes in the 1960s and 1970s (Millard, 2004d, 2004e; Weinstein, 2013) needed several trademarks, such as playing, technological innovation, or showmanship, to be influential. Following the ‘technique versus emotion’ debate (Waksman, 2003b), it is shown that in the 1980s and 1990s, virtuosos who could play the blues were able to bridge the gap in order to distinguish themselves and set an example against the widespread criticism of emotionless shredding (Herbst & Vallejo, 2023: 39–40). In other cases, players were included in the canon solely on the basis of their technical prowess, primarily for exceeding speed limits. The mastery of harmony and theory and, conversely, the emphasis on



basic scales like the pentatonic and the demonstration of stylistic versatility have also enabled virtuosos to enter the canon. Groove is a less appreciated feature and has only been attributed to a few players. Primary areas of appreciation are the ability to emulate other instruments with the guitar, for example, inspired by horns, violin, organ, banjo, pedal steel, slap-bass, mellotron, piano, and the Japanese koto (Govan, 2002; Thorpe, 2016, 2019; George, 2020; Neyens, 2020). “Virtuosity of sound” (Waksman, 2003b, 2004) has proved to be another appreciated form of virtuosity in Jimi Hendrix’s tradition (Walser, 1992; Weinstein, 2013), which was not followed by many players in the 1980s and 1990s. Contemporary players seem to value sonic virtuosity as well as compositional and technical virtuosity. However, canons rarely include current guitarists (Herbst & Vallejo, 2023: 8–16).

### **3.3.2 (Virtual) Communities of Practice**

Virtual guitar communities of practice have seldom been the focus of research, or in rare cases, research has been limited in perspective and location (Hartmann, 2016; Cole, 2018). This project studied two sub-areas: 1) How equipment is negotiated in general electric guitar message boards in relation to ‘Gear Acquisition Syndrome’ (Herbst & Menze, 2021); 2) how the contemporary virtuoso guitar scene unfolds on social media (Herbst & Vallejo, 2023).

#### ***Gear Acquisition Syndrome in Online Message Boards***

The project examined how equipment is discussed in virtual communities in two studies with two different research designs: A standardised survey of participants recruited on online message boards (Herbst & Menze, 2021: 133–180) and a qualitative netnography of online musicians’ forums (Herbst & Menze, 2021: 181–226). The studies are not limited to the (electric) guitar but evaluate different instruments to analyse practices and how guitarists compare with other instrumentalists. They extend the survey of electric guitarists in Herbst (2016) with a stronger emphasis on gear-related practices, extending the earlier focus on guitar distortion and related technology to include more general attitudes towards equipment and its use.

The survey (Herbst & Menze, 2021: 143–180) finds evidence that musicians of popular music consider equipment important because it is part of their artistic practice (see also Théberge, 1997) and their ‘extended self’ (Belk, 1988). The survey results are already summarised in Chapter 3.2.1 and will not be repeated here.

Online message boards for musicians are a rich source for sociological and musicological inquiry (DeNora, 2004). They do not replace local scenes but work in tandem with them and influence each other (Bakardjieva, 2003, 2005). The netnographic research (Herbst & Menze, 2021: 181–226) aimed to understand the Gear Acquisition Syndrome (GAS) discourse in these communities of practice by investigating how explicitly the phenomenon is discussed in the general negotiation of meaning, what cultural practices are associated with it, whether it is a

shared practice that defines the community, and, if so, to what extent GAS is a learned behaviour resulting from participation in the community.

The findings show that the three dimensions of ‘Communities of Practice’ (Wenger, 1998) occur in musicians’ message boards (Herbst & Menze, 2021: 181–226). In these forums, unwritten rules, knowledge, and norms are shared (‘mutual engagement’), reference is made to other boards and offline practices (‘joint enterprise’), and a shared discourse, characterised by routines, events, stories, and jargon (‘shared repertoire’), is produced. Although GAS is present in all three dimensions, it does not constitute itself in the communities, except in the equipment-centred groups, where it is a central part of the community discourse. Interestingly, all communities analysed indicated that knowledge of GAS was a prerequisite for joining the community. GAS is discussed in dedicated threads and is frequently brought up as a ‘running gag’ in non-GAS conversations. An interest in gear is generally seen as a positive trait if it is a conscious choice and not an excuse or distraction for those who wish to advance as players. Community members accept GAS as an integral part of their musical practice, linked on the one hand to musical progress, motivation, and practice, and on the other to boredom and lack of purpose or direction. It is only when there is a mismatch between playing and GAS or when musicians buy equipment on credit that GAS is considered a problem. Usually, it is treated with humour. A closer look at the discourse reveals a more serious engagement with gear; many musicians seem aware of the risks of unhealthy behaviours and monitor their practices.

Compared to similar forums for music producers (Cole, 2011; Carvalho, 2012; Crowdy, 2013; Williams, 2015; Kaiser, 2017; O’Grady, 2019), the research suggests that musicians’ boards are far less competitive (Herbst & Menze, 2021: 224–226). Members enjoy their “guilty pleasures” together because owning and buying equipment would be much less enjoyable if the pleasure was not shared with like-minded people. New acquisitions are celebrated regardless of musical necessity and use. Consequently, buyers rarely post audio or video recordings of themselves playing newly purchased gear. If musical necessity is ever questioned, it is usually by the buyers themselves.

Concurring with some of the literature (Wright, 2006), a popular notion is that guitarists are more gear-centric than other instrumentalists. This view is not supported by the two empirical studies—the survey and the analysis of message boards (Herbst & Menze, 2021: 133–226). Guitarists may be more vocal about their gear-related urges and desires; otherwise, non-guitarists are just as likely to discuss their instruments and take ‘GAS tests’ to determine their level of affliction.

### *Contemporary Virtuoso Electric Guitar Scene*

To date, no studies of contemporary virtuoso guitar scenes exist. This pioneering research (Herbst & Vallejo, 2023) analyses the scene’s online practices in two respects: 1) How playing perfection is viewed and treated on the internet regarding authenticity and ethics; 2) how the

internet provides income opportunities that enable contemporary performers to make a living from their music.

The research (Herbst & Vallejo, 2023: 64–67) locates contemporary electric guitar virtuosity within a longer tradition in popular music, revealing conflicts between performance and recorded music over authenticity. Building on work by Grossberg (1992), Moore (2002), and Waksman (2003b), it shows that a traditionalist ideology that values authenticity of expression (Moore, 2002) is still present in the contemporary guitar scene. Using the example of the power metal band Dragonforce, who have had to prove their authenticity in their live shows because they have been repeatedly accused of speeding up their records (Seth, 2017), the research examines the notion of the ‘superhuman’ and the competitive advantage that virtuoso guitarists gain in the marketplace by outperforming other virtuosos (see Turner, 2015; Leech-Wilkinson, 2018). It highlights the demand for perfection and the state of constant competition that puts pressure on musicians to constantly improve their level of playing, which has led to several scandals on Instagram and YouTube in late 2019, with virtuosos accused of faking their video-recorded performances (Astley-Brown, 2019a, 2019b). By analysing the discourse on Instagram and YouTube, the research finds that guitarists are caught in a paradox: They cannot publish a spontaneous, ‘authentic’ video of their playing, but neither can they afford to release anything less than perfection. Even if the performances are perfect, guitarists must prove their authenticity or be accused of cheating. In today’s progressive guitar scene, performing virtuosity is required even for those who do not explicitly aspire to it. Success is inevitably linked to technical ability. Even musicians who see themselves as artists and composers rather than virtuoso performers are rarely exempt from this pressure (see also Leech-Wilkinson, 2018).

Analysis of videos accusing guitarists of faking and videos explaining how to spot fakery provide clues to the aesthetic and ethical values of the current scene, according to the research’s findings (Herbst & Vallejo, 2023: 64–67). Faking is deemed unfair to players who do not cheat, as it sets the bar for speed and cleanliness at an unattainable level, creating unrealistic goals for aspiring players, negatively affecting mental health (Mann, 2019) and potentially “kill[ing] the future of this instrument for the next generation” (Gardiner, 2019). The YouTubers studied argue that beauty lies in imperfection, with the guitar’s characteristic string noise, variations in pick attack, and slightly off-pitch bendings. They concede that while perfect performances have aesthetic value and may be essential to the realisation of compositions, ‘touch-ups’ must be made transparent for the sake of fairness to other players. Such honesty applies not only to highly technical performances but also to neo-soul players, who claim to have ‘come up’ with a song in less than an hour that is, in fact, meticulously produced. The same goes for the ‘perfect improvisation’, which is nothing other than fully composed (Gardiner, 2019; Todd, 2019). The research (Herbst & Vallejo, 2023: 64–67) concludes with a case study of accusations and reactions of the players involved, showing that toxic accusations on the internet can lead to physical threats, career setbacks due to mental health issues, and loss of endorsement

opportunities (Mann, 2019). All of this demonstrates the seriousness with which the scene takes perfection and authenticity.

For decades, fans have critiqued electric guitar playing, if only to discuss their favourite virtuoso (see, e.g., McIver, 2008). Global connectivity, video, and social media platforms have exacerbated this toxic atmosphere. As the research discusses (Herbst & Vallejo, 2023: 64–67), guitarists may be disproportionately affected by negativity compared to other instrumentalists (see also Astley-Brown, 2020). In the guitar community, musicians are under scrutiny and must prove that their technical skills are authentic, as a key component of integrity and commitment. That is especially true for guitarists who surpass the norm; their videos and live performances must be free of fakery. Traditionalist authenticity in the romantic tradition (Moore, 2002; Waksman, 2003b) seems no less important than in the past, despite the music's progressive nature and the scene's primary home being on the internet.

Despite the drawbacks of social media, many contemporary guitarists must rely on it. The research (Herbst & Vallejo, 2023: 68–81; Vallejo & Herbst, 2024) explores alternative (modern social media-based) business models that allow young virtuosos to make a living. It shows how communication has changed from once inaccessible guitar heroes to personal interaction between virtuosos and followers on social media. Drawing on research and manuals on the music business (e.g., Fitterman Radbill, 2017; Klein et al., 2017; Weissman, 2017), it is argued that with the decline of the recording industry, income has increasingly been generated from live music (Williamson & Cloonan, 2013; Fitterman Radbill, 2017), which has then shifted to alternative, steady income streams from online platforms (Weissman, 2017). The research analyses the posting habits and different strategies of social media celebrities in the electric guitar community, ranging from daily one-minute videos and collaborative tracks by popular artists to videos of music 'in the making', involving followers in the creative process (see also Bennett, 2016). Engaging and maintaining the 'tribe' (Godin, 2008; Owsinski, 2016) is facilitated by behind-the-scenes stories, insights into work in progress, interviews, and trivia, all of which can be observed on guitar virtuosos' social media channels. Whether for commercial reasons or out of sincere interest, contemporary artists interact personally with their followers, creating a real or imagined bond (Marwick & Boyd, 2011; Click et al., 2013). While the 1960s and 1970s saw the rise of the aloof guitar hero, in the 1980s, it was the sympathetic but distant guitar god (Millard, 2004d, 2004e; Weinstein, 2013). The 2010s and 2020s suggest a very different approach, with guitar celebrities in close and regular contact with their fans (see also Baym, 2012).

In contrast to the generally pessimistic outlook on the music industry (Weissman, 2017), Bobby Owsinski (2016) suggests that contemporary artists can make a decent living from multiple income streams rather than relying solely on record royalties. To study how business models have changed from older generations to contemporary artists, the research (Herbst & Vallejo, 2023: 68–81; Vallejo & Herbst, 2024) analyses the value young virtuosos place on traditional music releases versus internet-based achievements such as YouTube views. The

findings show that releasing albums is not a priority for many. Calculating estimated revenues from Spotify streams and YouTube views (see Hearn, 2017) indicates that the most commercially successful virtuosos are contemporary YouTubers, whose royalties far exceed those of established guitarists from streaming, at least when income from physical record sales and touring revenue is excluded. The findings suggest that the internet affords contemporary guitarists a new lucrative business model (see also Jung, 2014), with professional careers based on a completely different musical practice that no longer requires playing in a band, recording in a studio and releasing records, or performing live.

The research (Herbst & Vallejo, 2023: 76) also explores other forms of income, such as the sale of guitar tablature. Many current solo artists and bands offer authorised tablature as well as merchandise such as T-shirts, guitar picks, notepads, baseball caps, and face masks. Teaching, a traditional source of income, is being used in new ways to generate income alongside other forms of demonstration. Contemporary guitarists continue to perform at music conventions, give clinics in music stores and masterclasses online, or support events hosted by established virtuosos. Some virtuosos also offer one-to-one lessons via video-calling applications or face-to-face teaching. Others sell a wide range of standardised, downloadable video and score-based lessons on their websites and platforms like Patreon. Live performance is still a source of income that some musicians rely on, but it is hardly profitable. Like older generations of players, many contemporary virtuosos endorse brands (Weinstein, 2013), often with their own signature series. A systematic analysis of signature equipment provides further evidence of the viability of the new social media-focused business model. Despite short careers, sometimes as short as two years, many of the young guitar virtuosos are on a par with their long-standing colleagues in terms of the quantity and reputation of endorsements.

Altogether, the research (Herbst & Vallejo, 2023: 68–81) found that what used to be the responsibility of labels, managers, and other support staff is now commonly carried out by the artists themselves. Music is only one part of the profession because contemporary guitarists record, produce, and distribute their songs, create artwork, and animate videos. But they are still doing more: Running their websites; selling their music, tablature, lessons, and merchandise on other platforms; regularly recording and editing videos for their social media channels; taking care of everything that was once delegated to labels, managers, and other support staff. As the research suggests, many contemporary guitarists have become “cultural entrepreneurs” (Morris, 2014), defined by the ‘hyphen’ (Fitterman Radbill, 2017: 63): Guitarist-composer-innovator-producer-promoter-YouTuber-teacher-entrepreneur.

## 4. Conclusion

The electric guitar has been a popular instrument for over half a century, and this is unlikely to change any time soon. As was suggested in the introduction, popular music research has not paid much attention to the (electric) guitar. However, the topic found its place in a steady stream of publications, research theses, and conferences such as ‘The Electric Guitar in Popular Culture’ at Bowling Green State University, Ohio, in 2015; “Quand la Guitare (s’) Electrifie/When the Guitar Electrifies (Itself)” held at the Philharmonie de Paris, in 2016; the annual GITEC meetings held in Germany since 2017; and the conference ‘The Electric Guitar in American Culture’ at Texas Tech University in Lubbock, Texas, in 2018 and again in 2021.

At the 2015 conference in Bowling Green, Steve Waksman (2015) took stock of guitar research in his keynote address. Rather than proposing a distinct academic field of ‘guitar studies’, as has recently been done with the formation of ‘metal music studies’, he acknowledges the progress made in guitar literature over the last fifteen years. Waksman concludes that considerable progress has been made, particularly in the areas of gender and the guitar; race and ethnicity; the guitar as a global instrument with distinct histories in various parts of the world; the guitar’s presence in modern media; and some less in guitar technique and technology. As he observes and criticises, most of the work has been published by popular music historians, journalists, and biographers, addressing an audience of collectors and guitar enthusiasts. Without wishing to detract from their valuable contribution, it must be pointed out that there is still a gap in our knowledge of electric guitars, which academic researchers have yet to fill using a variety of methodological approaches from different disciplines. The present research project, with its numerous publications, provides deeper insights into guitar playing, technology, and culture, shedding light on some of the gaps in the informal field of ‘(electric) guitar studies’.

## References

- Abasi Concepts (2020). Modern Solutions for the Modern Guitarist. <https://abasicconcepts.com> (accessed 8 March 2023).
- Adelt, U. (2017). Displaying the Guitar: The Rock and Roll Hall of Fame and the Museum of Pop Culture. *Rock Music Studies*, 4(3), pp. 207–220.
- Adelt, U. (2020). Electrifying the Beat: Rhythm Guitar Performances of Keith Richards, Joan Jett, and Nile Rodgers. *Rock Music Studies*, 7(2), pp. 132–146.
- Adelt, U. (2022). Let There Be Guitar: Rhythm Techniques in the Music of Malcolm Young, Maybelle Carter, and Bob Marley. *Rock Music Studies*, 10(1), pp. 1–15.
- Albertine, V. (2014). *Clothes Clothes Clothes: Music Music Music. Boys Boys Boys*. New York: Thomas Dunne Books.
- Alleyne, M. (2020). *The Essential Hendrix: An A-Z Compendium*. San Diego: Cognella Academic Publishing.
- Appen, R. von & Doehring, A. (2006). Nevermind The Beatles, Here's Exile 61 and Nico: 'The Top 100 Records of All Time' – A Canon of Pop and Rock Albums from a Sociological and an Aesthetic Perspective. *Popular Music*, 25(1), pp. 21–39.
- Arksey, H. & Wright, P. T. (1999). *Interviewing for Social Scientists*. London: Sage.
- Astley-Brown, M. (2019a). Are Your Favorite Instagram Guitarists Faking their Incredible Technique? *Guitar World*. <https://www.guitarworld.com/news/are-your-favorite-instagram-guitarists-actually-faking-it> (accessed 8 March 2023).
- Astley-Brown, M. (2019b). Manuel Gardner Fernandes Responds to Instagram Fakery Accusations: 'There Was Never a Video that Was Sped Up. *Guitar World*. <https://www.guitarworld.com/news/manuel-gardner-fernandes-responds-to-instagram-fakery-accusations-there-was-never-a-video-that-was-sped-up> (accessed 8 March 2023).
- Astley-Brown, M. (2020). The Biggest Threat to the Guitar? It Could Well Be Guitarists: How Online Hate Endangers the Instrument We Love. *Guitar World*. <https://www.guitarworld.com/features/the-biggest-threat-to-the-guitar-it-could-well-be-guitarists-how-online-hate-endangers-the-instrument-we-love> (accessed 8 March 2023).
- Aures, W. (1985). Der sensorische Wohlklang als Funktion psychoakustischer Empfindungsgrößen. *Acustica*, 58, pp. 282–290.
- Babiuk, A. (2016). *Beatles Gear: All the Fab Four's Instruments from Stage to Studio*. San Francisco: Backbeat Books.
- Babiuk, A. & Prevost, G. (2014). *Rolling Stones Gear: All the Stones' Instruments from Stage to Studio*. San Francisco: Backbeat Books.
- Bacon, T. (1981) (Ed.). *Rock Hardware: The Instruments, Equipment and Technology of Rock*. Poole: Blandford Press.

- Bakardjieva, M. (2003). Virtual Togetherness: An Everyday-Life Perspective. *Media, Culture & Society*, 25(3), pp. 291–313.
- Bakardjieva, M. (2005). *Internet Society: The Internet in Everyday Life*. London: Sage.
- Bannister, M. (2006). ‘Loaded’: Indie Guitar Rock, Canonism, White Masculinities. *Popular Music*, 25(1), pp. 77–95.
- Bartlett, B. & Bartlett, J. (2009). *Practical Recording Techniques: The Step-by-Step Approach to Professional Audio Recording*. London: Focal Press.
- Basener, C. (2011). *The Essential Guide to Alternate Picking: Improve Your Picking Technique and Develop Killer Chops for Precise Lead Playing*. UK: CreateSpace Independent Publishing.
- Baugh, B. (1993). Prolegomena to Any Aesthetics of Rock Music. *The Journal of Aesthetics and Art Criticism*, 51(1), pp. 23–29.
- Baym, N. (2012). Fans of Friends? Seeing Social Media Audiences as Musicians Do. *Participations: Journal of Audience and Reception Studies*, 9(2), pp. 286–316.
- Bayton, M. (1997). Women and the Electric Guitar. In S. Whiteley (Ed.). *Sexing the Groove: Popular Music and Gender*. London: Routledge, pp. 37–49.
- Bayton, M. (1998). *Frock Rock: Women Performing Popular Music*. Oxford: Oxford University Press.
- Bech, S. & Zacharov, N. (2006). *Perceptual Audio Evaluation: Theory, Method and Application*. Hoboken: Wiley.
- Becker, W. (1996). G.A.S. <http://sdarchive.com/gas.html> (accessed 8 March 2023).
- Belk, R. W. (1988). Possessions and the Extended Self. *Journal of Consumer Research*, 15, pp. 139–168.
- Belk, R. W.; Ger, G., & Askegaard, S. (2003). The Fire of Desire: A Multisited Inquiry into Consumer Passion. *Journal of Consumer Research*, 30, pp. 326–352.
- Bell, C. R. & Cresswell, A. (1984). Personality Differences among Musical Instrumentalists. *Psychology of Music*, 12, pp. 83–93.
- Bennett, L. (2016). Singer-Songwriters in the Digital Age: New Trajectories in Connectivity and Participation Between Musicians and Fans on Social Media. In K. A. Williams & J. A. Williams (Eds.). *The Cambridge Companion to the Singer-Songwriter*. Cambridge University Press, pp. 329–340.
- Bennett, A. & Dawe, K. (2001) (Eds.). *Guitar Cultures*. Oxford: Berg.
- Berger, H. M. (1999). *Metal, Rock, and Jazz: Perception and Phenomenology of Musical Experience*. Hanover: Wesleyan University Press.
- Berger, H. M. & Fales, C. (2005). ‘Heaviness’ in the Perception of Heavy Metal Guitar Timbres: The Match of Perceptual and Acoustic Features over Time. In P. D. Greene &



- T. Porcello (Eds.). *Wired for Sound: Engineering and Technologies in Sonic Cultures*. Middletown: Wesleyan University Press, pp. 181–197.
- Berkers, P. & Schaap, J. (2018). *Gender Inequality in Metal Music Production*. Bingley: Emerald Publishing Limited.
- Bitoun, J. (2018). *Guitars and Heroes: Mythic Guitars and Legendary Musicians*. Buffalo: Firefly Books.
- Bliss, K. (2017). Eric Clapton on Declining Guitar Sales: ‘Maybe The Guitar Is Over’. *Billboard*. <https://www.billboard.com/articles/columns/rock/7957989/eric-clapton-guitar-sales-declining-tiff> (accessed 8 March 2023).
- Bockris, V. (1993). *Keith Richards: The Biography*. London: Penguin.
- Bourdage, M. (2010). ‘A Young Girl’s Dream’: Examining the Barriers Facing Female Electric Guitarists. *IASPM Journal*, 1(1), pp. 1–16.
- Bowen, G. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, 9(2), pp. 27–40.
- Boym, S. (2001). *The Future of Nostalgia*. New York: Basic Books.
- Braun, J.; Zolfagharian, M., & Belk, R. W. (2016). How Does a Product Gain the Status of a Necessity? An Analysis of Necessitation Narratives. *Psychology & Marketing*, 33, pp. 209–222.
- Brewster, D. M. (2003). *Introduction to Guitar Tone & Effects: A Manual for Getting the Best Sounds from Electric Guitars, Amplifiers, Effects Pedals & Processors*. Milwaukee: Hal Leonard.
- Brooks, C. A. (2018). *Legato Guitar Technique Mastery: Legato Technique Speed Mechanics, Licks and Sequences for Guitar*. Brighton: Fundamental Changes.
- Brosnac, D. (1987). *The Amp Book: A Guitarist’s Introductory Guide to Tube Amplifiers*. Westport: The Bold Strummer.
- Brown, C. T. (1992). *The Art of Rock and Roll*. Englewood Cliffs: Prentice Hall.
- Brownstein, C. (2015). *Hunger Makes Me a Modern Girl: A Memoir*. New York: Riverhead Books.
- Bruck, M. (2005). *Guitar World Presents Guitar Gear 411: Guitar Tech to the Stars Answers Your Gear Questions*. Van Nuys: Alfred Publishing.
- Cameron, J. E.; Duffy, M., & Glenwright, B. (2015). Singers Take Center Stage! Personality Traits and Stereotypes of Popular Musicians. *Psychology of Music*, 43(6), pp. 818–830.
- Carson, M.; Lewis, T.; Shaw, S.; Baumgardner, J., & Richards, A. (2004). *Girls Rock!: Fifty Years of Women Making Music*. Lexington: University Press of Kentucky.
- Carfoot, G. (2006). Acoustic, Electric and Virtual Noise: The Cultural Identity of the Guitar. *Leonardo Music Journal*, 16, pp. 35–39.

- Carter, N. (2016). *Electric Guitar Gear: A Complete Beginner's Guide to Understanding Guitar Effects and the Gear Used for Electric Guitar Playing & How to Master Your Tone on Guitar*. Scotts Valley: CreateSpace Independent Publishing Platform.
- Carvalho, A. T. (2012). The Discourse of Home Recording: Authority of “Pros” and the Sovereignty of the Big Studios. *Journal on the Art of Record Production*, 7. <https://www.arpjournal.com/asarpwp/the-discourse-of-home-recording-authority-of-%E2%80%9Cpros%E2%80%9D-and-the-sovereignty-of-the-big-studios> (accessed 8 March 2023).
- Chappell, J. (2010). *The Recording Guitarist*. Milwaukee: Hal Leonard Books.
- Clapton, E. (2007). *Eric Clapton: The Autobiography*. London: Arrow Books.
- Clarke, E. F. (2005). *Ways of Listening: An Ecological Approach to the Perception of Musical Meaning*. Oxford: Oxford University Press.
- Clawson, M. A. (1999). Masculinity and Skill Acquisition in the Adolescent Rock Band. *Popular Music*, 18(1), pp. 99–114.
- Click, M. A.; Lee, H., & Holladay, H. W. (2013). Making Monsters: Lady Gaga, Fan Identification, and Social Media. *Popular Music and Society*, 36(3), pp. 360–379.
- Coelho, V. (Ed.). (2003). *The Cambridge Companion to the Guitar*. Cambridge: Cambridge University Press.
- Cole, S. J. (2018). Use Value as a Cultural Strategy against Over-Commodification: A Durkheimian Analysis of Craft Consumption within Virtual Communities. *Sociology*, 52, pp. 1052–1068.
- Compo, S. (1998). Dick Dale. In J. Buckley & M. Ellingham (Eds.). *Rock: Rough Guide*. Stuttgart: J. B. Metzler, pp. 187–188.
- Cook, Nicholas (2009): Methods for Analyzing Recordings. In N. Cook (Ed.): *The Cambridge Companion to Recorded Music*. Cambridge: Cambridge University Press, pp. 221–245.
- Cook, N. & Leech-Wilkinson, D. (2009). A Musicologist's Guide to Sonic Visualiser. [m.cch.kcl.ac.uk/redist/pdf/analysing\\_recordings.pdf](http://m.cch.kcl.ac.uk/redist/pdf/analysing_recordings.pdf) (accessed 8 March 2023).
- Cope, Andrew L. (2010). *Black Sabbath and the Rise of Heavy Metal Music*. Farnham: Ashgate.
- Copsey, R. (2019). Guitar Music is Thriving, so Why do We Think it's Dying? *Official Charts*. [https://www.officialcharts.com/chart-news/guitar-music-is-thriving-so-why-do-we-think-it-s-dying\\_\\_25558](https://www.officialcharts.com/chart-news/guitar-music-is-thriving-so-why-do-we-think-it-s-dying__25558) (accessed 8 March 2023).
- Corey, J. (2017). *Audio Production and Critical Listening: Technical Ear Training*. London: Routledge.

- Coulthard, D. & Keller, S. (2012). Technophilia, Neo-Luddism, eDependency and the Judgement of Thamus. *Journal of Information, Communication & Ethics in Society*, 10(4), pp. 262-272.
- Covach, J. (2012). *What's That Sound? An Introduction to Rock and its History*. New York: W. W. Norton.
- Covach, J. & Boone, G. (Eds.) (1997). *Understanding Rock: Essays in Musical Analysis*. Oxford: Oxford University Press.
- Cross, C. R. (2006). *Room Full of Mirrors: A Biography of Jimi Hendrix*. London: Hodder & Stoughton.
- Crowdy, D. (2013). Chasing an Aesthetic Tail: Latent Technological Imperialism in Mainstream Production. In S. Baker, A. Bennett & J. Taylor (Eds.). *Redefining Mainstream Popular Music*. London: Routledge, pp. 150–161.
- Custodis, M. (2011). Living History: The Guitar Virtuoso and Composer Steve Vai. <http://www.uni-muenster.de/imperia/md/content/musikwissenschaft/pdf/custodis-vai.pdf> (accessed 8 March 2023).
- Cutler, C. (1995). *File Under Popular: Theoretical and Critical Writings on Music*. New York: Autonomedia.
- Davies, S. (1999). Rock versus Classical Music. *The Journal of Aesthetics and Art Criticism*, 57(2), pp. 193–204.
- Davis, F. (1979). *Yearning for Yesterday: A Sociology of Nostalgia*. New York: The Free Press.
- Dawe, K. (2010). *The New Guitarscape in Critical Theory, Cultural Practice and Musical Performance*. Aldershot: Ashgate.
- De Clercq, T. & Temperley, D. (2011). A Corpus Analysis of Rock Harmony. *Popular Music*, 30(1), pp. 47–70.
- DeNora, T. (2004). Musical Practice and Social Structure: A Toolkit. In E. Clarke & N. Cook (Eds.). *Empirical Musicology: Aims, Methods, Prospects*. Oxford: Oxford University Press, pp. 35–56.
- Denzin, N. K. (1978). *The Research Act: A Theoretical Introduction to Sociological Methods*. New York: McGraw Hill.
- Doyle, M. (1993). *The Sound of Rock: A History of Marshall Valve Guitar Amplifiers*. Westport: The Bold Strummer.
- Dubé, L.; Bourhis, A., & Jacob, R. (2005). The Impact of Structuring Characteristics on the Launching of Virtual Communities of Practice. *Journal of Organizational Change Management*, 18(2), pp. 145–166.

- Düvel, N.; Kopiez, R.; Wolf, A., & Weihe, P. (2020). Confusingly Similar: Discerning between Hardware Guitar Amplifier Sounds and Simulations with the Kemper Profiling Amp. *Music & Science*, 3, pp. 1–16.
- Edgers, G. (2017). Why My Guitar Gently Weeps: The Slow, Secret Death of the Six-String Electric. *Washington Post*.  
<https://www.washingtonpost.com/graphics/2017/lifestyle/the-slow-secret-death-of-the-electric-guitar> (accessed 8 March 2023).
- Eichas, F. & Zölzer, U. (2018). ‘Gray-Box Modeling of Guitar Amplifiers’. *Journal of the Audio Engineering Society*, 66, pp. 1006–1115.
- Einbrodt, U. D. (1988). Die Entwicklung des Gitarrensounds in der Rockmusik. In H. Rösing (Ed.). *Musikalische Werdegänge*. Hamburg: Coda, pp. 93–100.
- Einbrodt, U. D. (1997). *Experimentelle Untersuchungen zum Gitarrensound in der Rockmusik*. Frankfurt am Main: Peter Lang.
- Einbrodt, U. D. (1998). Die Schwingungsknoten-Dämpfung beim elektrischen Gitarrensound. In H. Rösing & T. Phleps (Eds.). *Populäre Musik, Politik und mehr... Ein Forschungsmedley*. Karben: CODA, pp. 104–122.
- Einbrodt, U. D. & Pape, W. (1992). Die Entwicklung des Sounds in der Rockmusik. In B. Hoffmann, W. Pape & H. Rösing (Eds.). *Rock / Pop / Jazz im musikwissenschaftlichen Diskurs*. Hamburg: CODA, pp. 114–134
- Ekers, M. (2020). *Zappa’s Gear: The Unique Guitars, Amplifiers, Effects Units, Keyboards and Studio Equipment*. Milwaukee: Hal Leonard.
- Elflein, D. (2010). *Schwermetallanalysen: Die musikalische Sprache des Heavy Metal*. Bielefeld: transcript.
- Evans, T. & Evans, M. A. (1977). *Guitars. Music, History, Construction and Players: From the Renaissance to Rock*. New York: Paddington Press.
- Everett, H. (2003). ‘The Association That I Have with This Guitar Is My Life’: The Guitar as Artifact and Symbol. *Popular Music & Society*, 26(3), pp. 331-350.
- Everett, W. (Ed.) (2008). *Expression in Pop-Rock Music: Critical and Analytical Essays*. London: Routledge.
- Fellezs, K. (2018). Edge of Insanity: Tony MacAlpine and Black Virtuosity. *Journal of Popular Music Studies*, 39(1-2), pp. 109–1126.
- Fernandez, K. V. & Lastovicka, J. L. (2011). Making Magic: Fetishes in Contemporary Consumption. *Journal of Consumer Research*, 38, pp. 289–299.
- Fitterman Radbill, C. (2017). *Introduction to the Music Industry: An Entrepreneurial Approach*. London: Routledge.

- Fiore, G. (2012). Reminiscence, Reflections, Resonance: The Just Intonation Resophonic Guitar and Lou Harrison's Scenes from Nek Chand. *Journal for the Society of American Music*, 6(2), pp. 211–237.
- Fiore, G. (2014). Heterophonic Tunings in the Music of Larry Polansky. *Tempo*, 68(267), pp. 29–41.
- Fiore, G. (2018). Tuning Theory and Practice in James Tenney's Works for Guitar. *Music Theory Spectrum*, 40(2), pp. 338–356.
- Flick, U. (2017). *Doing Triangulation and Mixed Methods*. London: Sage.
- Ford, L. (2016). *Living Like a Runaway: A Memoir*. New York: Dey Street Books.
- Fornadley, C. (2015). *Tone Wizards: Interviews with Top Guitarists and Gear Gurus on the Quest for the Ultimate Sound*. Pennsauken: BookBaby.
- French, R. M. (2008). *Engineering the Guitar: Theory and Practice*. New York: Springer.
- French, R. M. (2012). *Technology of the Guitar*. New York: Springer.
- Frey, B. (2018). Document Analysis. In B. Frey (Ed.). *The SAGE Encyclopedia of Educational Research, Measurement, and Evaluation*. Thousand Oaks: SAGE. doi: 10.4135/9781506326139
- Frith, S. & McRobbie, A. (1978). Rock and Sexuality. In S. Frith & A. Goodwin (1990) (Eds.). *On Record: Rock, Pop, and the Written Word*. London: Routledge, pp. 371–389.
- Frith, S. (1986). Art versus Technology: The Strange Case of Popular Music. *Media Culture Society*, 8, pp. 263–279.
- Gardiner, J. (2019). Fake Guitar Playing – It Needs to STOP! *YouTube*. <https://www.youtube.com/watch?v=kc722VQB1EU> (accessed 8 March 2023).
- Gay, L. C. (1998). Acting up, Talking Tech: New York Rock Musicians and Their Metaphors of Technology. *Ethnomusicology*, 42(1), pp. 81–98.
- George, A. (2020). *High Intensity Guitar Technique: Book 3. Virtuoso Techniques*. Independent Publishing.
- Gibson, C. (2019). A Sound Track to Ecological Crisis: Tracing Guitars All the Way Back to the Tree. *Popular Music*, 38(3), pp. 183–203.
- Gibson, C. & Warren, A. (2021). *The Guitar: Tracing the Grain Back to the Tree*. Chicago: University of Chicago Press, 2021.
- Gibson, C. & Warren, A. (2016). Resource-Sensitive Global Production Networks: Reconfigured Geographies of Timber and Acoustic Guitar Manufacturing. *Economic Geography*, 92, pp. 430–454.
- Gibson, J. (1979). *The Ecological Approach to Visual Perception*. London: Routledge.

- Gibson, W. (2022). All You Need Is Guitar Pedals: The Communicative Construction of Material Culture in YouTube Product Reviews. *Discourse, Context & Media*, 49, 100626.
- Gil, V. (2014). *Extended Range Guitars: Cultural Impact, Specifications, and the Context of a Mix*. MA thesis, Los Angeles: California State University.
- Godin, S. (2008). *Tribes: We Need You to Lead Us*. New York: Portfolio.
- Gordon, R. (2013). *Can't be Satisfied: The Life and Times of Muddy Waters*. Edinburgh: Canongate Books.
- Govan, G. (2002a). *Creative Guitar: Advanced Techniques*. London: Sanctuary Publishing.
- Govan, G. (2002b). *Creative Guitar: Cutting-Edge Techniques*. London: Sanctuary Publishing.
- Gracyk, T. (1996). *Rhythm and Noise: An Aesthetics of Rock*. Durham: Duke University Press.
- Grey, J. M. & Gordon, J. W. (1978). Perceptual Effects of Spectral Modifications on Musical Timbres. *The Journal of the Acoustical Society of America*, 63(5), pp. 1493–1500.
- Grossberg, L. (1992). *We Gotta Get Out of this Place: Popular Conservatism and Postmodern Culture*. London: Routledge.
- Groves, R. M. et al. (2009). *Survey Methodology*. Hoboken: Wiley.
- Hagen, R. (2011). Musical Style, Ideology, and Mythology in the Norwegian Black Metal. In J. Wallach, H. M. Berger, & P. D. Greene (Eds.). *Metal Rules the Globe: Heavy Metal Music Around the World*. London: Duke University Press, pp. 180–199.
- Hannan, C. (2018). Difficulty as Heaviness: Links between Rhythmic Difficulty and Perceived Heaviness in the Music of Meshuggah and The Dillinger Escape Plan. *Metal Music Studies*, 4(3), pp. 433–458.
- Hara, N.; Shachaf, P., & Stoerger, S. (2009). Online Communities of Practice Typology Revisited. *Journal of Information Science*, 35(6), pp. 740–757.
- Hartmann, B. J. (2016). Peeking Behind the Mask of the Prosumer: Theorizing the Organization of Consumptive and Productive Practice Moments. *Marketing Theory*, 16, pp. 3–20.
- Hearn, E. (2017). Digital Downloads and Streaming: Copyright and Distribution Issues. In M. Halloran (Ed.). *The Musician's Business and Legal Guide*. London: Taylor and Francis, pp. 64–76.
- Heatley, M. & Shapiro, H. (2009). *Jimi Hendrix Gear: The Guitars, Amps and Effects That Revolutionized Rock 'n' Roll*. London: Voyageur Press.
- Heister, H.-W. (2004). Zur Theorie der Virtuosität: Eine Skizze. In H. von Loesch, U. Mahlert, & P. Rummenholler (Eds.). *Klang und Begriff: Vol. 1. Musikalische Virtuosität*. Mainz: Schott, pp. 17–38.

- Helmholtz, H. L. F. v. (1954). *On the Sensations of Tone*. New York: Dover (Original work published 1877).
- Herbst, J.-P. (2016). *Die Gitarrenverzerrung in der Rockmusik: Studien zu Spielweise und Ästhetik* [*Guitar Distortion in Rock Music: Studies on Playability and Aesthetics*]. Münster: LIT.
- Herbst, J.-P. (2017a). Historical Development, Sound Aesthetics and Production Techniques of Metal's Distorted Electric Guitar. *Metal Music Studies*, 3(1), pp. 24–46.
- Herbst, J.-P. (2017b). Influence of Distortion on Guitar Chord Structures: Acoustic Effects and Perceptual Correlates. In W. Auhagen, C. Bullerjahn, & C. Louven (Eds.). *Akustik und musikalische Hörwahrnehmung*. Göttingen: Hogrefe, pp. 26–47.
- Herbst, J.-P. (2017c). 'Gear Acquisition Syndrome' – A Study of Electric Guitar Players. In J. Merrill (Ed.). *Popular Music Studies Today*. Wiesbaden: Springer, pp. 139–148.
- Herbst, J.-P. (2017d). Shredding, Tapping and Sweeping: Effects of Guitar Distortion on Playability and Expressiveness in Rock and Metal Solos. *Metal Music Studies*, 3(2), pp. 231–250.
- Herbst, J.-P. (2017e). Akkordstrukturen im verzerrten Rockgitarrenriff: Eine experimental-analytische Studie zur Auswirkung von physikalischen und psychoakustischen Faktoren [Chord Structures in the Distorted Rock Guitar Riff: An Experimental and Analytic Study on the Effect of Physical and Psychoacoustic Factors]. *ASPM Samples*, 15. pp. 1–27.
- Herbst, J.-P. (2017f). Virtuoses Sologitarrenspiel im Rock und Metal: Zum Einfluss von Verzerrung auf das 'Shredding' [Virtuoso Solo Guitar in Rock and Metal Music: On the Influence of Distortion on 'Shredding']. In T. Phleps (Ed.). *Schneller, höher, lauter. Virtuosität in populären Musiken*. Bielefeld: transcript, pp. 131–152.
- Herbst, J.-P. (2018). Heaviness and the Electric Guitar: Considering the Interaction between Distortion and Harmonic Structures. *Metal Music Studies*, 4(1), pp. 95–113.
- Herbst, J.-P. (2019a). Distortion and Rock Guitar Harmony: The Influence of Distortion Level and Structural Complexity on Acoustic Features and Perceived Pleasantness of Guitar Chords. *Music Perception*, 36(4), pp. 335–352.
- Herbst, J.-P. (2019b). Old Sounds with New Technologies? Examining the Creative Potential of Guitar 'Profiling' Technology and the Future of Metal Music from Producers' Perspectives. *Metal Music Studies*, 5(1), pp. 53–69.
- Herbst, J.-P. (2019c). Empirical Explorations of Guitar Players' Attitudes Towards their Equipment and the Role of Distortion in Rock Music. *Current Musicology*, 105, pp. 75–106.

- Herbst, J.-P. (2023). 'It just Is My Inner Refusal': Innovation and Conservatism in Guitar Amplification Technology. In A. Moore & G. Bromham (Eds.). *Distortion in Music Production: The Soul of Sonics*. London: Routledge, pp. 174–184.
- Herbst, J.-P.; Czedik-Eysenberg, I., & Reuter, C. (2018). Guitar Profiling Technology in Metal Music Production: Public Reception, Capability, Consequences and Perspectives. *Metal Music Studies*, 4(3), pp. 481–506.
- Herbst, J.-P. & Menze, J. (2021). *Gear Acquisition Syndrome: Consumption of Instruments and Technology in Popular Music*. Huddersfield: Huddersfield University Press.
- Herbst, J.-P. & Vallejo, A. P. (2023). *Rock Guitar Virtuosos: Advances in Electric Guitar Playing, Technology and Culture*. Cambridge: Cambridge University Press.
- Herbst, J.-P. & Waksman, S. (2024). *The Cambridge Companion to the Electric Guitar*. Cambridge: Cambridge University Press (forthcoming).
- Heritage, G. (2016). 'It's Like a Mach Piece, Really': Critiquing the Neo-Classical Aesthetic of '80s Heavy Metal Music. In A. R. Brown, K. Spracklen, K. Kahn-Harris, & N. Scott (Eds.). *Global Metal Music and Culture: Current Directions in Metal Studies*. London: Routledge, pp. 50–67.
- Hill, Matthew (2014). *George Beauchamp and the Rise of the Electric Guitar up to 1939*. PhD thesis, Edinburgh: University of Edinburgh.
- Hochman, J. (2016). Disorienting Guitar Practice: An Alternative Archive. *Critical Studies in Media Communication*, 33(1), pp. 95–108.
- Holm-Hudson, K. (Ed.) (2002). *Progressive Rock Reconsidered*. London: Routledge.
- Huber, D. M. & Runstein, R. E. (2005). *Modern Recording Techniques*. London: Focal Press.
- Hurwitz, T. (2013). *The Serious Guitarist. Essential Book of Gear: A Comprehensive Guide to Guitars, Amps, and Effects for the Dedicated Guitarist*. Van Nuys: Alfred Publishing.
- Iommi, T. (2013). *Iron Man: My Journey Through Heaven and Hell with Black Sabbath*. London: Simon & Schuster.
- Jackson, B. (2006). *Grateful Dead Gear: All the Band's Instruments, Sound Systems and Recording Session, 1965–1995*. San Francisco: Backbeat Books.
- Jackson, L. (1995). *Queen & I: The Brian May Story*. London: Smith Gryphon.
- Jackson, L. (2008). *Brian May: The Definitive Biography*. London: Piatkus Books.
- James, J. P. (2017). *Paul Kossoff: All Right Now: The Guitars, The Gear, The Music*. Leicester: Matador.
- Jauk, W. (2007). Der Sound des hedonisch-performativen Körpers und das Spiel der Elektrogitarre. In F. Krieger & B. Hoffmann (Eds.). *Jazzforschung / Jazz Research*, 39. Graz: Akademische Druck- und Verlagsanstalt, pp. 273–289.



- Jauk, W. (2009). *Popmusic + MedienKunst: Der musikalisierte Alltag der digital culture*. Osnabrück: epOs Music.
- Jones, C. W. (2017). *The Rock Canon: Canonical Values in the Reception of Rock Albums*. London: Routledge.
- Juchniewicz, J. (2009). The Perception and Restoration of Tonality in Power Chords. *Missouri Journal of Research in Music Education*, 46, pp. 21–30.
- Juchniewicz, J. & Silverman, M. J. (2011). The Influence of Progression Type and Distortion on the Perception of Terminal Power Chords. *Psychology of Music*, 41(1), pp. 119–130.
- Jung, E.-Y. (2014). Transnational Migrations and YouTube Sensations: Korean Americans, Popular Music, and Social Media. *Ethnomusicology*, 58(1), pp. 54–82.
- Kaiser, C. (2017). Analog Distinction – Music Production Processes and Social Inequality. *Journal on the Art of Record Production*, 11. <https://www.arpjournal.com/asarpwp/analog-distinction-music-production-processes-and-social-inequality> (accessed 8 March 2023).
- Kearney, M. C. (2010). Pink Technology: Mediamaking Gear for Girls. *Camera Obscura*, 25(2), pp. 1–39.
- Kermode, F. (1985). *Forms of Attention*. Chicago: University of Chicago Press.
- Kitts, J. & Tolinski, B. (2002). *The 100 Greatest Guitarists of All Time*. Milwaukee: Hal Leonard.
- Klein, B.; Meier, L. M., & Powers, D. (2017). Selling Out: Musicians, Autonomy, and Compromise in the Digital Age. *Popular Music and Society*, 40(2), pp. 222–238.
- Kozinets, R. V. (2020). *Netnography: The Essential Guide to Qualitative Social Media Research*. London: Sage.
- Lalaina, J. (2008). Dawn of the Shred. *Guitar World*, 29(11), pp. 70–74.
- Lartillot, O.; Toiviainen P. & Eerola T. (2008). A Matlab Toolbox for Music Information Retrieval. In C. Preisach et al. (Eds). *Data Analysis, Machine Learning and Applications. Studies in Classification, Data Analysis, and Knowledge Organization*. Heidelberg: Springer, pp. 261–268.
- Lave, J. & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Lee, D. (2015). *A Global Approach to Guitar Tuition: Developing an Electric Guitar Meta-Canon*. MA thesis, Hobart: University of Tasmania.
- Lee, D. (2016). Developing an Electric Guitar Meta-Canon. *Australia and New Zealand Association for Research in Music Education 38th Conference, Auckland, New Zealand*. [https://www.researchgate.net/publication/324888966\\_Developing\\_an\\_Electric\\_Guitar\\_Meta-Canon](https://www.researchgate.net/publication/324888966_Developing_an_Electric_Guitar_Meta-Canon) (accessed 8 March 2023).

- Lee, D. (2020). A Calamity of Janes (Or Lack Thereof): Observations of a Gender Crisis in Guitar Communities. Conference: *Florida Educational Research Association Virtual Forum*, Florida, USA. [https://www.researchgate.net/publication/346027461\\_A\\_Calamity\\_of\\_Janes\\_Or\\_lack\\_t\\_hereof\\_Observations\\_of\\_a\\_Gender\\_Crisis\\_in\\_Guitar\\_Communities](https://www.researchgate.net/publication/346027461_A_Calamity_of_Janes_Or_lack_t_hereof_Observations_of_a_Gender_Crisis_in_Guitar_Communities) (accessed 8 March 2023).
- Lehmann, M. & Kopiez, R. (2013). The Influence of On-Stage Behavior on the Subjective Evaluation of Rock Guitar Performances. *musicae scientiae*, 17(4), pp. 472–494.
- Lemme, H. (1995). *Gitarren-Verstärker-Sound*. München: Pflaum Verlag.
- Lemme, H. (2009). *Elektro-Gitarren: Technik und Sound*. Aachen: Elektor-Verlag.
- Lewis, K. (2018). *Brothers and Sisters: Instrument and Idiom in the Music of Maybelle Carter, Memphis Minnie and Sister Rosetta Tharpe*. PhD thesis, Guildford: University of Surrey
- Lilja, E. (2005). *Characteristics of Heavy Metal Chord Structures: Their Acoustic and Modal Construction, and Relation to Modal and Tonal Context*. Licentiate Thesis, Helsinki: University of Helsinki. <https://helda.helsinki.fi/bitstream/handle/10138/19617/characte.pdf> (accessed 8 March 2023).
- Lilja, E. (2015). Dealing with the 3<sup>rd</sup>: Anatomy of Distorted Chords and Subsequent Compositional Features of Classic Heavy Metal. In T.-M. Karjalainen & K. Kärki (Eds.). *Modern Heavy Metal – Markets, Practices and Cultures*. Helsinki: Aalto University, pp. 393–403.
- MacCallum, J. & Einbond, A. (2008). Real-Time Analysis of Sensory Dissonance. In R. Kronland-Martinet, S. Ystad, & K. Jensen (Eds.). *CMMR 2007*. Berlin: Springer, pp. 203–211.
- Mahon, B. (2007). *From Lowbrow to High Art: The Institutionalization of the Electric Guitar*. PhD thesis, Calgary: University of Calgary.
- Maloof, R. (2004). *Jim Marshall: The Father of Loud. The Story of the Man Behind the World's Most Famous Guitar Amplifiers*. San Francisco: Backbeat Books.
- Mann, L. (2019). Rings of Saturn Lucas Mann 'Fake Guitar' Debunked - Jared Dines Reaction & Response Video. YouTube. <https://www.youtube.com/watch?v=5mqYqW7Cnlw> (accessed 8 March 2023).
- Marrington, M. (2017). From DJ to Djent-Step: Technology and the Re-Coding of Metal Music Since the 1980s. *Metal Music Studies*, 3(2), pp. 251–268.
- Marrington, M. (2019). The DAW, Electronic Music Aesthetics, and Genre Transgression in Music Production: The Case of Heavy Metal Music. In R. Hepworth-Sawyer (Ed.). *Producing Music*. New York: Routledge, pp. 52–74.

- Martinez-Reyes, J. (2015). Mahogany Intertwined: Enviromateriality Between Mexico, Fiji, and the Gibson Les Paul. *Journal of Material Culture*, 20(3), pp. 313–329.
- Marwick, A. & Boyd, D. (2011). To See and Be Seen: Celebrity Practice on Twitter. *Convergence: The International Journal of Research into New Media Technologies*, 17(2), pp. 139–158.
- Matabane, M. I. (2014). *Axe to Grind: A Cultural History of Black Women Musicians on the Acoustic and Electric Guitar in the United States*. PhD thesis, Atlanta: Emory University.
- Mayring, P. (2014). *Qualitative Content Analysis: Theoretical Foundation, Basic Procedures and Software Solution*. Klagenfurt. <http://nbn-resolving.de/urn:nbn:de:0168-ssoar-395173> (accessed 8 March 2023).
- McAdams, S.; Depalle, P., & Clarke, E. (2004). Analyzing Musical Sound. In E. Clarke & N. Cook (Eds.). *Empirical Musicology: Aims. Methods. Prospects*. Oxford: Oxford University Press, pp. 157–196.
- McDonald, C. (2000). Exploring Modal Subversions in Alternative Music. *Popular Music*, 19(3), pp. 355–363.
- McIver, J. (2008). *The 100 Greatest Metal Guitarists*. London: Jawbone.
- Meinel, E. (1987). *Elektrogitarren*. Frankfurt a. M.: Verlag Erwin Bochinsky.
- Michael, M. (1994). *Keith Richards in His Own Words*. London: Omnibus Press.
- Middleton, R. (1990). *Studying Popular Music*. Buckingham: Open University Press.
- Millard, A. J. (2004a) (Ed.). *The Electric Guitar: A History of an American Icon*. Baltimore: Johns Hopkins University Press.
- Millard, A. J. (2004b). Inventing the Electric Guitar. In A. J. Millard (Ed.), *The Electric Guitar: A History of an American Icon*. Baltimore: Johns Hopkins University Press, pp. 41–62.
- Millard, A. J. (2004c). Solidbody Electric Guitars. In A. J. Millard (Ed.), *The Electric Guitar: A History of an American Icon*. Baltimore: Johns Hopkins University Press, pp. 89–104.
- Millard, A. J. (2004d). The Guitar Hero. In A. J. Millard (Ed.), *The Electric Guitar: A History of an American Icon*. Baltimore: Johns Hopkins University Press, pp. 143–162.
- Millard, A. J. (2004e). Heavy Metal: From Guitar Heroes to Guitar Gods. In A. J. Millard (Ed.), *The Electric Guitar: A History of an American Icon*. Baltimore: Johns Hopkins University Press, pp. 163–180.
- Miller, K. (2012). *Playing Along: Digital Games, YouTube and Virtual Performance*. Oxford: Oxford University Press.
- Millington, J. (2015). *Land of a Thousand Bridges: Island Girl in a Rock & Roll World*. United States: Independent Publisher.

- MIZ: German Music Information Centre (2014). Instrumentalspiel in Haushalten nach Instrumentengattungen, MIZ 12/2014. <http://www.miz.org/downloads/statistik/133/statistik133.pdf> (accessed 8 March 2023).
- MIZ: German Music Information Centre (2020a). Pupils enrolled at public music schools, by instrument, MIZ 5/2020. [http://www.miz.org/downloads/statistik/208/03\\_EN\\_Pupils\\_instruments\\_public\\_music\\_schools.pdf](http://www.miz.org/downloads/statistik/208/03_EN_Pupils_instruments_public_music_schools.pdf) (accessed 8 March 2023).
- MIZ: German Music Information Centre (2020b). Appreciation of various music genres by age group, MIZ 9/2020. [http://www.miz.org/downloads/statistik/242/31\\_EN\\_Appreciation\\_music\\_genres\\_by\\_age\\_group.pdf](http://www.miz.org/downloads/statistik/242/31_EN_Appreciation_music_genres_by_age_group.pdf) (accessed 8 March 2023).
- MIZ: German Music Information Centre (2022a). Pupils enrolled at public music schools, by instrument, MIZ 6/2022. <https://miz.org/de/statistiken/schuelerinnen-der-vdm-musikschulen-nach-faechern?filter%5Bresource%5D%5B0%5D=Statistik&rows=1000&widget%5Bdescription%5D%5Btid%5D=15490&context=musikleben&position=48> (accessed 8 March 2023).
- MIZ: German Music Information Centre (2022b). Appreciation of various music genres by age group, MIZ 10/2022. <https://miz.org/de/statistiken/bevorzugte-musikrichtungen-nach-altersgruppen?filter%5Bresource%5D%5B0%5D=Statistik&widget%5Bdescription%5D%5Btid%5D=15490&context=musikleben&position=15> (accessed 8 March 2023).
- Mohr, D. (2010). *Statistical Methods*. Amsterdam: Elsevier.
- Moore, A. F. (2001). *Rock the Primary Text: Developing a Musicology of Rock*. Aldershot: Ashgate.
- Moore, A. F. (2002). Authenticity as Authentication. *Popular Music*, 21(2), pp. 209–223.
- Moore A. F. (2008) (Ed.). *Analyzing Popular Music*. Cambridge: Cambridge University Press.
- Moore, A. F. (2012). *Song Means: Analysing and Interpreting Recorded Popular Song*. Farnham: Ashgate.
- Morris, J. W. (2014). Artists as Entrepreneurs, Fans as Workers. *Popular Music and Society*, 37(3), pp. 273–290.
- Morrish, J. (1999). *The Fender Amp Book*. London: Jawbone.
- Moylan, W. (2020). *Recording Analysis: How the Record Shapes the Song*. New York: Routledge.
- Müller, M. (2015). *Fundamentals of Music Processing: Audio, Analysis, Algorithms, Applications*. Heidelberg: Springer.
- Murray, C. S. (2011). *Boogie Man: The Adventures of John Lee Hooker in the American Twentieth Century*. Edinburgh: Canongate Books.

- Murray, C. S. (2012). *Crosstown Traffic: Jimi Hendrix and Post-War Pop*. Edinburgh: Canongate Books.
- Mynett, Mark (2016). The Distortion Paradox: Analysing Contemporary Metal Production. In A. R. Brown, K. Spracklen, K. Kahn-Harris, & N. Scott (Eds.). *Global Metal Music and Culture: Current Directions in Metal Studies*. London: Routledge, pp. 68–87.
- Mynett, M. (2017). *Metal Music Manual: Producing, Engineering, Mixing, and Mastering Contemporary Heavy Music*. London: Routledge.
- Neyens, K. (2020). *Creative Tapping for Modern Guitar: Discover Creative Guitar Tapping Techniques and Licks for Any Musical Genre*. Brighton: Fundamental Changes.
- Norman, P. (2020). *Wild Thing: The Short, Spellbinding Life of Jimi Hendrix*. London: Weidenfeld & Nicolson.
- O’Grady, P. (2019). The Politics of Digitizing Analogue Recording Technologies. In R. Hepworth-Sawyer, J. Hodgson, & M. Marrington (Eds.). *Producing Music*. London: Routledge, pp. 119–133.
- Obrecht, Jas (1978). Heavy-Metal Guitarist from California Hits the Charts at Age 21. *Guitar Player*, 11/1978. <https://www.vhnd.com/2010/06/07/eddie-van-halens-first-interview-heavy-metal-guitarist-from-california-hits-the-charts-at-age-21> (accessed 8 March 2023).
- Obrecht, J. (2003). ‘A Century of Blues Guitar’. In V. A. Coelho (Ed.). *The Cambridge Companion to the Guitar*. Cambridge: Cambridge University Press, pp. 87–108.
- Ostberg, J. & Hartmann, B. J. (2015). The Electric Guitar – Marketplace Icon. *Consumption Markets & Culture*, 18(5), pp. 402–410.
- Owsinski, B. (2016). *Music 4.1: A Survival Guide for Making Music in the Internet Age*. Milwaukee: Hal Leonard.
- Page, J. (2020). *Jimmy Page: The Anthology*. Guildford: Genesis Publications.
- Palmer, R. (1995). *Rock & Roll: An Unruly History*. New York: Harmony Books.
- Pamir, A. & Herbst, J.-P. (2021). Guitar’s Covid Comeback. *TRT World / Showcase*, 29 November 2021. [https://www.youtube.com/watch?v=EmibJfAue\\_4](https://www.youtube.com/watch?v=EmibJfAue_4) (accessed 8 March 2023).
- Pinch, T. & Reinecke, D. (2009). Technostalgia: How Old Gear Lives on in New Music. In K. Bijsterveld, & J. van Dijck (Eds.). *Sound Souvenirs: Audio Technologies, Memory and Cultural Practices*. Amsterdam: Amsterdam University Press, pp. 152–166.
- Pfleiderer, M. (2010). Vocal Pop Pleasures: Theoretical, Analytical and Empirical Approaches to Voice and Singing in Popular Music. *IASPM Journal*, 1(1), pp. 1–16.
- Plomp, R. & Levelt, W. J. M. (1965). Tonal Consonance and Critical Bandwidth. *Journal of the Acoustical Society of America*, 38, pp. 548–560.

- Port, I. (2019). *The Birth of Loud: Leo Fender, Les Paul, and the Guitar-Pioneering Rivalry That Shaped Rock & Roll*. London: Simon & Schuster.
- Power, M. (2014). *Hot Wired Guitar: The Life of Jeff Beck*. London: Omnibus Press.
- Rensen, M. & Stösser, V. (2011). *Guitar Heroes: Die besten Gitarristen von A-Z*. Bergkirchen: PPV Medien.
- Reyes, I. (2013). Blacker than Death: Recollecting the Black 'Turn' in Metal Aesthetics. *Journal of Popular Music Studies*, 25(2), pp. 240–257.
- Rooney, J. (2012). *Bossmen: Bill Monroe and Muddy Waters*. Vermont: JRP Books.
- Rötter, G. & Steinberg, R. (2018). Die Musikerpersönlichkeit. In: A. C. Lehmann & R. Kopiez (Eds.). *Handbuch Musikpsychologie*. Bern: Hogrefe, pp. 435–460.
- Rotundi, J. (1997). Is Rock Guitar Dead...or Does it Just Smell Funny? *Guitar Player*, 31(9).
- Rubin, D. (2018). *100 Great Guitarists and the Gear that Made Them Famous*. Milwaukee: Hal Leonard.
- Rumsey, F. & McCormick, T. (2006). *Sound and Recording: An Introduction*. London: Focal Press.
- Sargent, C. (2009). Playing, Shopping, and Working as Rock Musicians: Masculinities in 'De-Skilled' and 'Re-Skilled' Organizations. *Gender & Society*, 23, pp. 665–687.
- Sawyer, C. (1980). *The Arrival of B. B. King: The Authorized Biography*. New York: Da Capo.
- Schauss, G. (2012). *The Total Shred Guitarist: A Fun and Comprehensive Overview of Shred Guitar Playing*. Van Nuys: Alfred.
- Schauss, G. (2017). *Speed Guitar: Learn Lightning Fast Alternate Picking and Coordination*. Van Nuys: Alfred Music.
- Schauberger, S. (2013). 'She Plays Guitar like a Man' – Kanonisierung, Macht und Gender in der Geschichte der E-Gitarre. In T. Maina et al. (Eds.). *ShePOP. Frauen. Macht. Musik*. Münster: Telos Verlag, pp. 149–163.
- Schiffner, W. (1994). *Rock und Pop und ihre Sounds: Technik, Thesen, Titel*. Aachen: Elektor-Verlag.
- Schmidt-Horning, S. (2004). Recording: The Search for the Sound. In A. J. Millard (Ed.). *The Electric Guitar: A History of an American Icon*. Baltimore: Johns Hopkins University Press, pp. 105–122.
- Seth, L. (2017). Dragonforce Guitarist Shoots Down Accusation Band Speeds Up Its Songs In The Studio. *Blabbermouth*. <https://search.blabbermouth.net/news/dragonforce-guitarist-shoots-down-accusation-band-speeds-up-its-songs-in-the-studio> (accessed 8 March 2023).

- Shelvock, M. (2014). The Progressive Heavy Metal Guitarist's Signal Chain: Contemporary Analogue and Digital Strategies. *KES Transactions on Innovation in Music*, 1(1), pp. 126–138.
- Shuker, R. (2010). *Wax Trash and Vinyl Treasures: Record Collecting as a Social Practice*. Burlington: Ashgate.
- Slash (2007): *Slash*. London: Harper Collins.
- Slaven, J. E. & Krout, J. L. (2016). Musicological Analysis of Guitar Solos from the Roots of Rock Through Modern Heavy Metal. *Metal Music Studies*, 2(2), pp. 245–251.
- Smith, A. (2020). *Monsters of River and Rock: My Life as Iron Maiden's Compulsive Angler*. London: BMG.
- Speed, B. (2010). *Beginners Guide to Electric Guitar: Gear, Technique, and Tons of Riffs*. Van Nuys: Alfred Publishing.
- Stebbins, R. A. (2009). *Leisure and Consumption: Common Ground/Separate Worlds*. Houndmills: Palgrave Macmillan.
- Stederoth, D. (2017). While My Guitar Gently Weeps: Zur Sound-, Groove- und Performance-Virtuosität in der Populären Musik. In T. Phleps (Ed.). *Schneller, höher, lauter: Virtuosität in populären Musiken*. Bielefeld: transcript, pp. 51–64.
- Stephenson, K. (2002). *What to Listen for in Rock: A Stylistic Analysis*. New Haven: Yale University Press.
- Strachan, R. (2017). *Sonic Technologies: Popular Music, Digital Culture and the Creative Process*. New York: Bloomsbury Publishing.
- Strohm, J. (2004). Women Guitarists: Gender Issues in Alternative Rock. In A. J. Millard (Ed.). *The Electric Guitar: A History of an American Icon*. Baltimore: Johns Hopkins University Press, pp. 181–200.
- Stump, J. (2014). *Metal Guitar Chop Shop: Building Shred and Metal Technique*. Boston: Berklee Press.
- Stump, J. (2017). *Guitar Sweep Picking and Arpeggios*. Boston: Berklee Press.
- Summers, A. (2006). *One Train Later: Andy Summers. A Memoir*. London: Portrait.
- Tagg, P. (2011). Caught on the Back Foot: Epistemic Inertia and Visible Music. *IASPM Journal*, 2(1-2), pp. 3–18.
- Talbot, M. (2000). Introduction. In M. Talbot (Ed.). *Liverpool Music Symposium: Vol. 1. The Musical Work: Reality or Invention?*. Liverpool: Liverpool University Press, pp. 1–13.
- Taylor, T. D. (2001). *Strange Sounds: Music, Technology & Culture*. New York: Routledge.
- Théberge, P. (1997): *Any Sound You Can Imagine: Making Music/Consuming Technology*. Hanover: Wesleyan University Press.

- Terhardt, E. (1984): The Concept of Musical Consonance: A Link Between Music and Psychoacoustics. *Music Perception*, 1, pp. 276–295.
- The Jimi Hendrix Experience (1967). *Purple Haze*. On: *Are You Experienced?*. Reprise.
- Thorpe, R. (2016). *Progressive Metal Guitar: An Advanced Guide to Modern Metal Guitar*. Brighton: Fundamental Changes.
- Thorpe, R. (2019). *Heavy Metal Lead Guitar: An Introduction to Heavy Metal Soloing for Guitar*. Brighton: Fundamental Changes.
- Todd, L. (2019). Fake Shredders: Hot Take. YouTube. <https://www.youtube.com/watch?v=yucPd0n9hfg> (accessed 8 March 2023).
- Tolinski, B. (2012). *Light & Shade: Conversations with Jimmy Page*. New York: Broadway Books.
- Tolinski, B. (2017). *Play it Loud: An Epic History of the Style, Sound, and Revolution of the Electric Guitar*. New York: Anchor books.
- Townshend, P. (2012). *Who I Am*. London: Harper Collins.
- Traube, C. & Depalle, P. (2004). Phonetic Gestures Underlying Guitar Timbre Description: Proceedings of International Conference of Music Perception and Cognition (ICMPC 8). Evanston. <http://www.icmpc8.umn.edu/proceedings/ICMPC8/PDF/AUTHOR/MP040123.pdf> (accessed 8 March 2023).
- Turner, G. (2015). *Electric Guitar Performance Techniques: Meaning and Identity in Written Discourse*. PhD thesis, Sheffield: University of Sheffield.
- Uimonen, H. (2016). Celebrity Guitars: Musical Instruments as Luxury Items. *Rock Music Studies*, 4, pp. 117–135.
- Vai, S. (2013). *Steve Vai's Guitar Workout: The Virtuoso's Complete 10 hour and 30 Hour Practice Routines*. Milwaukee: Hal Leonard.
- Vai, S. (2019). *Vaideology: Basic Music Theory for Guitar Players*. Milwaukee: Hal Leonard.
- Vallejo, A. P. (2021). *Development, Mechanics and Compositional Uses of Virtuositic Electric Guitar Techniques*. MA thesis, Huddersfield: University of Huddersfield.
- Vallejo, A. P. & Herbst, J.-P. (2024). Thumping, Glitch, and Butterfly Tapping: Innovations in Guitar Technique in the New Millennium. In J.-P. Herbst & S. Waksman (Eds.). *The Cambridge Companion to the Electric Guitar*. Cambridge: Cambridge University Press (forthcoming).
- Virtala, P.; Huotilainen, M.; Lilja, E.; Ojala, J., & Tervaniemi, M. (2018). Distortion and Western Music Chord Processing: An ERP Study of Musicians and Nonmusicians. *Music Perception*, 35, pp. 315–331.



- Von Wartburg, I.; Rost, K., & Teichert, T. (2006). The Creation of Social and Intellectual Capital in Virtual Communities of Practice: Shaping Social Structure in Virtual Communities of Practice. *International Journal of Learning and Change*, 1(3), pp. 299–316.
- Waksman, S. (1996). Every Inch of My Love: Led Zeppelin and the Problem of Cock Rock. *Journal of Popular Music Studies*, 8(1), pp. 5–25.
- Waksman, S. (1998). Kick Out the Jams! The MC5 and the Politics of Noise. In A. Herman, J. Sloop, & T. Swiss (Eds.). *Mapping the Beat: Popular Music and Contemporary Theory*. Hoboken: Wiley, pp. 47–75.
- Waksman, S. (1999a). *Instruments of Desire: The Electric Guitar and the Shaping of Musical Experience*. Cambridge: Harvard University Press.
- Waksman, S. (1999b). Black Sound, Black Body: Jimi Hendrix, the Electric Guitar, and the Meanings of Blackness. *Popular Music and Society*, 23(1), pp. 75–114.
- Waksman, S. (2001). Into the Arena: Edward Van Halen and the Cultural Contradictions of the Guitar Hero. In A. Bennett & K. Dawe (Eds.). *Guitar Cultures*. Oxford: Berg, pp. 117–134.
- Waksman, S. (2003a). The Turn to Noise: Rock Guitar from the 1950s to the 1970s. In V. A. Coelho (Ed.). *The Cambridge Companion to the Guitar*. Cambridge: Cambridge University Press, pp. 109–121.
- Waksman, S. (2003b). Contesting Virtuosity: Rock Guitar Since 1976. In V. A. Coelho (Ed.). *The Cambridge Companion to the Guitar*. Cambridge: Cambridge University Press, pp. 122–132.
- Waksman, S. (2003c). Reading the Instrument: An Introduction. *Popular Music & Society*, 26(3), pp. 251–261.
- Waksman, S. (2004). California Noise: Tinkering with Hardcore and Heavy Metal in Southern California. *Social Studies of Science*, 34 (5), pp. 675–702.
- Waksman, S. (2009). *This Ain't the Summer of Love: Conflict and Crossover in Heavy Metal and Punk*. Berkeley: University of California Press.
- Waksman, S. (2015). *Guitar Studies: Some Thoughts About a Field That Doesn't Really Exist (Yet)*. *The Electric Guitar in Popular Culture*. Bowling Green State University. Ohio: unpublished Keynote Presentation.
- Waksman, S. (2018). Crossing the Electronic Divide: Guitars, Synthesizers, and the Shifting Sound Field of Fusion. In R. Fink, M. Latour, & Z. Wallmark (Eds.). *The Relentless Pursuit of Tone: Timbre and Popular Music*. Oxford: Oxford University Press, pp. 253–276.
- Walser, R. (1992). Eruptions: Heavy Metal Appropriations of Classical Virtuosity. *Popular Music*, 11(3), pp. 263–308.

- Walser, R. (1993). *Running with the Devil: Power, Gender, and Madness in Heavy Metal Music*. Hanover: Wesleyan University Press.
- Wang, A. (2018). Guitars are Getting More Popular, So Why Do We Think They Are Dying? *Rolling Stone*. <https://www.rollingstone.com/music/music-news/guitars-are-getting-more-popular-so-why-do-we-think-theyre-dying-630446> (accessed 8 March 2023).
- Weinstein, D. (1991). *Heavy Metal: The Music and Its Culture*. Boulder: Da Capo Press.
- Weinstein, D. (2013). Rock's Guitar Gods: Avatars of the Sixties. *Archiv Für Musikwissenschaft*, 70(2), pp. 139–154.
- Weissman, D. (2017). *Understanding the Music Business: Real World Insights*. London: Routledge.
- Wenger, E. (1998). *Communities of Practice: Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.
- Wheeler, T. (1992). *American Guitar: An Illustrated History*. New York: HarperPerennial.
- Whiteley, S. (1990): Progressive Rock and Psychedelic Coding in the Work of Jimi Hendrix. *Popular Music*, 9(1), pp. 37–91.
- Wicke, P. (1990). *Rock Music: Culture, Aesthetics and Sociology*. Cambridge: Cambridge University Press.
- Williams, A. (2015). Technostalgia and the Cry of the Lonely Recordist. *Journal on the Art of Record Production*, 9. <https://www.arpjournal.com/asarpwp/technostalgia-and-the-cry-of-the-lonely-recordist> (accessed 8 March 2023).
- Williamson, J. & Cloonan, M. (2013). Contextualising the Contemporary Recording Industry. In L. Marshall (Ed.). *The International Recording Industries*. London: Routledge, pp. 11–29.
- Winkler, P. (1978). Towards a Theory of Popular Harmony. *Theory Only*, 4, pp. 3–26.
- Wright, J. (2006). *GAS! Living with Guitar Acquisition Syndrome*. Raleigh: Lulu.
- Zollner, M. (2014). *Physik der Elektrogitarre*. Regensburg: Manfred Zollner Selbstverlag.
- Zoupa, C. (2018). *Ultimate Shred Machine: The Ultimate Guide to Picking, Tapping and Sweeping*. Brighton: Fundamental Changes.
- Zwicker, E. & Fastl, H. (2007). *Psychoacoustics: Facts and Models*. Berlin: Springer.