BOOK REVIEWS

WHEN THE UNCERTAINTY PRINCIPLE GOES TO 11: OR HOW TO EXPLAIN QUANTUM PHYSICS WITH HEAVY METAL, PHILIP MORIARTY (2018)

Dallas, TX: BenBella Books Ltd., 352 pp., ISBN 978-1-94464-852-7, p/bk, $17.95

Reviewed by Dawn Hazle, University of Nottingham

Perhaps your school science teacher used examples from sport to explain the intricacies of velocity and acceleration, or planetary orbits as an illustration of atomic structure? Using real-world examples to explain tricky concepts is not new, nor restricted to ‘pops’ publications, the genre that this book falls firmly into, as it is aimed at the general reader interested in science rather than a true textbook or reference. The book does not claim to be a comprehensive primer to quantum physics, but neither does this mean the science loses out or is dumbed down, as some of the concepts can take two or three readings for someone who has not taken physics at university. The book seeks to explain, as per the subtitle, the main concepts of quantum physics using heavy metal examples from the harmonics of a guitar string and the wave patterns of a bass drum beater, to the Fourier components of Stryper’s spandex and the predictability of moshers’ movements. The book is accompanied by a YouTube channel, ‘Uncertainty to 11’, which seeks to explain some of the concepts that require good visual representation unachievable with static pictures.

Philip Moriarty is a professor of physics and astronomy at the University of Nottingham, teaching undergraduate modules as well as supervising postgraduate students, and specializes in nanoscale research, in which he is widely published in academic journals (University of Nottingham 2019). As a rock and metal fan, Moriarty chooses to use something he is very familiar with to explain the vagaries of one of the most theoretical of the branches of physics, quantum. The book is very much aimed at people who have not pursued similar science subjects beyond secondary school but are interested in quantum
theory, such as this reviewer, and will especially appeal to metalheads and hard rock fans due to the analytical content and examples portrayed, although any casual reader with an interest in technical science should find it accessible. Those who have taken modules at University level in quantum theory may find the explanations too simplistic.

Moriarty’s style is loose but informative and easy to follow and reads very much like a public lecture aimed at people in the pub (PubhD 2019). This loose style, however, extends to what this reviewer considers an overuse of tangential footnotes. Footnotes generally are better than most alternatives, especially when used for narrative additions, but it can be very distracting to read a whole new paragraph or three in the middle of a sentence, sometimes even multiple times per sentence. That said, it is very much like Moriarty’s lecturing style, although tangents are much less jarring in speech, and the book should be read as such (Moriarty 2017). Much like a lecture, the book also contains many laugh-out-loud moments, such as ‘repeating the experiments with jet pack-enabled moshers to check for a 2-D-to-3-D transition in the dynamics would make for a fascinating experiment. That would be a fun grant application to write’ (Moriarty 2018: 291 n22). The book is appropriately illustrated by Pete McPartlin, whose gloriously untidy style suits both the metal aesthetic and uncertainty of quantum theory, and anyone familiar with a certain iconic Nottingham venue will be impressed by the illustration on page 290. Moriarty prefers to use British English, as stated on page 4 in note 5, but there are many examples of American English, especially in the latter parts of the book, which I suspect may be a result of editing and I found these quite jarring given the apparent importance of the 5th note in the entire book (4 n5).

The majority of the book revolves around explaining the grounding principles of quantum theory using examples from metal music, interspersed with brief biographies of key scientists, thought pieces on rock and metal, and discussions around academia, popular culture and society. Chapter 1 begins at what might be regarded as the beginning of metal studies: what is and is not heavy metal, and how it does not matter at all in this book, with Moriarty stating ‘for every KISS, Mötley Crüe, or Whitesnake the metal critic will cite to make their case, I’ll counter with Opeth, Meshuggah, and Dream Theater’ (3).

I particularly liked the follow-up notes which list the reasons Rush should be included in the metal canon:


After a lot of prefacing, the key discussion of Fourier transformation gets underway, with Moriarty explaining that Fourier analysis (as it is also known) is simply showing that ‘a pattern in space or time can be broken down into the waves that make it up’, using examples of the same note played on a piano and guitar, and explaining the basics of why they sound different (14). Moriarty then goes from complex waves such as played by piano and guitar to simple waves, a whistle, which make it easier to demonstrate to concept of sine waves discussed in Chapter 2.

Chapter 2 starts like most of the other chapters, with a discussion of theory and mathematics in the general world before diving into a metal-themed explanation. I found the potential energy explanation quite difficult to follow because there were too many numbers and variables, but the example’s
Book Reviews

The conclusion brings it back into focus with the classic real-world analogy of the amount of energy in a Mars bar, which is enormous compared to the potential energy of a CD case (19–21). A metal music example follows immediately, and the sine wave created by a drum beater is illustrated by both McPartlin and by a video on the ‘Uncertainty to 11’ YouTube channel (Uncertainty to 11 2018). Unfortunately, due to the changeable nature of Internet-based media, most of the direct video links do not work and some searching is required, plus it is quite tiresome inputting a long random alphanumerical link. I would recommend such links are fully referenced, which they are not in this book, and this will aid in finding the resource later: the fifteen videos under the ‘Uncertainty to 11’ channel are relatively easy to find but everything else requires a bit more searching, and readers may, like this one, find this overtaxing and not bother. A second example of a sine wave uses Marsha the Mosher, running around a circle pit, to explain why radians are preferable to angles, as well as the connection between running in a circle and a sine wave (31–33).

Chapter 3 begins with a historical look into Moriarty’s life, his first Metallica concert, which he attended because Anthrax opened for them (41). He recalls that Anthrax’s drummer referenced the same comic as his younger self liked, which drew him to that particular band. These themes of comic books, science fiction programmes and fantasy stories are certainly something many metalheads and other music lovers can understand, as cross-referencing in fandoms is commonplace: the physicists-as-metalheads fandom from Chapter 1 is a good example (4). Moriarty was, at the time of his first Metallica concert, a guitarist in a band and did not really appreciate Metallica until that concert, and he now considers Master of Puppets his favourite rhythm guitar album because of the riffs (40–41). In his admiration of the riffs, he even uses the phrase ‘Cthulhu be praised’, adding another subculture or fandom to the mix (40). This chapter explains Fourier transformation using the wah-wah pedal, extensively employed in Master of Puppets, although examples use the simpler whistle sine wave introduced in Chapter 1. Pages 45–47 are dedicated to explaining why the Fourier transform is so terrifying for many less-experienced physicists, with 47–50 eventually introducing the comparison of standing waves with electrons in atoms after two pages of 1970s science fiction reportage culminating in Moriarty effusing over Rush’s 2112 album and its epic ‘Discovery’ (45–47, 47–50). Finally, standing and travelling waves are explained and the latter is used to introduce the key concept, in both metal and quantum physics, of phase (56).

Chapter 4 continues the discussion of phase and standing waves by introducing nodes and harmonics and an in-depth exploration of frequency. Moriarty uses Fear Factory’s ‘ScumGrief’ (with YouTube videos) to explain distortion and explains fully how the wah-wah pedal works (77–79). This chapter is very maths-heavy, but I found it easy to follow, and further explanation of the simplified physics is available in the appendix. I also found it quite groundbreaking, as I did not know anything about harmonics and their very defined nature, as well as the connection between a guitar’s musicality and the mathematical nature of harmonics (70–71).

Chapter 5 starts with Moriarty recounting more of his life story, in this case how he failed his third-year exams at university because he spent too much time in music, but by the time he started his Ph.D. he regretted leaving his experiments to practice with the band (82–83). This somewhat irrelevant piece of information lends to the book’s strange autobiographical feel but may connect readers in the same position to the historical Moriarty and provide
inspiration. It merely prefaces the explanation of Moriarty’s Ph.D. and ongoing research using scanning probe microscopes to detect and move individual molecules and even atoms, which leads to a discussion of electrons and explanations of how they move. The flow of electrons in the quantum (nanoscale) world is compared in the macroscale (normal) world using a broken electric cable, a lost tour bus and the moshpit (87–91). McPartlin’s illustrations are crucial here: it would be very difficult to explain the concept of electron ‘tunnelling’ without the aid of pictures (91). The section ends on a cautioning of extrapolating quantum tunnelling into the macroscale world, something Moriarty calls ‘quantum woo’, and is discussed in more detail in the next chapter (93). The whole chapter ends with a very concise and clear description of wave–particle duality’s probabilistic nature (102).

The opening of Chapter 6 is largely devoted to countering the previously mentioned ‘quantum woo’. Moriarty uses simple algebra to show why the change in scale between the nano- and macroscale worlds means that any effect of quantum tunnelling and the like is immeasurably small in the normal-scale world (114). He then moves on to explain how quantum physics got its name, light and electrons in atomic structures. The real-world example of how batteries work was unfortunately difficult to follow and I felt it added nothing to the lengthy explanations already covered in this chapter (136–40).

Chapter 7 deals with the nature of ‘uncertainty’ in the nanoscale world, with Moriarty stating that it is not always uncertain because ‘[e]ach atom is, in essence, a building block that can be pushed across a surface to form a regular and stable pattern, just as we can connect Lego blocks to form different structures’ (151). This is characteristically appended by a frivolous note directing the reader to a metal version of The Lego Movie’s theme tune (151 n3). On the other hand, Moriarty also relates a mind-blowing example of quantum science in this chapter, when he explains how it is possible to hear the response of a tuning fork to a chemical bond being made (158). For the ‘uncertain’ component of this chapter, and to fully explain the uncertainty principle behind the book, Moriarty turns to guitar chugging and relates how palm-muting a guitar shortens the sound in time and, therefore, widens the peak of the simplified, fundamental, harmonic frequency spectrum, making the frequency more uncertain (164). In the final section, Moriarty clarifies that the observer-as-interference problem is not related to uncertainty, but rather to decoherence (184–86).

Until now, the book has dealt with the sonic dimension, but this is not the only domain in which Fourier transform works, and Chapter 8 deals with visual transformation. Moriarty explains part of the metal code’s visual dimension using death metal logos, while managing to include Scottish death metal band Party Cannon’s totally contradictory bubble-balloon logo as if to prove metal is just as uncertain as much of the world around us (190). He goes on to talk about subversion and metal as ‘highbrow culture’ before launching into the driving force behind both this idea of subversion and the visual Fourier transforming in this chapter, the Christian metal band Stryper. The stripes of Stryper’s stage-wear are used to show how adding and subtracting frequencies to an image make it sharper or less-well defined, with the real-world examples of JPEGs and MP3s used to show what happens when higher frequencies are removed. I felt the discussion around the uncertainty principle and observer effect on page range 200–01 was repetitious and should have been included in the previous chapter (200–01).
Chapter 9 is concerned with looking at the very macroscale objects of planets and gravity, and their nanoscale near-equivalents, atoms or molecules and electrostatic force, as well as the Cosmic Microwave Background left over from the Big Bang, and logarithmic scales. Moriarty tells us that the ‘most seminal connection between metal and quantum physics we can imagine’ is that the Cosmic Microwave Background and a metal gig are about the same sound pressure level, about 110 dB, although the Big Bang is much heavier, about fifty octaves lower than the lowest string of a drop B tuned guitar (224–29).

Chapter 10 starts with Moriarty bemoaning the Internet generations’ propensity to not do things for themselves (242). He goes on to explain that the greatest leaps in understanding have come from feeling stupid, and that teachers should ‘kindle and sustain’ enthusiasm (243). This eventually leads to Eddie Van Halen’s use of a phaser to create a specific sound and how it works using interference. A visual representation is provided by the infamous double slit experiment, a staple of any school physics lab and easily replicated at home, which shows how the slits interfere with the light photons (250–66). The difference between visual and sonic dimensions is further explained using pictures of One Direction and Motörhead, although I found this a little hard to understand at first and had to re-read it a few times (270–71).

The opening of Chapter 11 refers to boisterous metal gigs which leads into a discussion about the problems with moshing, as well as a brief note on Nazism in metal (274–75, 275, n4). The bulk of the rest of the chapter is devoted to thermodynamics and explaining Jesse Silverberg’s research into the movement of moshers in a pit and its remarkable parallels to gas molecules, starting with a groundbreaking revelation that ‘moshers at metal gigs can be treated just like – and I don’t know how to break this to you metal fans – dumb, directionless molecules in gas’ (278–79). Moriarty also makes sure we understand the distinction between thermodynamics, which deals with systems, and most other physics especially quantum theory, which wants to break the system into the smallest components possible (281).

The conclusion is far from that: instead, it lists the interesting topics that did not make it into the book, as well as a brief history of how the book came about. This did not matter to me although I would have preferred it not to be called a conclusion. Two of the most fundamental sentences in one of the most fundamental paragraphs in the whole book for me, an arts student with a monumental interest in science, is found on page 308:

STEM [science, technology, engineering and medicine] students can learn a great deal from the arts and humanities, and vice-versa. It’s a great shame some can’t see beyond the narrow confines of their chosen discipline. (308)

This is followed by an honourable mention to Nottingham Trent University and its foundation degree in heavy metal performance, which is actually only a pathway in the Foundation Degree in Music Performance (Nottingham Trent University 2019). The close of the chapter describes the Metal Music Studies journal as a possible ‘first step towards academia accepting the educational power and potential of metal’ (309).

The final chapter is devoted to explaining some of the more challenging maths. This is designed both as a chapter to be read along with the rest of the book, and to be dipped into while reading the main sections: I found the
latter the more-beneficial method and the maths was, indeed, challenging enough that a few attempts were necessary. This chapter does contain a small but important note on the ‘ludicrousness of the academic publishing industry’ as Moriarty bemoans the lack of open access despite most research being publicly funded (325 n12).

Perhaps the most disappointing part of the book is the index: what has been included seems arbitrary, and anything I actually wanted to look up was not listed. I think it would have been preferential not to have included an index at all although this does seem to be a staple of popsci books such as Stephen Hawkings’s *A Brief History of Time* or Jim Al-Khalili’s *Black Holes, Wormholes and Time Machines* (Al-Khalili 2001: 259–65; Hawking 1988: 189–98). Al-Khalili’s work, though, does contain a bibliography, missing from both Hawkings and Moriarty’s books (Al-Khalili 2001: 254–58).

Overall, this book is a very good general introduction into quantum physics. I would suggest a basic knowledge of some physics concepts is very useful (my 2002 A-level C grade was more than enough), and you will also get more out of the book if you are a metal music fan, but it is not a prerequisite. If you are familiar with very basic quantum physics already, it might help you understand some of the more nebulous concepts, or simply be an entertaining way of revising. Regardless, Moriarty’s book is an entertaining way to learn more about quantum physics and metal music.

REFERENCES


——— (2018), *When the Uncertainty Principle Goes to 11: Or How to Explain Quantum Physics with Heavy Metal*, Dallas, TX: BenBella Books Ltd.


https://orcid.org/0000-0002-0053-3144
What names come to mind when you think of metal musicians? How many of them are female, and what positions do they occupy in their bands? Chances are that women are outnumbered by men and that most of them have the role of a singer. Such deliberations lie at the heart of *Gender Inequality in Metal Music Production* (Berkers and Schaap 2018). The authors set out to explore how many women are involved in metal music production, how present they are in the various subgenres, what roles they fulfil in bands, and how their degree of recognition differs from that of men. With these guiding questions, they address common perceptions in metal music culture of women still being a minority who do not have equal opportunities to men.

Over the last decade, a lot has been written on gender in metal music (i.e. Berkers and Schaap 2015; Gruzelier 2007; Heesch and Scott 2016; Herron-Wheeler 2014; Hill 2016; Hoad 2017; Nordström and Herz 2013; Riches et al. 2013; Savigny and Sleight 2015; Schaap and Berkers 2014; Vasan 2010). Most of these studies have either been theoretical or qualitative case studies based on approaches such as ethnological observation, interviews or study of online scenes, which do not, to the present, quantitatively disclose the extent of gender inequality in metal music. To bridge this gap, the authors of *Gender Inequality in Metal Music Production* draw upon the largest publicly available database for metal music, the *Metal Archives* (Encyclopaedia Metallum 2018). With more than 100,000 registered bands from all over the globe, the archive – the only source for statistical data used in the book – includes a wide range of artists at all career stages, from amateurs to professionals (20–21). Using a specifically designed web scraper, capable of examining websites of all registered bands, the authors quantitatively investigated questions around gender based on 350,348 musicians active between 1964 and 2015. Methodically, these primary data were extended qualitatively with twenty interviews plus further secondary sources such as online materials and third-party interviews (20–21).

One of the characteristics inherent in qualitative case studies is the restriction to study local scenes at one single moment in time. With the *Metal Archives* spanning over fifty years of metal history, longitudinal trends can be explored quantitatively. The results confirm the common impression of women being a minority in metal music production. Merely 3 per cent of metal artists are female (34). This number has slightly increased since the 1970s, likely due to the rise of women as vocalists, keyboardists and players of other non-metal instruments such as strings and flutes (70–73). The data further demonstrate that metal music has become a global phenomenon in the past decade. Whilst the percentage of female metal musicians does not differ much between the continents, it does so between some countries. Still, in only ten countries, i.e. Uzbekistan, Armenia and Taiwan, women make up 10 per cent of the musicians (41–45). As the authors suggest, this uneven distribution is likely linked
with the popularity of different subgenres of metal that are strongly gendered. Indeed, the data reveal disparity between male (death, black and thrash) and female (gothic, folk, power and progressive) metal subgenres, and it confirms differences between countries. The percentage of women seems to be disproportionately higher in Japan, Russia and Holland. The authors explain this finding with the popularity of subgenres such as heavy and power metal in Japan, gothic and folk metal in Russia and gothic and progressive metal in Holland, which all belong to the feminine end of the metal music spectrum. Hence, it does not come as a surprise that 16 per cent of the gothic and 9 per cent of the folk metal musicians are women (55–61). The data also confirm expected roles in bands; nearly half (44 per cent) of all women are singers, followed by ‘non-metal instruments’ such as cello, violins and harp (19 per cent); bass guitar (12 per cent); and keyboards (10 per cent). Only 8 per cent perform as guitarists and 6 per cent as drummers (71–73). In other words, the ratio above average of women in gothic and folk metal bands can largely be explained by their role as singers (often with a clean voice) and by their playing of ‘non-metal instruments’. These two roles, as the authors emphasize, are ambiguous regarding status; women are in the spotlight as vocalists, but as supporting instrumentalists they play marginal roles. Drawing on the theoretical model of horizontal and vertical sex segregation (Ridgeway 2011), the authors conclude that the stereotypical instrumentation and prominence of female singers lead to role encapsulation, allowing for metal music to remain masculine. Women as instrumentalists occupy positions with relatively little prestige, but then again, taking up these roles is often the only chance for them to join the otherwise heterosocial circle of male bands (73–77).

The recognition that women receive as a minority within the metal scene is a double-edged sword, as the authors emphasize (85–88). On the one hand, they stand out from the crowd of skilled masculine musicians (88–91), but on the other hand, they suffer from gender-based evaluations that undermine their musical abilities and encapsulate them to the roles of singers and supporting instrumentalists (91–95). Consequently, female musicians might question their musical abilities and suspect receiving positive attention for being an exotic token (Berkers and Schaap 2018: 82–85; Roth 2004). The authors see in record label deals, which also have implications on the musicians’ financial situation and professional status, a way to measure recognition with the quantitative data available. The results demonstrate that at no time since 1964 gender has had a significant effect on being signed to a record label. The authors conclude that the negative and positive tensions are likely to cancel each other out, except in a few subgenres where gender seems to play a crucial role (95–100). Whilst it is surprising that women in gothic metal bands have no effect on the likelihood of getting signed to a record deal, probably because they are less visible in this genre, the study finds that women are disadvantaged in getting a record deal in death and black metal; subgenres that are the most male-dominated. Notwithstanding gender having negligible effect on recognition, the authors found evidence in original interviews and secondary sources that several groups strategically use their female band member for marketing purposes. Yet, they also highlight the negative consequences of such practices, limiting women to predefined, stereotypical or encapsulated roles (95–100).

The book is structured in four chapters on the four areas of interest: (1) longitudinal trends and cross-national differences, (2) subgenres, (3)
instrumentation and (4) recognition. Each chapter includes a summary of relevant theories and empirical data onto which the original quantitative analyses are added. Discussion of previous research includes areas such as the history of women in metal music production, genre conventions and the question of ‘female-fronted metal’ as a genre, instrument stereotypes and prestige, social marking and tokenism. This helps readers not familiar with the discourse to understand the study’s findings in a wider context. Furthermore, the authors succeed in bringing together general and other music-related discourses on gender with those specific to metal music. The empirical analyses are well connected to the current state of research and contribute important quantitative results so far lacking in metal music studies. The presentation is clear and does not require an understanding of quantitative methods. Most of the analyses are based on absolute numbers and percentages extracted from the data set. However, this is one of the weak points of the study. While the authors are always aware of the methodical limitations, and at no point overstate the significance of their findings, some results are based on unstable ground. For example, when concluding that in ten countries the percentage of women amongst all musicians exceed 10 per cent, five of these countries had less than twenty registered musicians in total, and only two had more than fifty (41–45). Thus, several results should better be taken with a pinch of salt. It is likely that significance tests would have revealed few or no systematic differences between the countries regarding the ratio of female musicians. A similar result can be expected for other areas of analysis such as those surrounding subgenres. Only the analysis of recognition, operationalized with record labels (95–100), used a significance test, which turned out not significant. It would have helped to evaluate the significance of the results if the authors had explained their choice and exclusion of methods. If they expected the intended readership not to be familiar with quantitative methods, they could have added more powerful tests in footnotes or in the appendix. Yet, with their descriptive evaluation, it remains open whether the findings are systematic. Whilst numbers and percentages can be compared, standardized effect strengths would have given a clearer and more thorough indication of gender inequality. The authors may be willing to provide such analyses in future research, or, given the sophisticated process of collecting the data, they might decide on making the data set publicly available.

Another point worth raising concerns the qualitative case studies that motivated a quantitative investigation in the first place. Despite doing excellent work combining different theories and data from gender studies, sociology, psychology, music education and popular music studies, the authors hardly discuss their findings against the backdrop of the many ethnomusicological case studies in metal music studies. Consequently, their interpretations and conclusions are very clear, but maybe do not consider enough the complexity the case studies indicate. This critique is not a particular weakness of this study, since it can be expressed for quantitative methods in general.

The methodical criticism should not distract from the fact that *Gender Inequality in Metal Music Production* is a significant contribution to the disciplines of metal, popular music and gender studies. The book confirms the widespread perception of women being disadvantaged in this genre, and it offers convincing explanations based on theory and empirical data. On a
methodological level, the study is also one of the few quantitative works in metal music studies, and as such might motivate other researchers to explore different methodologies. This would certainly help the discipline to develop and gain value at an institutional level.

REFERENCES

——— (2018), Gender Inequality in Metal Music Production, Bingley: Emerald Publishing.

https://orcid.org/0000-0001-7453-0141
Gender Inequality in Metal Music Production (Berkers and Schaap 2018) is a book that aims to reveal the participation of female musicians in metal-based quantitative and qualitative analysis methods. The authors present a critical data analysis, that includes academic literature, online resources and band interviews. The statistical information and qualitative evaluation of gender differences are used to explain why female artists are underrepresented even in contemporary metal music. The book addresses the question: ‘what is the extent of gender inequality in metal music production and how we can explain this?’ (21–22).

The introduction provides comprehensive information for a better understanding of the further chapters. This includes the representation of women in popular music and other music genres, by playing various instruments, and their degree of recognition compared to male counterparts (8–9). The authors point out certain qualities and patterns of behaviour assumed to be typical for males and females from their early years to adulthood. Boys are typically raised to be tough, while girls are encouraged to be delicate and romantic (6). They argue that these characteristics are also linked to music genres, where men tend to prefer ‘harder’ and ‘non-mainstream’ music like rock or metal, and women gravitate towards ‘softer’ and more mainstream genres like pop, classical or folk (9). These gender observations and traditional musical characteristics of rock and pop lead some people to view rock as a ‘male rebellion’ and pop as feminine music (11). Even musical instruments are ‘gendered’ when women are overrepresented as singers and underrepresented as instrumentalists; especially when it comes to guitars and drums (Wych 2012; Bayton 1998; Van Bork 2007). According to the authors, women in metal are obliged to fit into some ‘masculinist codes’ and ways of representing gender (Hoad 2017; Nordström and Herz 2013), which restrains them to two roles: ‘den mothers’ and ‘band whores’ (Berkers and Schaap 2018: 17).

As a female metal artist I mostly agree with the authors. However, I question the statement that women in metal have no other choice but turn into ‘den mothers’ or ‘band whores’. According to the authors ‘den mothers’ demolish their femininity to become ‘one of the guys’ (17). On the contrary, ‘band whores’ emphasize their sexuality by being objectified by men (17). Although these categories presented by the authors might be found in reality and happen to be stereotypical, they do not completely describe female musicians in metal. I would suggest further distinguishing other ‘types’ and ‘roles’, because there are plenty of women in metal who receive respect for their talent, authenticity, sophistication and self-confidence, without fitting the roles of ‘den mothers’ or ‘band whores’.

Chapter 1 ‘Winds of change? Longitudinal trends and cross-national differences’ addresses the history of women in metal. It involves only those female artists ‘who managed to receive some recognition, and those from the global center of the world of metal – Western Europe and North America’ (28). It credits Jinx Dawson of Coven (28), Girlschool (29), as well as women in early-
mid-2000s bands like Nightwish and Evanescence (30). It raises the issue of ‘female fronted’ metal, the label often applied to bands with a female lead singer while neglecting their actual music and sound. There is a kind of irony that I appreciate as the authors prove that label to be discriminatory. It shows that the label ‘female fronted’ sounds as absurd as ‘male backed’, ‘Jewish fronted’ or ‘black guitaristed’ (31). The presented statistical data confirm that metal production is dominated by men, as women are only 3 per cent of the sampled population (34). There is no country in the world where women would form a metal majority.

Chapter 2 ‘Female fronted metal: Gender differences and (sub)genres’ digs deeper into the core of gender performance in particular styles of metal. Women are unequally represented in different subgenres. Most of them participate in gothic metal bands and are less involved in thrash metal, death metal and grindcore (56). Eventually, the chapter describes the problem of gendering subgenres through social marking. ‘Genres can be gendered in a direct way – being implicitly or explicitly marked as feminine’ (62). The authors state that ‘[m]ost gender-marked genres refer to femininity’ (62). Labels such as ‘female fronted’ or ‘all female band’ are good examples, as there is no label for male equivalents – ‘no one refers to Metallica as an all-male band’ (62).

Chapter 3 ‘All vocals, few chords: Gender differences in instrumentation’ explains gender in choosing musical instruments and hence, a role in the band. There is a gender segregation that lies upon the assumption that some instruments are more ‘feminine’ or ‘masculine’ and cultural beliefs about which instruments women and men should play (67). The statistical data also show how gender is linked to instrumentation (67), where the core metal instruments (like guitars and drums) fall into the category of ‘masculine’ (68). The chapter provides data showing that women in metal are mostly represented as vocalists and bassists, as it is rarer to find a female guitarist or drummer (71). On the contrary, men mostly tend to occupy the position of guitarists, followed by drummers and bass players; vocals are the last of their preferences. When it comes to particular genres, women mostly play roles as singers in gothic and progressive bands, and female bassists and guitarists are found more frequently in thrash metal (72).

Chapter 4 ‘Wielding the double-edged sword: Gender differences in artistic careers’ addresses the ambivalent perception of female artists in metal. It is described as ‘the double-edged sword’. On the one hand, women receive attention by standing out in a male-dominated scene. On the other, the reason for that attention is questionable as it is unclear if ‘it is an acknowledgement of musical skills or for being a woman?” (72). The chapter basically reviews social and cultural challenges that often make it difficult to be a woman in metal. These include social boundaries defining ‘how a girl should behave’, the role of ‘a male gaze’ and how they are described as ‘a female metal musician’ rather than just a metal musician (83). Finally, the authors discuss how having a woman in the band can increase and/or decrease the chance of getting signed to a record label due to all the perceived pros and cons (96).

In the conclusion the authors explain that the Metal Archives database used for statistical analysis might not be comprehensive (104). However, they succeed in providing important information about women in metal within the available sources and use them as good evidentiary support. Though females are underrepresented and ‘make up about 3 per cent of the total global metal music production’ (104), the authors acknowledge that they might become more visible since, according to some female musicians, metal has become more welcoming for women (104).
Berkers and Schaap mention Addison Herron-Wheeler and her journalistic research, which became a self-published book entitled *Wicked Woman: Women in Metal from the 1960s to Now* (2014). Herron-Wheeler draws a parallel between the female nature and the narrative discourse of metal music. She cites Sophie Drinker’s book *Music and Women* (1948), which refers to the power of female priestesses who practised witchcraft in the past. Herron-Wheeler compares modern female metal performers to the ancient priestesses of darkness, pointing out that metal music itself is about embracing the dark and the unknown side of life (Herron-Wheeler 2014). Thus, it could be suggested that women in metal are not attempting to ‘fit the boys’ club’, but reclaim their actual power. I share the authors’ assumption that women in metal might become more visible, especially when it comes to female growlers like Angela Gossow of Arch Enemy, Alissa White-Gluz (formerly The Agonist) who replaced her in 2014 (Hartmann 2014) and Tatiana Shmaylyuk of Jinjer, whose video ‘Pisces’ has received extensive attention on YouTube (Leon 2019).

As a female metal performer myself, I find the book useful and educational. I do appreciate the authors’ work, especially since it was done in circumstances with hardly any available data. As for future improvement, I would suggest including more interviews with female artists and using them as part of the data analysis.

Overall, I consider that the authors fulfilled their goal and ‘empirically assessed the extent of gender inequality in metal music production in a longitudinal and comparative perspective’ (103). Moreover, the book is easy to read, so it could be recommended for both academic and non-academic audiences, especially musicians and fans.

REFERENCES

https://orcid.org/0000-0002-3795-4049