**Beyond the black box in music streaming:**

**the impact of recommendation systems upon artists**

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**Abstract**

As algorithms have emerged as a key site of power in contemporary culture and society, they have been scrutinised by a number of media scholars, variously focusing on their opacity (Pasquale 2015), bias (Crawford 2016, Morris, J. W. 2015, Kay et al 2015) and social implications (Beer 2017, Eubanks 2018, Noble 2018, O’Neil 2016, Zuboff 2015). There has also been important work (Bucher 2018, Gillespie 2014) calling for a shift of attention away from the algorithms themselves to the actors that control them: the fundamental questions we should be asking of algorithms, after all, concern more than the specifics of code. This paper applies the arguments developed by Gillespie and Bucher to the algorithms utilised by music streaming services - the powerful but opaque curatorial systems that suggest songs to users. Although there has been important work on algorithms in the context of music streaming (Morris 2015, Morris and Powers 2015, Prey 2017, Airoldi et al 2017), this focus on music streaming remains relatively unusual. Even in the context of music streaming algorithms, our approach is also novel, in that we focus not on the possible effects upon *users* of music streaming platforms - that is, music fans - but, rather, on the possible effects on music *creators*. What, then, might be the effects upon songwriters and artists of the increasing prevalence of recommendation systems in music streaming?

**Introduction: The Growth of Music Streaming**

Although the terms are commonly conflated, this article concerns the *record* industry as distinct from the broader *music* industry; our focus is those aspects of the music industry that are directly related to recorded music. Opinions differ as to the extent of the shift experienced by the record industry since the emergence of digital technology. On the one hand, Wikström (2013, p. 4) identifies a ‘dramatic’ transformation, characterised by high connectivity and reduced control; music as a service, rather than a product; and an increase in amateur production. On the other hand, Rogers (2013, p. 178) insists that claims of a digital revolution are overstated: ‘forces of change have been diluted by forces of continuity’. Wikström and Rogers disagree primarily on the effects of digital disruption on record industries and artists. One particular change in the record industry, however, is beyond doubt: streaming platforms, such as Spotify, Apple Music, Tidal, Deezer and YouTube, have become increasingly dominant, ushering in a shift from ownership to access.

Globally, income from music streaming increased by 41.1% in 2017 from the previous year (IFPI 2018). This growth in streaming income, particularly from paying subscribers rather than those non-paying users accessing ad-supported streams, is the critical factor in an 8.1% increase in income from recorded music overall; revenue from downloads in the same period fell by 20.5%, and revenue from physical sales fell by 5.4% (IFPI 2018). Digital revenues now account for 54% of the global recorded music market, and streaming has for the first time become the single largest recorded music revenue source (IFPI 2018). This increase is particularly significant because it marks the third consecutive year of growth for recorded music globally - and because those three years of growth follow 15 years of decline (IFPI 2018). Working on behalf of record labels, the International Federation of the Phonographic Industry (IFPI) accuses certain streaming platforms, notably YouTube, of a ‘value gap’: a ‘mismatch between the value that some digital platforms… extract from music and the revenue returned to the music community – those who are creating and investing in music’ (IFPI 2018, p. 26). Yet streaming, more broadly, has been welcomed with open arms by the record industry, as the first good news since Napster ushered in the era of peer-to-peer file sharing around the turn of the millennium. By the end of 2017, music streaming platforms had 176 million paying subscribers globally, and the pace of growth is high: 64 million of those subscribers only signed up during that year (IFPI 2018, p. 10). Although paid-for streaming subscriptions might be reaching saturation in certain markets, growth is expected in other countries including Germany, Japan and Brazil (Mulligan 2018a). Spotify and Apple Music are the big two premium services worldwide, as of November 2018, with 87 million (Aswad 2018) and 50 million (Chang 2018) premium subscribers respectively. YouTube and SoundCloud actually have more users but, as primarily free services, they generate lower revenues. We can also identify some geographical variation. Apple Music tends to be more prominent in the United States, for instance, while Spotify dominates in in Europe. Other services are prominent in other territories: Deezer in France; QQ Music and Netease Music in China; Yandex and VK in Russia; Saavn in India. It is important to remember that total income from recorded music is still relatively low if viewed from a broader historical perspective: ‘total industry revenues for 2017 were still just 68.4% of the market’s peak in 1999’ (IFPI 2018, p. 10). It does seem, however, that streaming, in 2018, is the only game in town for recorded music: despite media claims of a ‘vinyl revival’, global revenue from physical sales was lower in 2017 than it has been at any point this millennium (IFPI 2018). In the specific United States context, for example, streaming accounted for 75% of recorded music revenues (physical 10%, downloads 12%, sync 3%) during the first half of 2018, accounting for $3.4 billion in revenue - up from $1 billion in the first half of 2015 (RIAA 2018).

Services such as Spotify and Apple Music have tens of millions of users, and provide tens of millions of songs. To manage systems of this scale, streaming services utilise a wide variety of technologies, including algorithms. Contemporary listeners do not only rely on services’ front-end interface to find music; increasingly, they also turn to suggestions from the services themselves - relying on service-generated playlists or radio stations to discover individual songs. The decline in the importance of the album is nothing new: the process of ‘unbundling’ albums into single tracks began with the launch of iTunes. What *is* new is the fact that individual songs are now ‘pushed’ to listeners by playlists, rather than being actively sought out. This is part of a broader trend, in which algorithms have become ‘a key logic governing the flows of information on which we depend’ (Gillespie 2014, p. 167). Consider, for instance, Netflix’s decision to license the *House of Cards* television series, starring Kevin Spacey, in 2011. While more traditional networks considered *House of Cards* unpromising, Netflix was able to analyse the viewing habits of its 33 million subscribers - and to conclude that there was, in fact, a sufficient potential audience to commission the show (Smith and Telang 2017). The series became a significant hit. Yet customer data did more than allow Netflix to commission *House of Cards* when others could not see the potential*.* Netflix was also able to promote the series in a novel fashion, for instance by creating multiple trailers for the show. Subscribers who had liked Kevin Spacey’s previous work were shown one trailer; subscribers known to like programmes with strong female lead characters were shown a different trailer; subscribers known to have enjoyed the previous work of director David Fincher were shown a third (Smith and Telang 2017, p. 8). Netflix, in other words, had identified ‘a new way to promote content (through personalised promotional messages based on individual preferences)’ (Smith and Telang 2017, p. 11). Music streaming services use data in a similar fashion, in the process establishing themselves as a new kind of intermediary: gatekeepers providing an interface between listener and catalogue - and acting, in the process, as DJ, radio station, storefront, and following Spotify’s October 2018 investment in DistroKid (Moon and Nellis 2018), distributor all in one.

Streaming services all have various tools to aid users in music discovery, and the balance between human and machine input varies from one to the next. These include: *text search*, for artist, release, genre, playlist name; *categorical lists*, grouping albums, artists and playlists by themes (for example Spotify includes ‘moods’, ‘decades’, ‘focus’, ‘gaming’) or outlining new releases; *playlists*, including by genre, mood, theme, popularity charts (by territory); and *hyperlinks* - any artist or album name is a clickable link to other parts of the catalogue. The user interface of these systems is critical in determining how users interact with the music catalogue. For example, an artist’s ‘latest release’ is shown at the top of their Spotify profile, followed by a list of five ‘popular’ songs (not necessarily in descending order of streams). Priority, then, is given to the new and popular - and this is largely beyond the artist’s control. The ‘latest release’ section, incidentally, is to some extent a misnomer; if an artist hasn’t released music for a certain period, ‘latest release’ disappears and ‘popular’ rises to the top of the artist’s profile page. Design choices made by music streaming services also affect discovery using the search bar. Results for searches via text strings - for example an artist name - will vary by user. Searching ‘James’ may give one user James Blake as the top result, for instance, and another user James Brown. There are, then, subtle systems in place that push listeners toward certain artists or songs, and away from others. As listeners increasingly rely on service’s tools to find music, it becomes increasingly important for artists to be noticed, or made visible, by those tools in order to maximise their share of streaming revenue. Understanding the systemic tools is therefore critical for recording artists, and this is true for the most established through to the least known. The prominence of streaming services has made the methods by which listeners find music critical to artist’s business models. Just as appearing on the first page of a Google search has long been key for online discovery, the logic emerging on music streaming platforms is as simple as it is ruthless: if an artist’s catalogue is not easily discovered, she will miss out on an audience and, therefore, revenue.

As the use of algorithms by music streaming services has gained prominence, so has it come under scrutiny by scholars. On the whole, those who have examined the impact of algorithms tend to focus on the effects on users. Prey (2017), for instance, has examined the ways in which individual listeners fall into categories designated by advertisers, arguing that commercial imperatives shape ‘algorithmic individuation’ on music platforms such as Pandora Internet Radio and Spotify. Meanwhile, Airoldi et al (2016) have examined the network associations within YouTube music videos, arguing that traditional genres increasingly sit alongside new algorithmically generated categories - ‘music for relaxation’, for instance, is as effective as ‘rock’ within machine categorisation. Our focus in this article, however, is the impact of algorithmic power - understood as located not in the algorithms themselves but in the actors behind those algorithms - on *artists*. Such a focus might seem odd: as Stahl (2013, p. 2) acknowledges, ‘successful artists often appear to us as paragons of autonomous self-actualisation’. The Romantic image of the artist as a rebellious outsider is powerful and enduring. As Stahl points out, however, ‘recording artists also typically work under unequal contracts and must hand over long-term control of the songs and albums they produce to their record companies.’ A less Romantic perspective on musicians would see them as carrying out ‘act[s] of labour within the industrialised process of cultural production’, even if cultural work may seem ‘hardy like work at all’ (Banks 2007, p.3-4). Typically, musicians’ contracts with a record label are exclusive, meaning that the artist cannot record for anyone else without permission, and assignable, meaning that they can be bought and sold without consulting the artist. Finally, as Stahl points out, recording contracts typically cover not a fixed period of time but a number of album options - which can close off access to a competitive market for periods of 20 years or more. Far from the lone genius of Romantic thought, we can conceive of artists as carrying out creative labour - not always in enviable conditions. As Stahl argues, then:

The recording artist - the successful recording artist, in particular - is a double figure. On the one hand, she is a symbolic figure offered for our consumption, contemplation, and identification; she enacts forms of expression, autonomy, and desirability, seeming to encapsulate some of our society’s most cherished virtues and values. On the other hand, she is a political and economic actor, a working person whose contractually governed relationship to her company is sometimes one of real subordination. In this doubleness, the recording artist embodies a paradox: as an agent of self-expression under contract to a major entertainment conglomerate or a subsidiary company, the recording artist is both autonomous and the target of control. He [sic] must be free to generate new material and unfree when it comes to the labour and intellectual property covered by the contract. (Stahl 2013, p. 2-3)

Artists’ relationships with their record labels may have been at times subordinate, but they were at least contractually defined. Relationships between artists and streaming platforms, by contrast, are much more vague.

**Music streaming algorithms: beyond the black box**

Since they are both powerful and mysterious, the algorithms deployed by music streaming services might seem to illustrate an information asymmetry that is widespread in the information economy: ‘corporate actors have unprecedented knowledge of our daily lives, while we know little to nothing about how they use this knowledge’ (Pasquale 2015, p. 9). The contemporary world, for Pasquale, resembles a one-way mirror or black box. Recommendation engines, for instance those operated by Amazon and YouTube, influence the choices we make - and that influence may not be benign. ‘The economic, political, and cultural agendas behind their suggestions are hard to unravel. As middlemen, they specialise in shifting alliances, sometimes advancing the interests of customers, sometimes suppliers: all to orchestrate an online world that maximises their own profits’ (Pasquale 2015, p. 9). This information asymmetry, characteristic of what Srnicek (2016) calls ‘platform capitalism’, is now fairly well established, acknowledged not only by scholars but in popular literature (O’Neil 2016). Also increasingly established - and again noted by O’Neil (2016) - is the understanding that claims to impartiality by the corporate actors that deploy algorithms should be received with a degree of scepticism. As Gillespie (2014, p. 180) states, ‘the performance of *algorithmic objectivity* has become fundamental to the maintenance of these tools as legitimate brokers of relevant knowledge’ (emphasis in original). Yet the impression that algorithms are neutral and objective is, for Gillespie (2014, p. 179) as for many others, ‘a carefully crafted fiction.’

These twin insights - firstly, the acknowledgement of a fundamental information asymmetry, and secondly, an understanding of algorithms as not neutral or impartial - are important in analysing music streaming algorithms, which are, to some extent, black boxes. Yet the black box analogy can create the impression that, if we were only able to peer inside one of these black boxes, we would discover a secret key that would somehow ‘explain’ or ‘solve’ the mysteries of music streaming. Our approach in this article is instead informed by the more novel suggestion, proposed by Gillespie (2014, p. 169), that we should not attempt to understand algorithms in isolation; instead, we must ‘unpack the warm human and institutional choices that lie behind these cold mechanisms’. This argument has been convincingly developed by Bucher (2018), who has made a strong case for moving beyond the black box analogy to a consideration of settings and contexts - a shift, in other words, ‘from what algorithms are to what they do’ (Bucher 2018, p. 42). Bucher’s contribution is to argue that examining algorithmic power does not require an examination of algorithms themselves. Algorithms, Bucher argues ‘do not work on their own but need to be understood as part of a much wider network of relations and practices’ (p.20); ‘we must not lose sight of the ‘human decision-making processes and programming that precede any algorithmic operation’ (p.35). The black box analogy is insufficient, then, because algorithmic systems themselves are simply one part of a larger picture. ‘Algorithms are socio-material practices, not merely a set of coded instructions’ (Bucher 2018, p. 152); they are not neutral but, instead, ‘reflect the values and cultural assumptions of the people who write them’ (p. 90). Netflix or YouTube deploy ‘not one algorithm but a collection of algorithms, working together to create a unified experience’ (Bucher 2018, p.47), and contemporary music streaming services likewise combine many different algorithms to control the various elements to what the user sees on their screens. Algorithms, in other words, are multiple. Algorithms also exist in a state of flux: online platforms are typically engaged in constant A/B testing, as those *House of Cards* trailers illustrate. Users are essentially participating in giant focus groups even if they are not aware of it, resulting in ‘the logic of ‘constant change’ (Bucher 2018, p. 48). Algorithms are not static or stable; instead, they can be ‘easily, instantly, radically and invisibly changed’ (Gillespie 2014, p. 178). The experience of any given platform will vary user to user; ‘the culture of experimentation complicates any effort to know algorithms, as the question inevitably arises as to which version, what test group, or what timeframe we are talking about’ (Bucher 2018, p. 48). Algorithms are not permanent but eventful, forever in a process of becoming (Bucher 2018, p. 49).

In considering the algorithms utilise by music streaming services, then, we need to do more than imagine what might be hidden within the black boxes. Opacity is by no means limited to the algorithms. Streaming deals, too, are opaque: there is ‘much confusion’ as to ‘how, exactly, streaming services are being licensed, how it is calculated what digital service providers (DSPs) must pay, and how that money is then processed and shared by the music rights industry’ (Cooke 2018, p. 8). Cooke (2018) identifies various reasons for this confusion: the complexity of streaming deals; the fact that the record industry (concerned with recordings) and the music publishing sector (concerned with songs and compositions) do not always license in the same way; variation between countries; the fact that most streaming deals are essentially revenue share agreements, making payments per-use difficult to predict; the fact that the specifics of many music streaming deals are kept secret due to non-disclosure agreements; and, finally, the fact that those responsible for developing new licensing arrangements have not always been effective in communicating these arrangements to the rest of the industry. Each month, as Cooke explains, a typical streaming service will pay a cut of its revenue to record labels and music publishers, calculated as a proportion of overall consumption; the copyrights in songs are treated by the record industry as distinct from the copyrights in sound recordings, with the former typically dealt with by music publishers, while the latter are typically controlled by record labels. Typically, Cooke suggests, a record label might expect to receive 50-60% of revenue; a music publisher might receive 10-15%; and the streaming service might retain approximately 30%. Yet ‘every deal is different, and usually secret’ (Cooke 2018, p. 15). Simply seeing inside the algorithmic back box will not shed much light on streaming platforms if streaming deals remain behind closed doors.

Also opaque is the extent to which streaming, while clearly benefiting the record industry in general, is benefitting individual artists. Streaming services tend to cite top-level statistics: Spotify, for instance, states that it has paid $8 billion to rights holders since its launch (IFPI 2018). What is less clear, however, is how much of that money reaches artists and songwriters. Even established artists such as Thom Yorke, Taylor Swift and David Byrne have complained about relatively low payments from streaming platforms, and the extent to which revenue from the sale of Spotify shares is passed from labels to artists remains a controversial topic (Paine 2018). If anything, less commercially successful artists have more to complain about, since what money does reach artists and songwriters tends to go to established stars. Spotify founder Daniel Ek has suggested that only 0.733% of acts on Spotify are in the ‘top tier’ in revenue terms - a tier that enjoys ‘material success’ and the ability to ‘live off their work’ (Ingham 2018). More than 99% of audio streaming, it is claimed, is of the top 10% of tracks (Krukowski 2018). Mulligan (2018b) has gone as far as to suggest that we may be witnessing the ‘end of the breakthrough artist’, pointing out that not one of America’s ten top-selling albums in 2017 was a debut; there was only one debut in the UK’s top ten in the same year. ‘Just 30% of Spotify’s most streamed artists in 2017,’ Mulligan (2018b) continues, ‘released their first album in the prior five years.’ While streaming is often presented as more democratic than traditional radio, then, there are reasons to treat the claim with caution. And again, the issue is much bigger than an algorithmic black box. Cooke (2018, p. 77) suggests that, on the sound recording side, a label might take perhaps 46.4% of revenue from relevant streams, with 11.6% going to the artist (assuming a total allocation of 58% to the *recording*); on the composition side, a publisher might take 3.6% of income from relevant streams and a songwriter 8.4% (assuming a total allocation of 12% to the *song*). This leaves the streaming platform with 30%. Yet as Cooke (2018, p. 76) acknowledges: ‘Quite how money is shared varies according to: each deal between a DSP and a rights owner; each artist and songwriter’s individual label and publishing contracts; and collecting society conventions. Splits are also evolving because DSP deals are renegotiated every few years and revenue share arrangements have been altered slightly.’ There is, then, not one revenue share split but many - and, like the algorithms, these splits are forever in flux.

There are other reasons, too, why we need to look beyond algorithmic black boxes for a proper understanding of music streaming. A selling point of Apple Music, for instance, is its use of human, rather than algorithmic, recommendation engines, and many of Spotify’s highly successful playlists, such as RapCaviar are also human-driven. Consider the high-profile hirings by Apple Music of BBC Radio 1 presenter Zane Lowe in 2015, and Charlie Sloth, a Radio 1 and 1Xtra presenter, in 2018. Consider, too the fact that DJ Semtex has recently left BBC 1Xtra, in part to increase his commitment to his Spotify podcast. Similarly high-profile hirings have been made at management level: former Radio 1 Head of Music George Ergatoudis is now the UK head of Apple Music, following a stint at Spotify; Austin Daboh, former Head of Music at 1Xtra, is now Head of Shows and Editorial, UK at Spotify; 1Xtra editor Ryan Newman also moved to Apple Music in 2018. To focus entirely on the algorithms used by these services, then, is to miss the bigger picture. Streaming platforms have many controlling inputs, of which computer code is just one. The system is not static, but continually developing through changes to the code, and interaction (by artists and listeners) with the service and the catalogue. Some Spotify playlists are algorithmically generated, while others, such as RapCaviar and Today’s Top Hits, are entirely curated by humans - albeit humans likely to be examining data when making curatorial decisions. Artists and their representatives have always had to work to attract the attention of gatekeepers and intermediaries, and they now have to be cognisant of the control structures of streaming services to successfully reach an audience.

**The inverted panopticon: a continuum of (in)visibility**

Online platforms are frequently discussed in terms of surveillance capitalism (Zuboff 2015, Bellamy Foster & McChesney 2014, Fuchs 2012), a model sometimes compared to Foucault’s panopticon (1984, p. 206). Yet Bucher (2018, p.84) insightfully inverts Foucault’s model. The threat of the panopticon, after all, was that of permanent visibility. With algorithms, Bucher argues, we are dealing not with a ‘threat of visibility’ but a ‘threat of invisibility’: ‘the problem is not the possibility of being constantly observed but the possibility of constantly disappearing, of not being considered important enough’ (Bucher 2018, p. 84). This threat of invisibility is of clear relevance to artists. Given the importance of streaming as a revenue source, the most obvious threat in this regard would be an outright ban, removing the possibility of earning revenue from streams (not to mention the other revenue streams, from live performance and direct-to-fan services, that are to a significant extent reliant on visibility on streaming services). According to Spotify (2017), no music has ever been banned from their platform. The banned/not banned binary, however, may be too simplistic. Might streaming services make more subtle changes to the visibility of a given artist? Might we, for instance, be able to identify artists subject to a ‘shadow ban’? Within the world of online forums, a shadow ban is a process in which a user is banned from part of a service, for instance, from posting on a particular thread, in a manner that is invisible to that user. The phrase has also been applied to social media, with President Donald Trump, for instance, acccusing Twitter of shadow banning certain Republicans from its platform (Stack 2018). Again, the crucial feature of a shadow ban is that the individual concerned is unaware that such a ban exists: ‘When a person is shadow banned, their posts on a platform are rendered essentially invisible to everyone but themselves. Their experience using a site may not change — they feel like they are still posting normally — but other people cannot see the material they produce’ (Stack 2018).

The notion of a shadow ban suggests that the banned/not banned binary is, indeed, too reductive. In fact, we suggest that even the question of whether or not an artist is subject so a shadow bans is too blunt a tool for examining the range of subtle of practices that may be occurring within music streaming services, not least because it suggests that platforms can only ban (shadow or otherwise) when, in fact, they can also *boost* visibility. Instead, we propose a sliding scale of possibilities, a continuum along which artists and their music could be both upgraded and downgraded. We can identify five possible points on this continuum. Firstly, a song or an artist could receive a *public upgrade*: an artist’s album, for instance, could appear on the interface homepage. Secondly, a song or artist could receive its antithesis, a *public downgrade*: for example, an acknowledgement that an artist has been made less visible on a given platform. Thirdly, a song or artist could receive a *shadow upgrade*: a song, for instance, could become more likely to be selected within algorithmically-generated radio stations. Fourthly, a song or artist could be subject to the opposite, a *shadow downgrade*: for example, an artist might not appear clearly within search results, requiring a user to spend additional time finding their catalogue. Fifthly, a song or artist might receive an *outright ban*: in other words, that song or artist would not appear on a given service at all.

As discussed, we are not aware of any artists receiving an outright ban from a streaming service. but we now provide examples to illustrate the other four points on this continuum. First, public downgrade and upgrade. In May 2018, it was announced that Spotify had removed the music of R&B artist R Kelly from its playlists as part of a new ‘hate content and hurtful conduct’ policy. Users were still able to find R Kelly’s music if they searched for it, but Spotify would no longer actively promote his recordings through their own playlists and recommendations. The move was in response to the #MuteRKelly social media campaign, which called for the singer to be boycotted due to sexual assault allegations - allegations that R Kelly denies. The move was noteworthy, in part, because it raised the question of whether streaming services should be making moral judgements - not to mention the subsequent question of the grounds on which such judgements might legitimately be made. For the purposes of this article, however, the move was noteworthy for a different reason: Spotify’s acknowledgement that they could, and would, tweak their algorithms to affect the visibility of a given artist. The R Kelly decision was fairly widely reported in the media, and Spotify issued a public statement on the subject. This was, in other words, a public downgrade. Under the same ‘hate content and hurtful content’ policy, Spotify also removed from its playlists the music of rapper Jahseh Dwayne Onfroy, better known as XXXTentacion. At the time, the rapper was on trial for false imprisonment, witness tampering and aggravated battery of a pregnant woman, charges to which he pled not guilty. This too, then, was a public downgrade. Strikingly, XXXTentacion is also an example of a public upgrade on the streaming service. When the rapper was shot dead in June 2018, in an apparent attempted robbery, Spotify then began to promote his music with the message ‘Rest in peace, XXXTentacion’ shown on the homepage of many users, alongside a promoted playlist (Cush 2018) - the platform, consequently, was accused of hypocrisy. The cases of R Kelly and XXXTentacion are particularly notable as public acknowledgement by Spotify that ‘downgrading’ of artist visibility is not only technically possible but a practice in which they were willing to engage. Spotify’s acknowledgement gives rise to further questions that we should ask not just of Spotify but of all streaming services. Are there other downgrades that have not been publicly acknowledged? On what grounds other than moral censure might a streaming service justify downgrading or upgrading artists in this fashion? It should be noted that, by the time XXXTentacion was shot dead, Spotify had dropped its ‘hate content and hurtful conduct’ policy; the policy, indeed, barely lasted a fortnight. Founder Daniel Ek admitted that the streaming service ‘rolled this out wrong and we could have done a much better job’, insisting that the platform did not intend to become a ‘moral police’ (Wang 2018). Furthermore, it was rumoured that Troy Carter, Spotify’s Global Head of Creator Services, threatened to quit over the policy (Halperin and Aswad 2018), and that representatives for artists including Kendrick Lamar called Ek to express their frustration (Sargent 2018) - itself an interesting hint of the power of the (high-profile) artist in a supposedly algorithmic age. The broader question of algorithmic accountability, however remains.

We move now to the shadow downgrades, the most rudimentary example of which can be experienced by undertaking the admittedly grim task of searching on Spotify for artists convicted of extremely serious and deeply repugnant sexual crimes. At least for the authors of this paper, for instance, neither Gary Glitter (convicted of possessing child pornography in 1999, then jailed in 2006 in Vietnam, and 2015 in the UK, on child sexual abuse charges) nor Lostprophets (whose singer, Ian Watkins, was sentenced to 35 years in prison for child sex offenses in 2013) appear in the results of an initial search for their respective names - although in both cases, the artists and their catalogues *do* appear when the ‘see all’ button is clicked. This would appear to be a shadow downgrade in action. The music still exists on the platform, and so fits with Spotify’s assurance that no music receives an outright ban. However, additional work is required to find the music. Not all high-profile criminal artists, however, appear to have been downgraded in this manner. The reasons for these disparities is not clear. Examples of the final category we identify, the shadow upgrade, are hardest to come by. Indeed, we have no evidence that such practice is occuring; we simply speculate as to what might be possible. While it is easy enough to see that Gary Glitter, for instance, has been made less visible in search results, it may be impossible to show that another artist is getting the opposite - i.e. preferential treatment. It would be entirely possible, however, for a shadow upgrade to make one particular artist with the first name of ‘James’ the top search result rather than another, or to make songs by a particular artist more likely to be selected by a particular algorithm. However, this would also be almost impossible to evidence. The term ‘shadow’ indicates that not only will the artist or individual user be unaware of a downgrade, but also that the criteria by which such a ban might be justified are also hidden. As previously described, there is no single algorithm or service, but many. There is therefore no means of appeal, as a downgrade is almost impossible to prove.

Since algorithms are both multiple and constantly in flux, the scenarios identified above should not be understood as mutually exclusive alternatives; it might be possible for an artist to be upgraded on one user’s profile but simultaneously downgraded on another’s. This could, indeed, be precisely the sort of A/B testing in which a streaming service might might wish to engage. Netflix, Bucher (2018) states, might be running not only two variants of an algorithm, but five or ten, with multiple tests being carried out in parallel. As a result, we should think of Netflix as a work in progress: ‘So-called A/B testing is integral to the culture of experimentation that governs platforms as a means of assessing and comparing how well different versions of the algorithm perform,’ although these experiments are ‘invisible’ to users (Bucher 2018, p. 48). This is also true of Facebook: Bucher describes the platform’s news feed as constantly being fine-tuned, ‘there is no clearcut way in which a certain state of the feed can be easily discerned’ (Bucher 2018, p. 81). The same is true of most streaming services. Due to the highly personalised nature of the systems, what one user sees could be wildly different from the next. Much as there is no single algorithm to study, so there is potentially no single system on which artists are downgraded or upgraded, but a dynamic set of systems, continually managed by both human and machine input. It is for this reason that the term ‘shadow ban’ does not suffice. Artists may not be removed from all playlists, but from a certain proportion. That proportion of listeners are shown a slightly different version of a given webpage, and their behaviour is used as a point of comparison: which version gains more clicks or longer listens? Since A/B testing is invisible, neither the user, nor the artist, will ever be aware of these changes in design. Additionally, due to the use of machine learning, even a human engineer may not be aware of such changes - Discover Weekly is essentially a unique playlist for each and every Spotify user, and so no human is ever aware of all 100m+ playlists in circulation. Only the machine system has such awareness.

The public downgrades of R Kelly and XXXTentacion appear to have been made for moral reasons; that appears true of the shadow downgrades of Gary Glitter and Lostprophets too. However there are a multitude of other possible influences over upgrades and downgrades. It has been alleged, for instance, that Spotify is ‘burying’ the music of artists who introduce new material exclusively with their rival Apple Music (Shaw and Santiano 2016). Katy Perry has allegedly been a victim of this practice: her 2016 track ‘Rise’, it is claimed, was ‘continually blackballed’ on Spotify’s biggest playlists, although it was not downgraded in search results (Ingham 2016a). This ‘blackballing’, it is alleged, was in response to the fact that the track was originally released as a ‘windowed’ iTunes and Apple Music exclusive, not appearing on Spotify for a full week. To be clear, Spotify insisted that it did not bury Katy Perry or other artists close to Apple or Tidal in search results (Ingham 2016a); but Ingham insists that the streaming service *did* keep them off its playlists - a similar situation to R Kelly and XXXTentacion in 2018, although one that was not publicly discussed as part of a PR campaign. Services have other business relationships to maintain that may somewhat influence internal decisions. For example since 2008, Spotify has reportedly had major investments from organisations including Goldman Sachs, the Coca Cola Company, and Dragoneer Investment Group (Ingham 2016b), and back in 2015 they made €68m from advertising (Ingham 2015). Financial investment through funding and advertising spend is important for the business both for growth, and to keep shareholders content. Artists themselves also may exert power and influence over the upgrades and downgrades, similar to the phone calls made to Daniel Ek around the XXXTentacion public downgrade. For example Bruno Mars (in November 2018, the 29th most streamed artist in the world on Spotify) played at Daniel Ek’s wedding to Sofia Levander in 2016; and Ed Sheeran (13th most streamed artist on Spotify), has spoken publicly in support of Spotify (Savage 2014, Associated Press 2015, Dredge 2014). Even established, top-tier artists could be vulnerable. What if a service takes issue with an artist’s political statements, or with a band performing in Israel? To be clear, this is not simply about algorithm design. Being downgraded by a particular algorithm is just one way power may be exerted over an artist - royalty rates could be changed, equity may be used as an incentive. The systems in place are influenced by many factors, only one of which is the structure of individual algorithms. However, financial pressure, personal relationships, human bias, market competition, and licensing agreements all guide music recommendations. While we do not know whether or not particular artists have been up or downgraded, this lack of knowledge is precisely the point. And looking inside the black box would not shed the required light.

**Conclusion: Implications for future research**

With most income from recorded music now generated through streaming services, and fans finding music through tools - text search, categorical lists, playlists, hyperlinks - controlled exclusively by these services, understanding these services and tools is of primary importance to the contemporary recording artist, as well as to scholars of the music industries. The notion persists that there is, within a given streaming platform, a black box, to which artists and their managers must gain access if they wish to understand and effectively benefit from that streaming service. In truth, there is no such ‘secret sauce’. Scholars and artists alike, then, need to look beyond specific algorithms, and to understand that the power behind recommendation systems is primarily located elsewhere. This power could conceivably result in downgrades or upgrades, be they ‘public’ or ‘shadow’, each with potentially significant effects on artists who are increasingly reliant on streaming services as a source of income from recorded music, as well as a means to gain the profile required to earn meaningful income from other revenue streams including live performance and direct-to-fan services. There was some excitement around the launch of Spotify for Artists, which allowed artists to access detailed data on their listeners, as well as to submit music to playlist curators, and this is indeed a positive step for creators. Yet to focus only on algorithms, or on data, is to neglect the fact that any streaming service will be subject to a number of influences: from employees, shareholders, advertisers, record labels, music publishers and so on; from rivalries with other streaming services; from public opinion, which may result in moral censure of particular artists. Any and all of these may have an impact on recommendation systems. An increased understanding of the subtleties of downgrades and upgrades, then, is necessary to truly understand the power of streaming services, and the potential financial consequences on artists. Downgrades and upgrades do not simply highlight the design of a given recommendation algorithm, but reflect the power that streaming services have over artists and their income. Scholars and researchers need to consider the entire system - not only the mythical standalone algorithm - and be mindful that this system is constantly becoming, constantly in flux, and therefore never fully visible. To obsess over an algorithmic black box at this or that streaming service is to neglect the fact that power dynamics extend far beyond code. Further research to shed light on power and control within music streaming services is therefore required.

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