Chinese Journal of Communication

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/rcjc20

From P2P to the cloud: music, platformization, and infrastructural change in China

Zhongwei Li & David Hesmondhalgh

To cite this article: Zhongwei Li & David Hesmondhalgh (01 May 2024): From P2P to the cloud: music, platformization, and infrastructural change in China, Chinese Journal of Communication, DOI: 10.1080/17544750.2024.2347626

To link to this article: https://doi.org/10.1080/17544750.2024.2347626

Published online: 01 May 2024.

CHINESE JOURNAL OF COMMUNICATION
https://doi.org/10.1080/17544750.2024.2347626

Routledge
Taylor & Francis Group

From P2P to the cloud: music, platformization, and infrastructural change in China

Zhongwei Li and David Hesmondhalgh

School of Media and Communication, University of Leeds, Leeds, UK

ABSTRACT

This article provides a history of the platformization of music in China and explores what this history might tell us about platformization in the Chinese context. It goes beyond existing accounts of digital music in China, which have been dominated by the issue of intellectual property enforcement, and beyond existing accounts of the platformization of cultural production by drawing upon interpretations of platformization as a closing down of the open and "generative" potential of internet architecture. The article also considers the musical socialities afforded by different kinds of digital music applications—for example, those involving individualism or reciprocity, gift-like sharing, or consumerist exchange. Our historical analysis has three stages: a review of Chinese digital music services in the 2000s, including P2P-based and FTP-based file sharing, website-based "celestial jukebox" arrangements, and MP3 search engines; an analysis of Xiami Music, which argues that it exhibits a trajectory similar to what Andersson Schwarz characterizes as "spotification" in Western contexts; and an analysis of the contemporary cloud-based model of music streaming platforms. We argue that, while accounts centered on intellectual property might highlight Chinese exceptionalism, the examination of platformization as an intervention in infrastructure points to trajectories common to both China and the West.

ARTICLE HISTORY
Received 28 July 2023
Accepted 2 April 2024

KEYWORDS
Platformization; infrastructure; China; spotification; cloud; music

In mainland China, as in many other places, the past two decades or so have witnessed the rise of digital platforms in social, economic, and cultural life. This has included a transition of digital music services towards a platform-based, copyright-centered ecosystem. While there has been some discussion of the form that platformization has taken in China (De Kloet et al., 2019; Wang & Yu, 2021), including some attention to platformization in the realm of Chinese culture (e.g. Wang & Lobato, 2019), there has been very little discussion of the platformization of Chinese music production and consumption (we discuss some of the exceptions below). By contrast, there has been extensive analysis of the forms that the platformization of music has taken in the Western context (e.g. Drott, 2018; Prey, 2018).

CONTACT Zhongwei Li z.li7@leeds.ac.uk

This article aims to contribute a more critically informed and analytically sophisticated account of the platformization of music in China and to explore what this might tell us about platformization in the Chinese context more generally. It goes beyond existing studies of digital platforms in China by engaging critically with a thread within digital platform studies that understands platformization in terms of its impacts on the politics of infrastructural systems (Hesmondhalgh et al., 2023). In investigating the Chinese path towards platformization from this infrastructural perspective, we are concerned with how the contradictions and contestations apparent in the Chinese context may enrich our understanding of platformization beyond the West. The article is thus an attempt to use "global China as a method" by understanding the ways in which China is integrated into global economy, politics, and culture rather than seeing it as a separate and utterly distinctive other (Franceschini & Loubere, 2022). While we make some comments about the differences and commonalities between the Chinese and Western versions of the platformization of music, our main aim is not comparative; it is to fill gaps in knowledge and research concerning the relationship between internet infrastructure, digital platforms, and other technologies in the realm of Chinese music.

We proceed as follows. In Section 2, we show how studies of digital music in China have been dominated by the issue of intellectual property enforcement. While this development is indeed important, we explain that our aim is to complement that emphasis by paying attention to equally significant developments in platformization and infrastructure that have been neglected in research on music, technology, and culture in China (and, to a large degree, in the West as well). Section 3 introduces these fundamental principles and the normative issues that they raise. Following recent work in legal studies, we understand this aspect of platformization as involving a shift in infrastructural politics, whereby the open and "generative" potential of internet architecture was closed down in favor of a platformed infrastructure (Cohen, 2019; Van Schewick, 2010; Zittrain, 2008). We also suggest in this section that many recent studies of the platformization of culture and music, whether focused on the Chinese or the Western cultural context, have not so far addressed these fundamental issues regarding the fate of key principles underlying internet architecture and infrastructure, which are central to understanding platformization. In Section 4, we relate such debates about platformization in general to the realm of culture and specifically music, drawing on Jonas Andersson Schwarz's (2014) account of "spotification," in which the Swedish music streaming platform Spotify exemplifies (and leads the way to) how the open infrastructure of the internet came to be disciplined and bounded, moving towards a formalized, centralized, and privatized top-down structure. But we also consider how the relations between infrastructural technologies and other digital music technologies (those that enable or limit capacities such as uploading, downloading, sharing, recommending, purchasing, subscribing, and advertising) afford different kinds of *musical sociality* (Durham & Born, 2022)—such as reciprocal versus individualized and consumer-driven forms of interaction—and involve different degrees of commodification.

The main part of our article (Section 5) recounts the history of digital music circulation and consumption in China, drawing upon these explanatory and normative perspectives, with a focus on the evolution of infrastructural designs, the applications built upon them, and the socialities they afford. We begin by reviewing the diversity of Chinese digital music services in the 2000s, including P2P-based and FTP-based

file sharing, website-based "celestial jukebox" systems, and MP3 search engines. We then examine Xiami Music, a platform with a novel design, arguing that it represents a trajectory similar to what Andersson Schwarz characterizes as "spotification." Finally, we turn to the contemporary cloud-based model of music streaming platforms, discussing its infrastructural politics and implications. In line with the emphasis on infrastructure and platformization in Sections 2 and 3, we examine the degree to which developments in China can also be understood, like "spotification," as a shift in infrastructural principles toward security and consumer convenience, foregoing possibilities of experimentation with alternative ways of consuming, distributing, and experiencing music. In our conclusions, we draw out some of the implications for understanding and assessing China's role in a global system, stressing that, whereas an account centered on intellectual property might highlight Chinese exceptionalism, attention to platformization as an intervention in infrastructure points to trajectories and predicaments common to China and the West.

Existing research on "copyrightization" in China

In previous research, the history of mainland China's digital music sector has been interpreted by business studies analysts as part of the long struggle between music rights holders and digital music distributors (Han, 2014; Liu, 2014; Shen et al., 2019; Tang & Lyons, 2016), or, as Chen (2019, p. ii) puts it, the dramatic process of "copyrightization." In this historical account, the lack of regulation and public support for intellectual property protection in the early 2000s allowed small and medium enterprises to experiment with a variety of both licensed and "pirated" digital music services, including searching and downloading as well as streaming. The result was what Shen et al. (2019), borrowing Chairman Mao's famous phrase, called the "hundred flowers blooming" stage of China's digital music sector.

This stage, marked by diversity and informality in business and cultural practices, came to an end in the early 2010s, when "a convergence of multiple institutional changes" (Gu, 2018, p. 74)—market competition, industry restructuring, and state regulation—led to a fast-paced tightening of copyright enforcement. After a series of major developments, particularly the 2015 Copyright Notice issued by the National Copyright Administration of China, millions of unauthorized songs were taken down, and a bidding war over exclusive copyright licenses started, followed by "a rapid process of acquisition and merger … reinforced by powerful economies of scale" (Shen et al., 2019, p. 240). Eventually, China's digital music business was consolidated into the hands of three tech giants: Baidu, Alibaba, and Tencent. Similar transitions have taken place in the screen sector: a bidding war over exclusive publishing rights was triggered by state intervention, and China's infamous online video piracy also diminished amid radical industrial consolidation and formalization; eventually, licensed on-demand video streaming services powered by local tech giants became dominant (Gu, 2018; Zhao & Keane, 2013).

In this literature, scholars have charted China's trajectory from a notorious violator of copyrights to a "well-controlled, copyright-centered pan-entertainment" regime of cultural production (Wang, 2021, p. 294). This focus on copyright enforcement has led to an almost unanimous research emphasis on the heavy hand of the state in

driving the Chinese path of platformization against the background of the "Internet Plus" strategy launched in 2015. Although this scholarship has contributed crucial insights, there are limits to a copyright-centric research agenda: not only the danger of methodological nationalism but also a longstanding logic of othering, positioning China as a case of deviation and isolation—a disruptive force external to the "normal" Western liberal order. Moreover, the protocols, applications, and digital platforms that provide the basis of digital music consumption have barely been mentioned in this literature. While the institutionalization of intellectual property, and the regulatory and industrial forces behind it, are important to the Chinese story of platformization, one should not neglect the parallel development of the material and logical infrastructures that underlie music circulation. As we will show in the rest of the article, an infrastructural perspective not only points to new avenues of critique and fresh analytical tools but also helps us go beyond treating China as a remote other to the West's putative normality, and, ultimately, reveals overlapping paths and shared concerns.

Platformization, generativity, and the reconfiguration of infrastructural politics

Definitions of digital platforms are a minefield, but at the core of the idea are two key elements. The first is that these platforms provide a digital basis "for delivering or aggregating services/content from service/content providers to end-users" (Van Gorp & Batura, 2015, p. 7). On music streaming platforms, content mainly takes the form of music licensed to service providers by rights owners, which are usually companies but sometimes musicians themselves. The second key element is that digital platforms automate market exchanges and turn relationships into data (Andersson Schwarz, 2017, p. 377). In the case of music, market exchange is financed by either subscription (*via* regular credit card payments) or advertising. Both are fundamentally reliant on the collection of data to provide automated recommendations, manage the sheer abundance of music available, and match advertisers with audience segments.

However, there is a crucial third element that is too rarely recognized in the burgeoning research on platformization: digital platforms also place significant restrictions on how digital technologies can be used, limiting how they might be modified and adapted (Andersson Schwarz, 2017, p. 377). This is a marked contrast with earlier digital technologies designed according to principles of openness and "generativity." The latter is Jonathan Zittrain's (2008, p. 70) term for "a system's capacity to produce unanticipated change through unfiltered contribution from broad and varied audiences." For Zittrain, generative digital systems are marked by high degrees of leverage ("how extensively a system or technology leverages a set of possible tasks"), adaptability ("how well it can be adapted to a range of tasks"), ease of mastery ("how easily new contributors can master it"), accessibility ("how accessible it is to those ready and able to build on it"), and transferability ("how transferable any changes are to others") (Zittrain, 2008, p. 71). We follow Zittrain in seeing these traits in positive terms, viewing the early combination of the personal computer (PC) and internet as having achieved a certain amount of this generativity, and understanding various developments, including what would later become known as platformization, as eroding that generativity (see Hesmondhalgh et al., 2023).

Such generativity was unevenly present in the pre-platform internet and was itself dependent on fundamental original principles of internet architecture. These were succinctly captured by legal scholar Barbara Van Schewick (2010): modularity (elements of a system are independent of each other), layering (modules or elements are organized into hierarchies), and the end-to-end principle, whereby lower layers of networks are general, while higher layers host particular functions. Importantly, the lower layers are agnostic about how the internet is used at the higher layers. This end-to-end principle is also tied to other infrastructural or architectural principles, such as "permissionless innovation" and "open-ness" (Ten Oever, 2021). As Brett M. Frischmann (2012, p. 322) put it, "End-to-end design sustains an infrastructure commons by insulating end-users from market-driven restrictions on access and use of the infrastructure." In Lawrence Lessig's framing, the early Internet mixed "free" and "controlled" layers. Its physical layer was owned by a mixture of businesses and states, and much of the content layer was owned in the form of copyright, but the code layer operated much more as a commons (Lessig, 2001, pp. 24–25).

The normative stakes here become clearer if we consider in general terms what is entailed by the loss of the generativity derived from these fundamental principles—even if those principles were not, of course, always adhered to in actual internet practice. Writing at the dawn of what would later come to be known as platformization, Zittrain (2008, p. 71) argued that the generative nature of the PC and internet was both the basis of their success—and "the instrument of their future failure." For Zittrain, the proliferation of poor-quality code that resulted from this openness drove users from the PC to "tethered devices" such as smartphones and games consoles. As these tethered technologies developed, users started to use the PC as a "dumb terminal" that allows access to websites with interactivity but no opportunity for "tinkering" (revision, amendment, and experimentation). These websites eventually became what we now know as digital platforms.

Let us provide a further explanation, and justification, of the normative principles we are considering by referring to developments in the realm of culture (Zittrain was writing about the internet as a whole and not concerned with music or culture). In an important but under-cited book, Tarleton Gillespie (2007) showed how the challenge to intellectual property in the realm of culture brought about by digitalization led hardware and software developers to produce "trusted systems," which, similarly to Zittrain's "tethered devices," offered copyright owners greater and more precise control over their products. These devices were "trusted" in that copying and sharing became built into the software systems built around them, limiting the leverage, accessibility, and transferability elements of Zittrain's schema. Such "black box" devices were means of controlling infringement, but they also allowed for "an incredibly subtle and complex parsing of the use of information so as to be sold" (Gillespie, 2007, p. 55). This paved the way for what has come to be known as "datafication," or the conversion of more and more aspects of social and cultural life into data, often for market exchange. Apple's iTunes was one such trusted system, innovating in personalized experiences of recommendation since 2003. The iPhone extended this tendency, even if Apple did not sell data to third parties.

These developments can be seen as an erosion of the generative potential of internet architecture or infrastructure in favor of different infrastructural principles (cf.

Cohen, 2019). The term "infrastructure" has been used in several confusing, inconsistent, and occasionally bewildering ways in recent years (Hesmondhalgh, 2021). However, a number of significant contributions have demonstrated how infrastructures across a range of domains (transport, energy, food, information) potentially function as resources for societies, communities, and individuals, often requiring considerable public investment to realize their potential (e.g. Frischmann, 2012; Van Schewick, 2010). In line with this approach, our article suggests that the original principles underlying internet architecture, which allowed for a generativity that many believed would serve the public good, were eroded in the specific case of musical distribution and consumption—and Chinese music in particular.

Recent studies have made progress in illuminating platformization in China (Davis & Xiao, 2021; De Kloet et al., 2019), sometimes with specific reference to cultural platforms (Wang & Lobato, 2019), and we share with these scholars the goal of moving beyond dichotomous understandings of China and the West. Some of these sources have even discussed the relationship of platforms to the concept of infrastructure in the context of China, often using infrastructure as a metaphor for how platforms seek to assume a fundamental place in a particular domain of society (e.g. Plantin & de Seta, 2019). In such works, the relationship between platforms and infrastructure is often conceived in terms of the "infrastructural ambition" of the major platforms rather than on the basis of a historicized understanding of how platforms have closed down the generative potential of internet infrastructural principles. Our approach follows the latter strategy.

Music platformization, "spotification," and musical socialities

How did such developments play out in the realms of media and culture? We have already indicated relevant developments in these domains in the form of "trusted systems," which became key tools for rights owners to manage the threat to their intellectual property posed by digitalization. However, the generativity afforded by internet (and PC) architecture was perhaps most apparent during what is often referred to in the West as the "peer-to-peer (P2P) moment" of the first decade of the century, when online file sharing became widespread—with music serving as a key site for experimentation with the technology and its appropriations. Researching online file sharing in the Swedish context, Andersson Schwarz (2014, p. 95), like Van Schewick (2010), sees the internet as "sequestered vertically" into layers of functionality, with the physical layer at the bottom and various protocol layers atop it. The internet protocol stack consists primarily of the internet protocol suite (the TCP/IP model) and the domain name system (DNS), on which basis new protocol-based communication technologies, including both P2P and streaming, add new layers of functionality, "exploiting" this pre-existing open architecture.

Under the fundamental principles of internet architecture, particularly the end-to-end design, the TCP/IP infrastructure is oriented towards radical decentralization. Nevertheless, the internet never lived up to the aspirations of its designers as an ideal network-of-networks. It soon began to function very much on a server–client model: servers were designated as powerful machines with fixed IP addresses, while PCs operated only as passive clients with temporary IP addresses. The P2P protocol

radically challenged this structure, allowing any computer to act in principle as both a client and a server at the same time. For this reason, the emergence of P2P was interpreted by Andersson Schwarz (2014, p. 101) as completing a full cycle in the history of the internet: "From p2p [sic] to server-client, then back to p2p again."

Because of the end-to-end principle, P2P is an extremely efficient way to maximize the generative and open potential of internet infrastructure. But it was, for the same reason, also highly susceptible to centralized exploitation from new layers of protocols imposed atop it. The music and audio streaming service Spotify represents a key case in which a "server-client-based shell" was built upon a P2P-based architecture so that "the user's own connection is harnessed by the application to spread data and ease music playback for other users" (Andersson Schwarz, 2014, p. 151)—a software with P2P "under the hood," as Andersson Schwarz puts it. Such developments led supporters of the Swedish Pirate Bay movement to coin the concept of "spotification":

> In order to spotify something, a commercial service provider has to take something which is free (that which previously constituted some sort of "common"), chop off its tail (that is, curtailing the supply and minimizing the technical quality), encode it (that is, setting up rules for how it can be used) and, lastly, impose a fee for using it (either through an advertising model or through a subscription model). (Andersson Schwarz, 2014, p. 115)

Andersson Schwarz borrows this "spotification" metaphor and further conceptualizes it, likening it to processes of enclosure theorized by political economy and to Deleuze and Guattari's notion of "reterritorialization." For him, the open infrastructure of the internet came to be disciplined and bounded in certain ways towards a formalized, centralized, and privatized top-down structure—that is, towards "a form of nested architecture that is antithetical to the open Web" (Andersson Schwarz, 2014, p. 116). This vision treats functionality, convenience, and security as the main goals of cybernetic systems, sacrificing the kinds of values we discussed above under the heading of generativity. It also permits private and governmental surveillance to a much greater degree, as norms of anonymity are waived in favor of credit card access. Digital platforms in the realm of culture—including music but also social media, video, and other domains—mean that such a shift is as apparent in the realm of everyday communication, information, and entertainment as it is in banking and retail (where functionality and security might often be difficult to argue against).

Our emphasis in this paper is on music, technology, and culture, with particular attention to the dynamics of platformization in the context of infrastructural politics. There is only limited space in this article to connect these issues directly to empirical research on the perspectives and experiences of users—although we are currently undertaking in-depth research on these matters in both China and Western Europe. Nevertheless, the socio-technical arrangements discussed in this article have implications for the kinds of musical socialities available to users. We pay some attention to this issue in what follows, drawing on Durham and Born (2022, p. 178) fruitful comparison of two sites of musical distribution and consumption—Spotify and a pseudonymized P2P file-sharing site they call "Jekyll"—in terms of how their technical design "envisages or configures certain socialities." According to Durham and Born (2022, p. 211), Spotify lacks "meaningful characteristics of circulatory sociality"; instead, its socialities "are limited to dyadic acts of exchange, forcefully circumscribed by the

platform's centralised design." By contrast, Jekyll's design "embodies certain aesthetic and ethical ideals," including a much greater degree of reciprocity, with the site using various features to enforce such reciprocity and discourage free-riding (Durham & Born, 2022, p. 211). Although our approach in this article is macro-historical, with a focus on theory-building rather than ethnography, Durham and Born's approach is a welcome reminder of the diverse ways in which apps, sites, platforms, etc. operate. A key contextual point for our approach is that sites such as Jekyll, for all their problems and limitations, have largely disappeared from Western music systems, leaving a somewhat homogeneous landscape of "mainstream" streaming platforms. Part of our goal in what follows is to assess whether similar developments can be discerned in China, and if so, what they tell us about China's place in global systems of technology and culture.

Digital music circulation in China: an infrastructural lens

How might this infrastructural perspective on platformization throw light on the circulation and consumption of music in China? What were the infrastructural changes that took place in parallel to the "copyrightization" discussed in Section 2, and what were their implications for the range of musical socialities afforded? In this section, we first outline the diversity of practices and services of music circulation in the so-called "hundred flowers blooming" stage in the 2000s. We then focus on the case study of Xiami Music before turning to contemporary cloud-based music-streaming platforms.

Music circulation on the early Chinese internet: the "hundred flowers blooming" stage

The story of digital music in China began with the prevalence of physical media and offline sharing. As the practice of extracting audio files from a CD through "ripping" became more common in the late 1990s, websites started making small numbers of music tracks, stored in their own servers, available for visitors to download or stream. Server sizes were reportedly very small: the famous Gaodi Music forum, which hosted a Real Audio channel in 1997, had a storage space of only 150 MB (Chen, 2019, p. 119). Once obtained online, files were widely circulated between peers offline. Stored in "burnt" CD-Rs or USB memory sticks, MP3 files were passed on either through commercial exchanges or as gifts among friends in a literal "peer-to-peer" manner. Later, as BBS forums, blogs, emails, and instant messaging services (such as QQ/QICQ and MSN) became popular, file sharing gradually moved online and reached its climax with the arrival of two major file transfer protocols, namely P2P and FTP (File Transfer Protocol).

P2P-based sharing became a phenomenon in China shortly after 2000 (Lu, 2006). In the case of music, established P2P networks—Soulseek, BitTorrent, and eDonkey (eD2k)—quickly gained a Chinese userbase, a process accelerated by locally developed P2P clients and websites, most notably the eMule VeryCD Mod and its associated database site for eD2k seeds. Replacing single dependency with decentralized coordination, P2P networks allowed storage and bandwidth to be mutually

provided and shared, radically breaking with the server–client structure. From a user perspective, the architectural design of P2P networks generated an imaginary of an openly connected transnational communication space, where a sense of participatory, taste-based community was lived out under loosely governed reciprocity. Soulseek, in particular, allowed users to browse each other's local file indexes, request single-source downloads, and chat *via* instant messaging. These technical designs afforded and sustained the practice of sharing: one could only download music *via* access to other users' local storage one-to-one, prompting a sense of reciprocal sociality across national boundaries. Today, many still recall the experience of sharing, discussing, and exchanging music on Soulseek with strangers (particularly foreigners) with shared musical tastes.

Around the turn of the century, FTP-based music-sharing networks also mushroomed. The FTP protocol points to a more centralized architecture based on the server–client model: users authenticate themselves or log on anonymously to download files from, or upload files to, a central server, though this often took place over smaller-scale local area networks (LANs). In early-2000s China, most reported FTP-based music sharing operated in BBS-forum communities, a large number of them university-based, with the central server often running on a student's own PC. These communities quickly extended offline. Some eventually evolved into music scenes; the Beijing Institute of Technology's music FTP forum, for example, gave birth to two rock acts that later became influential: Carsick Cars and Snapline. Similar to the P2P-based communities, the circulatory socialities centered around music in FTP-based portals were characterized by a loose sense of reciprocity and voluntary, participatory labor from both sides. Files were provided not only by those who managed the server but also by the "clients," many of whom would routinely log on and drop file packages from their local drives to the server, contributing to a participant-assembled archive of music.

On the commercial side, this period also witnessed a number of larger website-based digital music services, such as 9sky.com and 1ting.com, which represented early attempts to develop a version of what some Western analysts have called the "celestial jukebox" (Burkart & McCourt, 2004) in China. These sites stored a large repertoire of songs in their central servers and provided categorizations on a web-based interface. They were also among the first online providers to work out copyright deals with the record industry. The website-based "celestial jukebox" model would continue to be pursued by more powerful players, including top100.cn, Sina Music, and QQ Music. The last eventually evolved into the cloud-based streaming model that is dominant today.

Through an infrastructural lens, the website-based model represents a top-down, hierarchical structure that can be seen as the optimization of the server–client model. In these Chinese versions of the "celestial jukebox," music files in the central server were uploaded and managed almost exclusively top-down using professional labor. Former employees of these companies tell stories of building up the sites' repertoires with their own downloaded files, as also happened in the early days of Spotify; some companies employed a primitive method of generating metadata, hiring editorial teams whose daily work involved a great deal of listening and manual tagging. This led to a starkly different form of musical sociality than that in the P2P

and FTP scenes: the power relations between the content provider and the users mirrored those between major labels and their consumers in the traditional record industry, and the circulation of music became one-way, individualized, and consumer-oriented.

In 2002, Baidu, the dominant search engine, launched its music search service channel, Baidu MP3. Paired with Baidu 500, a popular music chart based on results of searches and downloads, Baidu MP3 provided specialized, algorithm-generated "deep links" to multimedia files stored on other servers, thereby making itself a comprehensive index for openly accessible music across the internet. Baidu MP3's sheer convenience lifted its use to a whole different scale: as of 2009, IFPI (2009, p. 16) estimated that Baidu accounted for "over half of the illegal music track downloads" in China. As Baidu made enormous advertising earnings through this service, other established search engines, including Yahoo!, Sogou, NetEase, and Google, also entered the MP3 search market. From an infrastructural perspective, search engines can be seen as another layer of functionality on top of the internet architecture that mines publicly accessible data, taking advantage of the generativity of the open Web to provide targeted services. The circulatory sociality it afforded was a highly individualized one marked by ease of use and an abundance of content, in a way comparable to that on contemporary streaming platforms, although users were arguably more proactive before the arrival of algorithmic recommendations. A distinctive phenomenon conditioned by China's pre-copyrightization digital environment, the dominance of MP3 search engines would last until Baidu's out-of-court settlement for copyright infringement with the major rights-holders in 2011.

During the "hundred flowers blooming" stage, the ethos of generative tinkering was manifest at what Lessig (2001) terms the "code" layers of the Chinese internet on various scales. Fundamentally, the open format of the MP3 file allowed end-users to obtain audio data from CDs, adjust their sound quality, and edit their metadata. The practice of MP3 conversion, along with P2P seeding and torrenting, was integral to musical socialities in file-sharing communities. Throughout the 2000s, college students taught each other to set up their own FTP servers; amateur programmers developed localized PC clients for downloading and file sharing through "modding"; and tech start-ups actively experimented on their service models, trying to integrate old and new technological designs in their products. As a result, the decade saw an emerging wave of "under-the-hood" P2P applications, which inserted various centralized elements designed specifically for music consumption atop the P2P protocol. These included Kuro, Kuwo, Kugou, Duomi, and most notably, Xiami Music, whose services sat between the commercial website-based "celestial jukebox" model and the radically decentralized P2P networks. In the following section, we examine in more detail the case of Xiami, which we see as a representative example of a Chinese version of "spotification."

The case of Xiami: "spotification" in the Chinese context

Founded as a music website in 2007, Xiami gained more than 20 million registered users by 2013, and it remained among the top five biggest music platforms in China until it ceased operating in 2021. It was often praised for its accurate music metadata,

comprehensive genre categorization, and smart recommendation algorithms. The Xiami Music website and application both bore a typical "celestial jukebox" interface design, offering an official repertoire for streaming or downloading that was organized and presented according to album, artist, and genres. Although, in this regard, Xiami was not substantially different from earlier website-based models, the platform had P2P in its DNA. In Xiami's repertoire, most if not all the songs were originally uploaded by users, and so were the various forms of paratextual data related to these files, including titles, artworks, genre tags, and release information. In other words, Xiami's repertoire was a crowd-sourced archive built up piece-by-piece by its users, many of whom were music aficionados with devotion to, knowledge of, and access to music information, including new releases.

Yet, on top of this P2P file-sharing architecture, Xiami was designed to be a closed system of music distribution. P2P networking was used only as a technical means of achieving efficient data transfer and obtaining public internet resources, ultimately tied to a centralized broadcast model. In the early stage of Xiami Music, files were processed *via* an integrated desktop client called Shark, which could be used as an MP3 download/upload client, a file manager, a browser, and a media player. Once approved as "successful uploads," user-contributed music files would be listed in Xiami's official repertoire for sale. This system used a virtual currency named "Xia coins," which could be purchased with cash or earned as a reward for various activities on the website, including album uploads, "profit through download," and "profit through promotion." "Profit through download" referred to the shares users earned by contributing P2P traffic to the network when others downloaded the songs they had downloaded; users were therefore encouraged to keep their Shark clients online as much as possible. The "profit through promotion" method, on the other hand, encouraged users to "promote" music they liked through various interactions, including commenting, making playlists, and publicly recommending songs.

The Xiami mechanism exemplified the same logic as the so-called ratio system Durham and Born (2022, p. 187) observed in the case of the music sharing community they pseudonymized as "Jekyll," where they discerned a "highly formalised" regulatory scheme governing the inherently informal P2P scene and its principle of reciprocity. As a desktop client, Shark was designed to exploit the knowledge, labor, and social interactions of its users, as well as their local storage and bandwidth, enclosing them into the closed, formalized system of the platform. In this sense, while Xiami's rule-governed form of circulatory sociality was ideologically aligned with P2P communities such as Jekyll, its architectural design was much closer to Spotify's, which, as Durham and Born (2022) point out, borrowed from its extra-legal, P2P predecessors.

While exploiting resources through P2P networks from below, Xiami sought to consolidate a server–client-based "celestial jukebox" that was managed and curated from above, or a P2P-based iTunes Store in which reciprocity was strictly governed by the principles of commodification. This combination was proposed as an innovative business model, termed the "P2P user distribution model," which Xiami offered as a solution for digital copyright. Seen in retrospect, this model pioneered today's platform-based mode of music distribution and consumption, which indeed pushed digital music services towards the "copyrightization" discussed in Section 2. Following

the penetration of 3G and more advanced wireless technologies, the mobile consumer market in China rapidly grew; companies such as Duomi, Kugou, and Tencent started developing specialized mobile apps for music streaming, and others followed suit. As the 2010s copyright bidding war reconsolidated the industry, the service models and software designs of music apps reconverged into a standardized trusted-system-based architecture. Xiami was no exception: in 2013, no longer able to bear the costs associated with exclusive copyright deals, Xiami was acquired by Alibaba, an acquisition which, coinciding with the launch of the Xiami Music mobile app, concluded Xiami's formal transformation into a copyright-centered music streaming platform. Its P2P features were gradually discontinued.

In early editions of Xiami's desktop client, to teach users how to achieve a "successful upload," the instructions page would explain in detail technical terms such as bitrates and ID3 Tags and how to use music compression software such as Foobar2000 to obtain MP3 files and refine their associated metadata. A decade later, in Xiami's mobile app for "tethered" mobile devices (see Section 3), these instructions for tinkering had become redundant: like most of the major streaming platforms, who embraced the trusted-system-based model, granting copyright owners almost absolute control, users were no longer encouraged and only rarely allowed to upload music or edit the official metadata base. Licensed music files, though still downloadable *via* subscriptions, were firmly protected with digital rights management (DRM) techniques, replacing the MP3 with encrypted formats—in the case of Xiami, the .xm format—only playable by and within the platform application.

Nevertheless, a few years' time was long enough for Xiami to build up an immense, collectively assembled database of music files and associated metadata. Based on this, it was able to develop a sophisticated customer relationship management (CRM) infrastructure, including its most celebrated recommendation algorithms for the personalized Xiami FM service. Looking back into history, the development of Xiami's music database bore striking similarities to the case of the CDDB (Compact Disc Database), which evolved from an open project of user-generated metadata into a privately-owned database to be used under license (Morris, 2012, p. 856). In both cases, users' participation in the generation and maintenance of metadata ended up contributing to the commodification of the digital music format. However, in Xiami's story, this contribution was, from the very start, afforded, facilitated, and manipulated by a novel platform design that took advantage of the generative nature of the internet's underlying infrastructure.

Xiami failed to survive the copyright war and was eventually shut down in 2021, losing much of its market share to QQ Music and NetEase Cloud Music, the two most commonly used music streaming apps today. Regardless, the architectural designs of all three platforms had become very similar to Spotify, which had relinquished its early P2P components. The evolution of Xiami speaks to the overall path of infrastructural change in China's cultural industries. As digital music services reconverged on standardization, the early reciprocity-based practice of sharing and exchanging music gave way to personalized, on-demand streaming—a trajectory that largely reproduced that of "spotification" in the western contexts.

Cloud-based streaming platforms: towards further centralization

Let us examine more closely this most recent change, which has also involved a further infrastructural shift: the move to the "cloud." Anticipating the contemporary cloud-based model, the late 2000s saw the rapid popularization of a new architecture for digital music circulation: online file hosting services, or so-called cyberlockers. In China, this started with netizens using foreign cyberlockers such as RapidShare and Megaupload, and later, the local service Rayfile, established in 2008. The architecture of cyberlockers was designed as server-based, much like FTP, yet their file storage services were provided by central servers for rent. For users, the rise of cyberlockers signified a shift away from the need to store, play, and manage music files on their local PCs. Later, as major players like Baidu and Alibaba entered the cyberlocker market, Chinese users gradually became accustomed to consuming media directly "in the cloud."

On the infrastructural level, the shift to the cloud represented yet another move towards closure, centralization, and loss of generativity. Primarily a set of infrastructure-based services, today's "cloud" provides on-demand service access to computing, network, and storage capacity, often outsourced by tech giants on a "pay-as-you-go" basis. Following Spotify's move to the Google Cloud Platform in 2016, the cloud has become the primary location of data storage (and analysis) for the music streaming industry. The situation in China is no different: QQ Music relies on Tencent Cloud, Tencent's cloud computing service brand, which started outsourcing infrastructure-based resources in 2010; NetEase also launched its Digital Sail cloud services in 2016. In comparison with the earlier website-based "celestial jukebox," the cloud-based model replaces the central server with huge cloud campuses comprising massive data centers. In a sense, these data centers have become the central server of central servers, further closing down the possibility of intervening in music circulation from below. Instead of storing data in file systems, content data for streaming is stored diffusely using object storage technology, which holds unstructured data as "objects," that is, distinct units bundled with metadata and a unique identifier, allowing each to be easily located. As a direct consequence, content must now be managed in a way that efficiently distributes it from different servers across a wide geographical range, making content delivery network (CDN) a key component of the infrastructure of music circulation today.

Cloud computing technology has fundamentally reshaped the interaction between users and content, providing access without the technological know-how apparent in their online piracy predecessors (Wang, 2017). This model has offered not only convenience and abundance but also more sophisticated CRM technologies, including personalized music recommendation algorithms, made possible by the ubiquitous, highly efficient cloud infrastructure. Yet the possibility of tinkering, which the P2P pirates held dear as a manifestation of the values of the open Web, has almost completely vanished. Musical socialities on these platforms are thus driven away from exchange and circulation, and towards personalized consumer behavior. While early versions of Xiami Music, like Spotify (see Born, 2022, p. 33), still tried to "mimic" the informal experience of music sharing on "real" P2P communities, "algorithmic individuation" has become the norm on contemporary streaming platforms (Prey, 2018). A

potential exception in China is users of NetEase Cloud Music, who actively engage with each other in the "comment" area. However, these socialities arguably have much less in common with music circulation on a P2P platform like Soulseek and are more like customer product evaluations on a C2C (consumer-to-consumer) platform such as Yelp.

Conclusions

In this article, we have explored how the history of China's digital music sector has been driven by competing regimes of infrastructural deployment. Layers of functionalities, provided in the form of applications atop an open, generative architecture, have shifted the way in which music is distributed and circulated. Telling this history through an infrastructural lens, we have charted a convergence of changes that constitutes a Chinese path towards platformization. In this evolution, the emancipatory potential promised by the openness and generativity of the internet has been closed down through the disciplining of communication infrastructures. This was what also happened in the West. In particular, through a case study of the design, evolution, and legacy of Xiami Music, we have identified a Chinese version of "spotification," signifying the broader trends of infrastructural transition that Chinese creative industries have undergone in tandem with the historical process of "copyrightization," the issue that previously dominated scholarly attention. This course of transformation also echoes the broad trend of formalization in the "informal circuit" of China's digital economy (Zhao, 2019), in which corporates drew on and profited from user-generated content, grassroots creativity, and participatory labor. In this regard, the infrastructural approach to platformization, even though it was developed for the Western context, offers analytical merits and a targeted critical stance that accounts for the importance of the internet's open and generative infrastructural potential. Engaging with normative ideals borrowed from Western platform and legal studies, we have worked towards an analytical framework suitable to the Chinese context. On top of the abovementioned values of openness and generativity, we add another layer of analysis pertaining to musical sociality, bringing a user-oriented normative perspective together with our infrastructural concerns.

However, historical contextualization also leads us to reflect critically on our provisional normative ground. The spotification thesis was premised on an ideal vision of the open Web, and to some extent of viewing "all data networking," as fundamentally based on the "free and unrestricted copying of files" (Andersson Schwarz, 2014, p. 92). But for all the potential of the principles underlying its architecture, the internet is not simply an open infrastructure; it is an inherently "extraterritorial" one marked by stark inequalities of resource distribution (Schiller, 2011). From its very birth, the Chinese internet was never free of geopolitical intervention, both from outside and from the nation state itself (Yang, 2012). The course of copyrightization in China's creative industries has been embedded in broader regimes of internet governance, conditioned by not only market competition and state regulation but also international pressure in the post-WTO era. Moreover, in the Chinese context, the term "infrastructure" has long been embedded within discourses of developmentalism and modernization (Hong & Harwit, 2020). Telecommunication

infrastructure, including that of mobile and broadband internet connections and cloud-based data centers, has been a key priority in the nation's past and current Five-Year Plans (Meng, 2023; Yu et al., 2012). The grand infrastructural ambitions of the Chinese state conditioned the specific infrastructural changes depicted in this article. It also profoundly reshaped the once transnational forms of musical sociality in the early P2P era, although there has not been space to offer a detailed analysis of this here.

While our main goal is not a comparative one, we have offered an analysis informed both by China's own historical trajectory and by theories originally developed in the Western context, in the hope that our analysis might provide guidance on how to reposition China (and academic research on China) as an integral part of the global capitalist order in the current historical conjuncture, rather than as a separate, exotic development. Communication protocols, compared with copyright policies, reach further across national boundaries. Similarly, investigation of technological shifts and infrastructural politics, rather than an exclusive or excessive focus on copyright, reveals more commonalities, overlapping agendas, and shared concerns between China and the West. In turn, this helps us see more clearly an ever-expanding, transnational regime of platformization.

Acknowledgments

This article was produced as part of a research project—Music Culture in the Age of Streaming—that has received funding from the European Research Council, under the European Union's Horizon 2020 Research and Innovation Programme, in the form of an Advanced Research Grant awarded to Professor David Hesmondhalgh at the University of Leeds (Grant agreement no. 1010020615). The authors would like to thank Dr. Bingzhe Liu for her comments on an earlier draft of the article.

Disclosure statement

No potential competing interests are reported by the authors.

Funding

H2020 European Research Council

Notes on contributors

David Hesmondhalgh is Professor of Media, Music, and Culture in the School of Media and Communication at the University of Leeds, England. From 2021 to 2026, he is Principal Investigator on a five-year research project addressing Music Culture in the Age of Streaming (MUSICSTREAM), which is funded by a European Research Council Advanced Research Grant.

Zhongwei (Mabu) Li is a postdoctoral research fellow at the University of Leeds working on the MUSICSTREAM project. His research explores the ruptures and continuities between the contemporary moment of platformization and music cultures of the past thirty years, focusing on China's path to global capitalist modernity. Before joining MUSICSTREAM, he worked as an LSE Fellow in Media and Communications.

ORCID

Zhongwei Li http://orcid.org/0000-0003-1386-3983
David Hesmondhalgh http://orcid.org/0000-0001-5940-9191

References

Andersson Schwarz, J. (2014). *Online file sharing: Innovations in media consumption*. Routledge.
Andersson Schwarz, J. (2017). Platform logic: An interdisciplinary approach to the platform-based economy. *Policy & Internet*, *9*(4), 374–394. https://doi.org/10.1002/poi3.159
Born, G. (2022). Introduction: Music, digitisation and mediation—For a planetary anthropology. In G. Born (Ed.), *Music and digital media: A planetary anthropology* (pp. 1–45). UCL Press.
Burkart, P., & McCourt, T. (2004). Infrastructure for the celestial jukebox. *Popular Music*, *23*(3), 349–362. https://doi.org/10.1017/S0261143004000236
Chen, Z. T. (2019). *China's music industry unplugged: Business models, copyright and social entrepreneurship in the online platform economy* [Doctoral dissertation, University of Nottingham]. https://eprints.nottingham.ac.uk/55633/
Cohen, J. E. (2019). *Between truth and power: The legal constructions of informational capitalism*. Oxford University Press.
Davis, M., & Xiao, J. (2021). De-Westernizing platform studies: History and logics of Chinese and U.S. platforms. *International Journal of Communication*, *15*, 103–122.
De Kloet, J., Poell, T., Guohua, Z., & Yiu Fai, C. (2019). The platformization of Chinese society: Infrastructure, governance, and practice. *Chinese Journal of Communication*, *12*(3), 249–256. https://doi.org/10.1080/17544750.2019.1644008
Drott, E. (2018). Why the next song matters: Streaming, recommendation, scarcity. *Twentieth-Century Music*, *15*(3), 325–357. https://doi.org/10.1017/S1478572218000245
Durham, B., & Born, G. (2022). Online music consumption and the formalisation of informality: Exchange, labour and sociality in two music platforms. In G. Born (Ed.), *Music and digital media: A planetary anthropology* (pp. 177–219). UCL Press.
Franceschini, I., & Loubere, N. (2022). *Global China as method*. Cambridge University Press.
Frischmann, B. M. (2012). *Infrastructure: The social value of shared resources*. Oxford University Press.
Gillespie, T. (2007). *Wired shut: Copyright and the shape of digital culture*. MIT Press.
Gu, J. (2018). From divergence to convergence: Institutionalization of copyright and the decline of online video piracy in China. *International Communication Gazette*, *80*(1), 60–86. https://doi.org/10.1177/1748048517742785
Han, D. (2014). How the copyright law was (not) made: Reinventing copyright in contemporary China. *International Journal of Communication*, *8*(1), 1516–1535.
Hesmondhalgh, D. (2021). The infrastructural turn in media and internet research. In P. McDonald (Ed.), *The Routledge companion to media industries* (1st ed., pp. 132–142). Routledge.
Hesmondhalgh, D., Valverde, R. C., Kaye, D. B. V., & Li, Z. (2023). Digital platforms and infrastructure in the realm of culture. *Media and Communication*, *11*(2), 296–306. https://doi.org/10.17645/mac.v11i2.6422
Hong, Y., & Harwit, E. (2020). China's globalizing internet: History, power, and governance. *Chinese Journal of Communication*, *13*(1), 1–7. https://doi.org/10.1080/17544750.2020.1722903
International Federation of the Phonographic Industry (IFPI). (2009). *Digital music report 2009*. IFPI.
Lessig, L. (2001). *The future of ideas: The fate of the commons in a connected world*. Vintage Books.
Liu, J. (2014). *Copyright and incentive: A music industry with Chinese characteristics* [Doctoral dissertation, Stanford University]. https://purl.stanford.edu/dy646mj8708
Lu, X. (2006). On P2P file-sharing: A major problem—A Chinese perspective. *Journal of Business Ethics*, *63*(1), 63–73.
Meng, B. (2023). "This is China's Sputnik moment": The politics and poetics of artificial intelligence. *Interventions*, *25*(3), 351–369. https://doi.org/10.1080/1369801X.2021.2003227
Morris, J. W. (2012). Making music behave: Metadata and the digital music commodity. *New Media & Society*, *14*(5), 850–866. https://doi.org/10.1177/1461444811430645

Plantin, J. C., & de Seta, G. (2019). WeChat as infrastructure: The techno-nationalist shaping of Chinese digital platforms. *Chinese Journal of Communication*, *12*(3), 257–273. https://doi.org/10.1080/17544750.2019.1572633

Prey, R. (2018). Nothing personal: Algorithmic individuation on music streaming platforms. *Media, Culture, and Society*, *40*(7), 1086–1100. https://doi.org/10.1177/0163443717745147

Schiller, D. (2011). Geopolitical-economic conflict and network infrastructures. *Chinese Journal of Communication*, *4*(1), 90–107. https://doi.org/10.1080/17544750.2011.544085

Shen, X., Williams, R., Zheng, S., Liu, Y., Li, Y., & Gerst, M. (2019). Digital online music in China—A "laboratory" for business experiment. *Technological Forecasting and Social Change*, *139*, 235–249. https://doi.org/10.1016/j.techfore.2018.10.022

Tang, D., & Lyons, R. (2016). An ecosystem lens: Putting China's digital music industry into focus. *Global Media and China*, *1*(4), 350–371. https://doi.org/10.1177/2059436416685101

Ten Oever, N. (2021). "This is not how we imagined it": Technological affordances, economic drivers, and the Internet architecture imaginary. *New Media & Society*, *23*(2), 344–362. https://doi.org/10.1177/1461444820929320

Van Gorp, N., & Batura, O. (2015). *Challenges of competition policy in a digitalised economy* European Parliament. IP/A/ECON/2014-12.

Van Schewick, B. (2010). *Internet architecture and innovation*. The MIT Press.

Wang, S. (2017). The cloud, online piracy and global copyright governance. *International Journal of Cultural Studies*, *20*(3), 270–286. https://doi.org/10.1177/1367877916628239

Wang, S. (2021). Platformization, pan-entertainment and piracy: What the fast-changing Chinese mediasphere tells us about technology, policy and the state. *Journal of Digital Media & Policy*, *12*(2), 293–309. https://doi.org/10.1386/jdmp_00043_1

Wang, W. Y., & Lobato, R. (2019). Chinese video streaming services in the context of global platform studies. *Chinese Journal of Communication*, *12*(3), 356–371. https://doi.org/10.1080/17544750.2019.1584119

Wang, J., & Yu, X. (2021). Three currents of platformization in China. *South Atlantic Quarterly*, *120*(4), 777–794. https://doi.org/10.1215/00382876-9443336

Yang, G. (2012). A Chinese internet? History, practice, and globalization. *Chinese Journal of Communication*, *5*(1), 49–54. https://doi.org/10.1080/17544750.2011.647744

Yu, J., Zhang, Y., & Gao, P. (2012). Examining China's technology policies for wireless broadband infrastructure. *Telecommunications Policy*, *36*(10–11), 847–857. https://doi.org/10.1016/j.telpol.2012.08.009

Zhao, E. J. (2019). *Digital China's informal circuits: Platforms, labour and governance*. Routledge.

Zhao, E. J., & Keane, M. (2013). Between formal and informal: The shakeout in China's online video industry. *Media, Culture & Society*, *35*(6), 724–741. https://doi.org/10.1177/0163443713491301

Zittrain, J. (2008). *The future of the Internet*. Yale University Press.