Etnomüzikoloji Dergisi
Ethnomusicology Journal
Yıl/*Year*: 1 • Sayı/*Issue*: 2 (2018)

Perspectives in Music Arising out of Blockchain-Technology and Its Corresponding Research Strategies

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For a start, let us take a look at one of the new services listed when searching the web for "music and blockchain". Results typically include Ujomusic, Peertracks, Revelator, DotBC, PledgeMusic, Musiconomy and more, some predominantly offering music, others primarily promoting new services for musicians and creative artists. Of course, these need not be seen in opposition. I chose Ujomusic for the following examples. This was also the platform which hosted one of the earliest experiments simultaneously licensing and monetizing music from the British singer-songwriter Imogen Heap by using a blockchain. When preparing this article, the new album from the Portuguese musician RAC was on offer:

As I was planning to pay using a cryptocurrency, I had acquired an amount of Ethereum coins beforehand, but will not go into the details of how I did this here. These can be found elsewhere on the web and typically require a registration on one of the cryptocurrency-trading-platforms. For now, we only need to know that coins are stored in a virtual wallet which enables sending and receiving money similar to a regular bank account. You might also want to know why I chose Ethereum and not Bitcoin, for example. This will become obvious further down in this article.

Figure 1: Excerpt from the website https://rac.ujomusic.com/ [15.2.2018]

The next thing I learned at Ujomusic was that I would not be able to use the standard-wallet just mentioned, but that I would be required to make use of the Chrome-browser and install a specific plug-in called Metamask. Among further functions, it contains another wallet, which did not immediately make sense to me. Again, it will be explained further down. Thus, the next step consisted in transferring ether from the standard-wallet to Metamask. As this was my first transaction using cryptocurrencies at all, I learned that a service charge (called "gas" in the Ethereum world) would apply and that I would be able to influence the speed of the transaction by setting a slider to a higher fee. Seems fair, doesn't it?

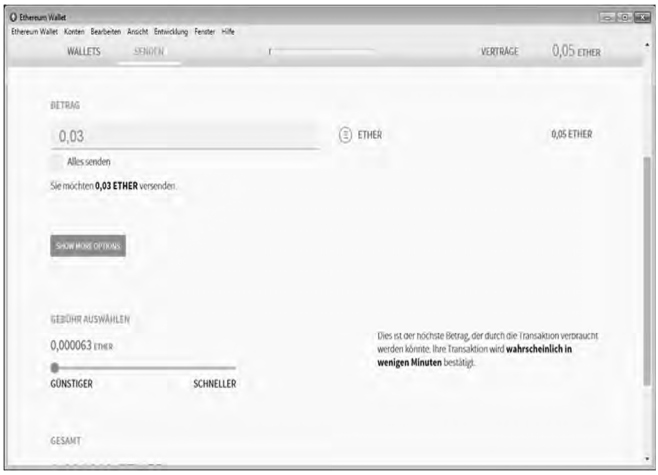


Figure 2: Transaction-window in the standard Ethereum wallet

0.000063 to 0.0021 ETH for (6.3ct to 2.10 EUR) for a transaction of 0.03 ETH (approx. 30 EUR) is equal to 0.0021%-7% of the total amount. Once the amount had arrived in Metamask, I was able to proceed with purchasing the album.

Figure 3: Popup of the Metamask-plugin for the Chrome browser [15.2.2018]

I received words of thanks from the musician and the platform congratulating me for being a pioneer (Ujo, 2017c) and next, the music was offered for download in four different file-formats (three of them lossless[1]) in a rather old-fashioned way.

I chose mp3, imported the files into my music player, which properly recognized the metadata for artist and song titles and was now ready for listening. It is noteworthy however, that none of the files seem to contain any form of protection (the only possible option being a watermark, but then again, I never personally registered with Ujomusic, so the only possible reference would be my Metamask account). In other words, having paid for the music made me trustworthy for the platform and the musician which seem to be confident that I would not pass on these files for free or upload them to a sharing-platform on the web.

[1] This term refers to compression algorithms which do not reduce the sound quality.

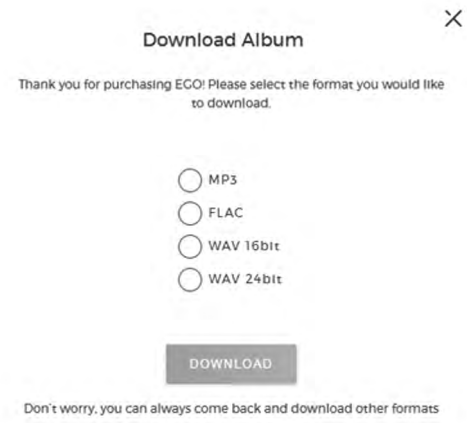
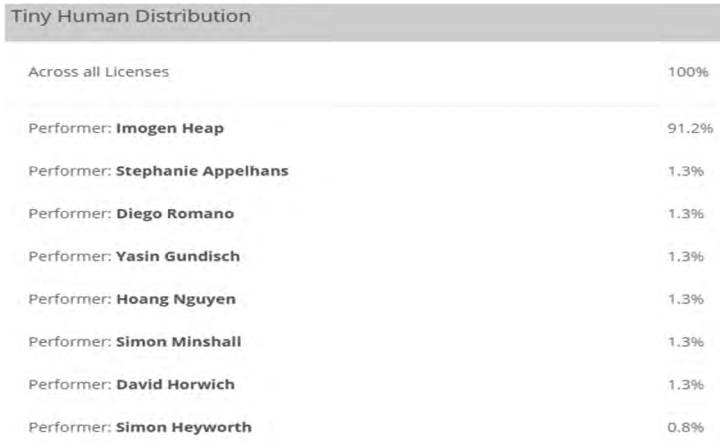


Figure 4: Popup from the website https://rac.ujomusic.com/ after purchase [15.2.2018]

Now, what is so special about the process just described, apart from the fact that a cryptocurrency was used for payment, and what does all of this have to do with music on the blockchain? The first answer to be given is that the according technology was developed to enable cryptocurrencies in the first place. However, paying a platform like Ujomusic with Ether instead of Euro or Dollars does not necessarily imply a change in conditions for the artists. It is most likely that the common practice of the music industry in the past decades will continue and only a percentage (be it large or small) will be passed on to the musicians. A second answer is tied to the musicians potentially being paid in cryptocurrencies themselves. It has been shown above that transaction-fees can be kept to a minimum; also, they require no minimum amount to be transferred. This is called "near-instant-micropayments" in the blockchain-world and could imply the musicians almost instantly getting paid once someone downloads or streams their music. Sounds promising, doesn't it? Now, the big issue related to this option is the question where the required licensing-information (copyright) and the according monetization agreements (contracts) will or can be stored. So far, it is mostly the national performance rights organizations (abbreviated below as PROs) / collecting societies which hold and maintain these databases. The contracts are typically part of the deal between the musician and a record label and/or a publisher (in fact, signing up with a major label usually requires the artist to also sign a second contract with the label's music publisher). So, the third answer lies in the fact that all of this information (and potentially increased in detail, see Heap, 2018, p. 4) could also be stored and secured on a blockchain, which in essence is a special form of a distributed and trustworthy database. Imogen Heap, for example, established the following distribution model for all income generated through her song "Tiny Human". Note that also session

musicians and studio technicians are included here which is not common practice as they usually get paid only once (there are exceptions in some countries such as Germany and its collecting society GVL which specializes in rights of performing musicians):



Tiny Human Distribution	
Across all Licenses	100%
Performer: **Imogen Heap**	91.2%
Performer: **Stephanie Appelhans**	1.3%
Performer: **Diego Romano**	1.3%
Performer: **Yasin Gundisch**	1.3%
Performer: **Hoang Nguyen**	1.3%
Performer: **Simon Minshall**	1.3%
Performer: **David Horwich**	1.3%
Performer: **Simon Heyworth**	0.8%

Figure 5: Popup from the website https://imogen2.surge.sh/#/imogen_heap/tiny_human/tiny_human [16.7.2017]

If this kind of split is also saved in the blockchain, the above-mentioned micropayments could automatically be initiated. Sounds great, some might say, as it seems very fair. Then again, this implies a degree of transparency which might not be approved by all players involved. For example, successful business models must often be hidden from competitors. The musicians themselves might be uncomfortable if the percentage of their revenue becomes public: What if someone raised the issue that Imogen Heap is greedy and should never receive more than 50%? This could cause great damage, especially on social media such as fan platforms. One of the major issues in the future introduction of blockchain-technology in music will most likely be tied to the issue of who will actually advocate for and benefit from transparency, and who will not. But now, let's start over with greater detail and better systematization:

Basics of Blockchain Technology

In order to assess the relevance of blockchain technology for music and other creative areas, we need to make an attempt to at least partially understand what's behind this term (Tapscott & Tapscott, 2016). It might be helpful to relate it to its original purpose, which was to realize digital currency independent from governments, central or commercial banks or any other

intermediaries – with *Bitcoin* being the first and most prominent representative. The most crucial issue with a digital currency which doesn't have material equivalents such as coins and bills, is to prevent one single Bitcoin from being spent twice (or even more often). In 2008, a groundbreaking paper was published under the synonym Satoshi Nakamoto, where major solutions were presented and Bitcoin is introduced (Nakamoto, 2008). The problem is solved by storing all transactions and adding them to a chronological chain of connected data blocks – hence the term blockchain. Each block is summed up into a digital fingerprint called *hashcode*, which is created by a powerful and irreversible encryption algorithm. This unique hashcode becomes part of the next block containing the transaction information. By means of this digital fingerprint, a new block is linked to the preceding one. If someone attempted to manipulate a data block, its hashcode would change and all subsequent blocks would become invalid. In a way, the use of every single Bitcoin can theoretically be traced back to the very beginning, the mythical Genesis block. As the whole technology relies on cryptography, virtual currencies such as Bitcoins are also called *cryptocurrencies*.[2]

Figure 6: Screenshot from video at https://anders.com/blockchain/ [28.4.2018] with inserted arrows indicating linking blocks through hashcodes

Next, if someone gained access to the server hosting the blockchain, there might still be ways for manipulation and for example to spend one Bitcoin twice as outlined above. This is why a blockchain is realized independently from a single server and instead operates as a peer-to-peer network. There exist a large number of simultaneous copies of the blockchain file spread all over the globe – this is what is called a *distributed ledger network*, the broader term of operating a blockchain. To add a transaction respectively a new block

[2] The site https://anders.com/blockchain/ contains very instructive videos to illustrate the operation of a blockchain.

to the chain requires huge calculating and encryption power, and formerly single users and nowadays almost exclusively specialized computer centers compete all around the globe to be the first one to find the new hashcode to verify the transactions. Once this is accomplished, the winner is rewarded by a relatively small amount of Bitcoin (this reward decreases over time); this is also how and why the total volume of the currency constantly increases (but is eventually limited to 21 million Bitcoins). I am pointing this out to make it clear that operating and making use of a blockchain is not for free, as some of the early enthusiastic comments on the technology suggested (Dickson, 2016). Another security feature of blockchains is the fact that they operate on open source software, so computer experts all around the world are able to identify and eliminate security leaks or ways of manipulation.

In the most recent years however, along with the Bitcoin-hype, the term blockchain has seen some erosion, so it has become a matter of debate how to define it. Characteristic for the Bitcoin-blockchain is its public availability and worldwide spread. As a matter of fact, the file is about 130 Gigabyte in size and currently spread on about 9500 nodes. Anyone can obtain a copy while most of the content is encrypted and thus not of much use. There are frequent reports in the media that banks and other companies are catching up on blockchain technology, which is quite easy as the required software is available for free. Many PROs have expressed interest (see section 5.5) and in 2017, Spotify even acquired the Mediachain-company presumably to experiment with its own blockchain technology (Sawers, 2017). But despite the encryption, we can imagine that a bank, a collecting society or a music streaming service running their own blockchain will not be equally interested in worldwide availability of their database, also since there remains some certain danger that computers of the future will be able to crack the encryption algorithms used. Thus, for the case of companies, distributed ledger will mean their blockchain is hosted on various computers in a number of places. As opposed to a central server, this also has security advantages. In addition, it will make use of similar validation strategies and the according open source software. However, it will then be up to the company if all the options mentioned in the case of the Bitcoin or Ethereum blockchain will also become available. Bo (2018) introduces and discusses various definitions in relation to current practices. Apart from the undisputed facts which Bo cites from Mike Orcutt "a blockchain is essentially a shared accounting ledger that uses cryptography and a network of computers to track assets and secure the ledger from tampering" (p. 1), Bo calls for an inclusion of the notion of disintermediation and the distinction between public and private blockchains into the definition. Xu et al. (2017) give the definition "blockchain is an emerging technology for decentralized and transactional data sharing across a large network of untrusted participants. It enables new forms of distributed software architectures, where agreement on shared states can be established

without trusting a central integration point." (p. 1) and provide detailed technical descriptions and comparisons as well as Valenta and Sandner (2017).

The Potential for Creative Industries and Especially for Music

Now, what does all of this have to do with creative industries? Well, some blockchains not only allow for financial but for many kinds of legal transactions. An example is the Ethereum blockchain which was in fact set up to enhance the limited functions of the original Bitcoin blockchain. This is why platforms such as Ujomusic draw on Ethereum (Ujo, 2017b) and other platforms such as PeerTracks even set up their own blockchains and cryptocurrencies (called "note" in this case, see Tschmuck, 2017, p. 33). Say you are an artist or a musician and wish to secure a *proof of authorship* for a new work you just created. Up until today, there is no central place for registering, and musicians typically make use of certain workarounds, such as sending the recording to themselves in material (e.g. a CD) or immaterial (e.g. an mp3-file) form, or by depositing it with a solicitor. Now, this proof of authorship could be placed on a globally available blockchain, linked to the artwork itself (if available in digital format) by means of digital fingerprint – a hashcode as mentioned above. Still, it currently remains an open question if this practice will prove fraud resistant and if it will be considered as evidence in case of trials in court. It is also noteworthy that this somewhat turns the principle of filesharing on its head. It is now the database holding the license information, which is realized in peer-to-peer format, while the cultural object it relates to – be it the Mona Lisa in the Louvre or an mp3-file – needs only to exist once. This could turn out to be an advantage when the decision is made that the files offered should be DRM-protected (see section 5.4).

In addition, the proof of authorship can be directly linked with licensing models that seem appropriate to the artist or rights holder. Typical collecting societies have a fixed model here requiring the authors to accept their terms and conditions upon registering. For example, making use of the flexible modes outlined in the creative commons license model is often not supported. All of this can be realized on a blockchain. Next, you might be a newcomer to the market and willing to offer your creation for free to receive the most recognition. At the same time, you might consider it unfair if some company stepped up and made use of it say in a television commercial or in a monetized YouTube-video. These sorts of things can be handled by so called smart contracts (Stark, 2016; Heap, 2018). You may thus define the first 1000 streams, downloads or other uses are for free, but require a payment once this number is surpassed.

Now to the side of the consumers and other users: You might own a bar and need optical and acoustical enhancement for your place. An example given by O'Dair (2016) is a person running a taco place in the south of the

US, willing to play only the music of one local band to give them special support. However, the PRO requires him "to buy a blanket license that gives him the right to play anything in the PRO's catalogue" ((Howard 2015b cf. O'Dair, 2016, p. 16). However, if the appropriate cultural products are administered via the blockchain, the terms of use will be flexible and even more important; the payment in whatever cryptocurrency might go directly to the artist with almost no time lag. Sounds tempting, doesn't it? It is also an option for optimized remuneration of musicians being featured on streaming services. Common practice is they receive only fractions of cents each time a title is streamed (Cooke 2015 cf. O'Dair, 2016, p. 7). Not getting paid much – which is the regrettable reality in most cases – is one thing. Even more important might be the lacking transparency, so the artists need to trust their company for the numbers. If their licenses are placed on a blockchain instead, artists themselves would be able to track how much use is being made of their work. However, this also touches upon issues of total control, so it will need to be carefully adjusted who gets access to which information, even more so if it will be used for improving marketing and sales strategies.

Next, you might not have created the cultural product all by yourself. However, typical collecting societies for music only register the names of the composer and the lyricist and the according rightsholders, while the performing artists and many other people involved (such as the producer) did at best get listed on the cover sleeve in the old days. Placing a proof of authorship on the blockchain would allow for precise tracking and preservation of all this information, including an agreement among the artists on how to share possible income generated (Heap, 2018, p. 4). In addition, quite some perspectives arise for research on creative processes. Remember many of the early Beatles songs were both credited to John Lennon and Paul McCartney (mostly out of convenience and/or partnership, but also out of a missing awareness for the juridical and monetary implications), although most of them were written individually? In comparison, doing retrospective stylistic analyses in musicology – my home discipline – to identify the factual authors seems like a strenuous and error-prone task (Headlam, 1995; Flender & Heuger, 1996).

There are even more benefits of the blockchain. If you don't like or need the painting you licensed or bought a while ago, you are now able to place a reference to it and its license on the blockchain again and find a subsequent customer or owner. Maybe in a hundred years, it will have become something like a highly valued van Gogh and also an object for research. As the blockchain cannot forget, it will preserve all information on provenience, something, that is otherwise very hard to achieve in art history (to be fair, other databases, even paper files, don't forget either, if they are well-preserved. However, Blockchain technology with its large amount of simultaneous copies of the distributed ledger is much more resilient against manipulations and

destruction).

Review of Music and Blockchain Related Sources and Literature

a. Articles and Books

Up to this point, academic writing on blockchain and music is scarce and only seldom properly published as book-chapters or articles. Since the whole area is rather new, most of these texts do not incorporate much original research and rather provide introductory knowledge complemented by assessments of the potential of the new technology. Around the year 2016, many of these comments were euphorious and made frequent use of terms like "disruption" and "disintermediation". An example is chapter 9 on music in the prominent introduction on the whole potential of blockchain-technologies by Tapscott & Tapscott (2016, p. 226-252). The overall idea was that if musicians make use of the blockchain-database themselves, they would be able to handle copyright, publish music, grant permissions and handle payments all on their own. This would mean that the established institutions for these kinds of purposes like copyright offices, record labels, music publishers, PROs, collecting societies etc. would become obsolete in the future. However, given the complexity of managing (even traditional) copyright on the one hand and the technical challenges of placing entries such as smart contracts on a blockchain on the other hand, more recent literature is now skeptical about the notions of disintermediation (Tschmuck, 2017) and disruption (Raine, 2017). Similarly, Remus (2016) makes it clear that the PROs have no need/requirement to move their existing databases to a blockchain.

Other articles and book chapters available are useful for background and context information. My own chapter addressing the mp3-phenomenon contains the argument that the massive losses the music industry faced in the early 2000s were primarily caused by burning CDs instead of illegal filesharing (Hemming, 2004). By means of investigating creative commons licenses and their acceptance among musicians, Schwetter (2015) makes it obvious that these prefer to devote their time and energy into creative work instead of digging deep into the details of licensing. Another chapter of mine (Hemming, 2016) extended the notion of "Mediamorphosis" (from Blaukopf, 1996) to clearly distinguish the digital stage (which started around 1982 with the introduction of the CD, and which is characterized by the remaining need for material objects) and an immaterial stage (which we entered with the advent of music-streaming and the disappearance of physical carriers). A recent article from Blocher, Hoppen, and Hoppen (2017) shows what the technical realization of placing licenses on the blockchain (for the case of software) actually looks like. A short essay by Leistert (2017) combines critical and optimistic aspects of blockchain-technology for society as a whole and hints at the similarities between smart contracts and DRM.

b. Working Papers and PDFs

To quickly circulate knowledge, quite a few useful sources on blockchain and music have been published in the form of working papers and/or PDFs on websites. The most prominent of these is the aforementioned paper circulated under the pseudonym of Nakamoto (2008) which simultaneously started Bitcoin and its blockchain. A useful but now slightly outdated set of working papers is provided by O'Dair, Beaven, Neilson, Osborne, and Pacifico (2016). They are written in academic style and contain a useful list of references. Another single PDF from O'Dair (2016) can be considered the most profound assessment of music and the blockchain of its time with a specific focus on monetization. A comprehensive treatment of music-related blockchain options is contained in Silver (2016) which features theoretical perspectives as well as a number of interviews with relevant people in the field. A similar source in German language is Voshmgir (2016).

c. Websites

Quite regrettably, many relevant and up-to-date-sources on blockchain and music, even from prominent figures like Imogen Heap or the Ujomusic-platform, are contained within regular websites. They are of limited academic suitability as they are often compilations themselves, only sometimes include author names and never contain page numbers. However, this article could not have been realized without drawing on these sources. If an author's name was given, I printed these sites into a PDF which gave me page numbers for proper referencing. All other websites are referenced in footnotes.

Dickson (2016) is one of the examples for the early tendency focusing on the disruptive potential – he calls it "silver bullet" – of blockchain-technology for the music industry and advantages to musicians. GEMA (2016) features Benji Rodgers from industry-near DotBC-media to promote his new integrative file format for music (see section 5.3). The site also includes a useful demo-video regarding blockchain-technology. Stark (2016) is not a music-related paper. The author is a lawyer and holds a blockchain consulting firm. It is outlined that Smart Contracts are specific to the Ethereum blockchain and a number of not too technical examples are given, mostly relating to the internet of things. The next three sources are short summaries of panel discussions. The first one was about creating a blockchain-based global database for music rights holders. The potential was acknowledged, but some current problems will remain. For example, the proper identification and remuneration of phenomena such as samples, cover versions or Mashups can and will not automatically be solved by the blockchain (Fink, 2017). The second

[3] This term relates to tools and products such as vacuum-cleaners or body scales which already existed before the age of the internet, but which are now connected to the web for additional functions.

discussion referred to the Imogen Heap / Tiny Human-experiment introducing Ethereum as an alternative blockchain enabling smart contracts. Other topics were the wish for more transparency and for more details in music rights databases (Perusich, 2017). The third discussion addressed the role of intermediaries, fairness and transparency in the light of blockchain-technology. It was confirmed that some music services such as Spotify have a problem with licensing due to poor data quality. Here, PROs could play an important role in the future, when it comes to providing and verification of the data, possibly on a blockchain. Accordingly, PROs and major labels as intermediaries will then not become obsolete, but transform into service providers. Also, the requirement for new file formats such as dotBC were discussed. All participants agreed that current processes in the music business are lacking transparency and efficiency (Spiegl, 2017). The single most useful source stems from de la Rouviere (2017), who is a member of the Ujomusic-team. It is almost an internal paper addressing all music and blockchain-related issues from the practical-technical point of view, especially when placing rights and distribution models on the Ethereum blockchain. It again becomes obvious that new intermediaries will definitely be needed in the future. Finally, Imogen Heap (2018) herself takes up the word for smart contracts and provides many more details, for example on the division of royalties, than were known so far. She also points out that music industry people are scared by the notion of "disruption" and that we should be speaking of "augmentation" (p. 2) instead.

By subscribing to relevant forums and platforms or simply performing an internet-search, new and relevant sources pop up almost daily. It will be a specific challenge for research to follow up on these developments.

Research Questions and Strategies

a. Changes in the Music Industry

To address this topic, please ask yourself if you have either full music albums in your collection, which you once downloaded illegally, or if you have self-burned copies of commercial music CDs. If you were at least a young adult by the late 1990s, I would assume the latter is true, but that you will hardly have downloaded full albums illegally in the past. I am saying this to confront an often-heard issue when it comes to the decline of the music industry around the turn of the millennium. Both actions described have the consequence that none of the people involved in creating, playing, recording or distributing music have received revenue for the cultural product you might have enjoyed (not even by blank media tax, as the blanks mostly used were sold as data carriers). And while self-burned CDs might have caused the greater damage compared to filesharing (Hemming, 2004, p. 117; also supported by Briegmann & Jakob, [2005]2009, p. 89), the losses the music

industries have faced are almost exclusively blamed on services like the early Napster (Knopper, 2018). Students from Boston had set up this platform in 1999. In the literature, Napster is often called a *peer-to-peer network*, thus similar to what *blockchain* technology relies on. However, Napster held a central database of all available files on all computers connected to the service, while it did not host any mp3s by itself. This is also why the service could barely be declared illegal in those days. At the same time, it did require a central server and ceased to operate once this was shut down in 2001. It was only up to subsequent filesharing platforms such as Gnutella or Kazaa to fully establish peer-to-peer networks. Once you connected to these, your own computer became a *node*, a part of this network, and hosted mp3s as well as (parts of) the directory. These kinds of networks cannot be shut down without eliminating a significant number of nodes. This is why they are resilient against manipulations say from authoritarian political regimes, something that is also true for blockchain-networks and which might gain additional importance given current global developments.

The music industry typically does not embrace new developments but tries to oppose their effects. Instead of offering their own, legal download-platforms to counter the illegal ones in the early 2000s, their strategy consisted in successful copyright-enforcement and the introduction of rather unsuccessful protection-mechanisms to prevent copying of CDs or audio extraction. Only with considerable delay and by the pioneering role of the computer company Apple, the iTunes Music store was introduced in 2003, the first one to offer music-files for legal and paid download. The music industry never even realized the impact of this step and for a while focused on selling music-DVDs and ringtones for cell phones instead. Similar things can be said about the advent of streaming. It sounds like a miracle that a Swedish startup around Daniel Ek was able to launch Spotify in 2006, one of the most successful music-streaming-services up to this day. While it has meanwhile become obvious that the large players of the music industry act as shareholders in the background (Knopper, 2018), their official strategy is again sideways. For example, they are said to greatly influence the recommendation-system in Spotify and other streaming-platforms to prioritize their own products (Benn, 2017). In spite of a massive sales decline for physical carriers, it is quite likely that the music-industry will react in a similar fashion towards the advent of blockchain-technology and downplay its potential instead of saying "this is exactly what we have been waiting for". This kind of argument is also contained in chapter 12 of Gerard (2017).

Considering the arguments outlined above, the following research strategies and questions emerge:

1. Follow-up media reports and all available figures regarding current developments in the music industry: fusions, sales strategies with back catalog in relation to new releases, identification of overall

revenue and profitable areas.
2. Try to identify who owns what, especially when it comes to streaming services and new licensing platforms in case they emerge.
3. Follow-up media reports and other sources on the tendency of incorporating blockchain-services into traditional companies.
4. Do qualitative empirical research, e.g. try to individually connect to one of the new platforms such as Ujomusic and be granted access to developments for academic purposes from an inside perspective (participant observation/ethnographic fieldwork).
5. Does the advent of blockchain-technology support the idea that we have entered a stage of immaterial mediamorphosis? (Hemming, 2016, pp. 409-410).

b. Potential Disintermediation and Monetizing Music with Cryptocurrencies

The notion of disintermediation has accompanied the increasing availability of the Internet since the 1990s and is not specific to blockchain-technology (Gellmann, 1996). With regard to music, it can be seen as a first example for disintermediation when bands started to place their music on homepages around the same time. However, as webspace was expensive and up- and downloads were time-consuming, this practice never had a strong effect, except that it probably attracted more visitors to concerts or made some people buy CDs from a regular store. Secure transmission over the Internet and direct payment options only gradually became available, so no one thought of switching to self-promotion, at least not if a recording contract was within reach. With the early Napster, someone could place their own MP3s in the filesharing network, but since there was no means of promotion other than the mere filename, this had a very limited effect. All of this changed when platforms such as SoundCloud, MySpace and Bandcamp entered the stage after the mid-2000s. Initial storage-space was for free and handling for musicians and bands was greatly improved. They could set up their own internal sites, provide visuals and additional information and thus reach a large number of listeners. So, these platforms might serve as examples for effective disintermediation, as record labels or stores were not needed anymore to get the music from its creators to its listeners. Once Blockchain-technology gets introduced, labels will no longer need to acquire rights by themselves, and artists in turn will not need the labels for collecting payments. However, a more precise view makes it obvious that, while some of the traditional intermediaries became obsolete, they were replaced by new ones, so it is actually inappropriate to speak of disintermediation. Section 5.5 contains further information on the role of old and new institutions and services.

Perhaps a more important notion of disintermediation refers to the modes

of payment. As demonstrated above, paying for music with a cryptocurrency requires some technical setup, but is otherwise – on the side of the user – not much different from paying with other Internet services or simply by entering credit card information. Musicians such as Björk get mentioned in the media since they also allow their music to be purchased using cryptocurrencies. In her case, this is realized by a meta-payment-platform called WorldPay, which offers almost any available payment option including Bitcoin. However, the cryptocurrency value is likely to be converted into a traditional currency and all payments down the line will be processed in a conventional fashion. This in turn means that hardly any of the original benefits will remain for the musicians.

The real difference and disintermediation only happen if a payment using a cryptocurrency is automatically split up among those entitled to a share, and the according amount is just as automatically transferred to the person's virtual wallet. As especially international money-transfers involving traditional banks or services such as Western Union cause high fees sometimes even on both sides, this option is unsuitable for small amounts. In the past, a failure of keeping track of author's postal addresses and bank account numbers has even led to lawsuits (Toynbee, 2009). With cryptocurrencies, the transaction costs can be adjusted to a tiny fraction of the value to be transferred, which itself can amount to only fragments of cents. At least, this was a frequently encountered point of view until the end of 2017. With the rise of public interest in Bitcoin and the advent of cryptocurrency speculation, the limits – known as the scalability problem – of the whole system became visible. As each block added to the chain is of limited size, it cannot contain and validate (!) an unlimited number of transactions. At the same time, the exchange value of one single Bitcoin climbed above $15,000. This meant for a while, that transactions of even the smallest scale would amount to $20-30, which of course is completely unsuitable for the initially praised near-instant micropayments. Meanwhile, due to adjustment processes also upcoming for Ethereum, the transaction-fees are back down to acceptable levels. However, it seems, that near-instant micro-payments would either require specialized blockchains and cryptocurrencies such as the "Note" or else remain out of reach. Still, it is crucial that payments (they might not always be small) can be passed on to the musicians instantly and without a significant reduction. This option should be held up in the future. Otherwise, the situation will persist that "it can sometimes take 2-3 years for the money to come, especially if it's international money" (Heap, 2018, p. 10).

Research strategies:

6. Follow up developments in the established cryptocurrencies and innovations regarding simplified validation strategies. Consider separate and/or specialized cryptocurrencies as serious alternatives and track developments and their acceptance.

7. Explore the technical requirements of smart contracts and their functionality.
8. Empirical research II: Interview musicians and other artrepreneurs about their readiness to accept cryptocurrency-payments, their satisfaction with existing and their requests for future services.
9. Investigate into the volatility (a measure of the risk in a financial instrument) of cryptocurrencies and its effect on the acceptance among musicians.

c. File Formats, Rights Databases and Tracking Provenience

When the CD was introduced as a joint venture from Philips and Sony in 1982, it was primarily promoted with its greatly improved audio quality, duration and handling when compared to vinyl-LPs. No one thought of including metadata on a medium which is in essence a data carrier. At best, this kind of information was printed in very small font on the booklet like on the record sleeve in the old days. So, while displaying this information could have been an interesting option for high-end CD-players even in those days, a great opportunity was missed to provide reliable data on authorship, performing musicians, rightsholders etc. along with the music. When extracting music from CDs as uncompressed (e.g. WAV) or compressed files (e.g. MP3) became available in the late 1990s, no metadata could automatically be included and needed to be added manually. This is how independent and notoriously unreliable and incomplete databases such as GraceNote[4] emerged, which are still in use today. As a matter of fact, the earliest versions of WAV or MP3 never even included the option to contain metadata themselves, this was only added later by internal upgrades of the file standards. In the beginning, it was again only the filename.

"Global Repertoire Database", "International Music Registry" or "Open music initiative" (OMI) are names for attempts to introduce file formats and databases containing enhanced and verified metadata. All of them are said to have failed for diverging interests of the players involved (Raine, 2017, p. 9; Tschmuck, 2017, p. 33; Heap, 2018, p. 1). Benji Rogers from dotBC has sought a different approach and developed a new file format ".BC" in close contact with traditional and new institutions of the music industry:

> "Rogers' team is developing a new blockchain-based file format. BC, which would replace MP3 and WAV files as the industry's digital standard. These .BC files would exist on a blockchain, could be uploaded to streaming services like Spotify, and work as both audio files and smart contracts with embedded information on rights holders and more. If adopted as the new standard, Rogers says dotBC could solve major issues,

[4] http://www.gracenote.com/

such as broken metadata, which dam up the revenue stream, thus making royalty collection more transparent and efficient." (Raine, 2017, p. 5).

"The final crucial point about Mr. Rogers' idea is that the VR application of the .bc codec is really a Trojan horse for a broader application. As more content holders embrace this codec in order to have their music used in VR applications, the codec will gain traction in other applications as well. At that point, music users/consumers of all stripes will have a choice to make: Do we use music that we know – because of the .bc codec – is authenticated by the artist/rights holder, and that stipulates how and at what rate it could be used, or do we ignore this, and recode it in whatever way we choose." (Howard, 2015, pp. 3-4)

It remains important that DotBC is not aiming at incorporating cryptocurrencies – or is this a strategic advantage, given the public's mistrust, the volatility of cryptocurrencies and the industry's conservatism? In any case, this kind of database remains a desirable aim for the near future:

"All usage rights. It's so frustrating to have a record out there and get endless emails about 'Can I put [this] thing into my wedding video? Can I remix this?' or 'I have remixed it, I sampled it,' and then trying to backtrack and figure out percentages and all that stuff later. And just contact info and license data. " (Heap, 2018, p. 6)

"At the moment it's really, really difficult to do business with songs. There's no database of songs to show you how to do things. So people just do things because they want to do things; and they haven't got time and money to go and find out how to get permission to use the thing, so they just use it. Most times people just use it and they don't tell us, because they're afraid that we might say no, but actually 99.999% of the time I say yes, because I want people to make other babies with my music, collaborate and do remixes and whatever". […] " each streaming company has to literally pay 200 organisations for one artist around the world." (Heap, 2018, pp. 9-10).

"We [at Ujo] hope to see things like a young duo build an innovative radio service over a weekend without having to go knock on the doors of the record labels. We hope to see stems automatically uploaded and available for remixing from your favourite DAW (Digital Audio Workstation). We hope to see the first AI [artificial intelligence] artist license their samples, Under The Hood and then be used in the latest vlog of a YouTube star that is yet to arrive. We hope to see decentralized bands reimplemented on this infrastructure". (de la Rouviere, 2017, pp. 2-3).

I already mentioned the long-term-option that a blockchain would enable for complete tracking of the provenience of an artwork if its copyright information initially gets stored. However, it remains an issue to be resolved how the information provided can be verified, and who will actually be in charge

and trusted for uploading. As many services are currently competing, it is almost impossible to decide as an artist which one – in addition to offering an optimum service for present needs – has the best future options. So, it is encouraging to hear that transferring information from one blockchain to another seems to be a problem which can be solved if this is needed for the future:

> "Swarm and IPFS's Filecoin are building incentivization layers that will allow users to replicate this data across the globe, so there would be no reliance on specific institutions for this open license ecosystem to exist." (de la Rouviere, 2017, p. 7).

I would like to add that the bigger problem for the future might not be properly indexing new releases (and how and where to store this information), but to convert existing databases from the PROs or the back catalogues into the new standard.

Are you familiar with the case of Cornelius Gurlitt? In 2012, a huge collection of 1280 seminal paintings from the early 20th century was discovered in his Munich apartment. He had inherited them from his father Hildebrand, who had acquired them in questionable circumstances during the Nazi era. Shortly before his death, Cornelius Gurlitt was able to entail the whole collection to the Museum of Fine Arts in Bern, Switzerland. But it will take decades before the collection can be put on display, because the provenience of each work needs to be resolved, first (Cano, 2017).

Research strategies:

10. Follow up the development of services offered and critically discuss their pros and cons.

d. Digital Rights Management (DRM) and the Need for Public and Political Intervention

Napster is nowadays a legal music-streaming service. One thing I like about it is the option to also download and store the music on your local computer (if it runs on Windows). The music can only be played back if your Napster-account is paid-up and valid. In the past years, Napster made use of DRM-protected WMA-files (Windows media audio) for this purpose. These need to be opened in Windows media player which then connects to a server to verify and grant the license needed for playback. This process is hidden behind the opaque message sometimes visible for a short moment when opening Windows media player "media changing" and next "downloading media usage rights". Over the years, quite a few of those files have piled up on my hard disk. Somewhere in the middle of 2017 however, I was suddenly returned a strange error message through which I actually realized for the first time that a server-connection had been attempted:

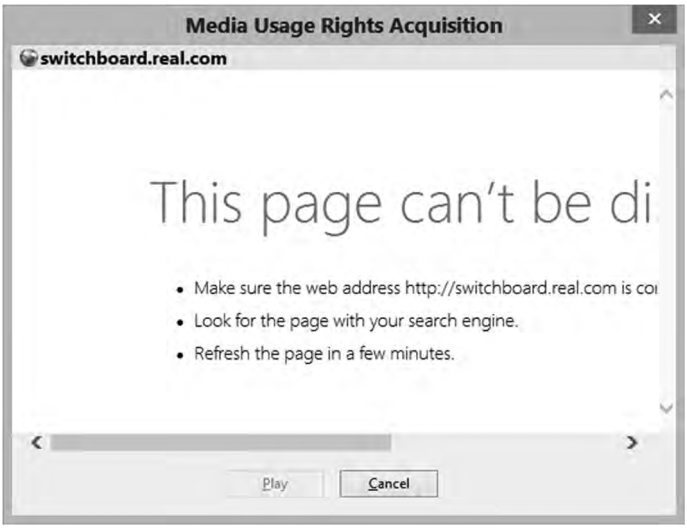


Figure 7: Popup from Windows Media Player after July 25, 2017

As the problem persisted, entries started popping up in the Napster user forums. Deleting the file and downloading it again would not help and the only workaround would be to go back to streaming. It was only after a while that it became obvious that Microsoft had stopped operating the WMDRM-licensing server on July 25, 2017 along with the introduction of the anniversary update for Windows 10. However, neither Microsoft- nor Napster-users were properly informed about this issue; apparently the service should silently go to sleep. I already thought Microsoft would be giving up DRM altogether and was surprised I could not find any media-reports about it. Next, Napster support advised me to install the latest software version which would enable downloads again. Sure enough, this now required the Windows 10 operating system including the anniversary update. This is when I learned that Microsoft had switched to a completely new DRM-management called PlayReady. Again, I could hardly obtain any information on what made this necessary. To my knowledge, DRM-protected WMA-files implement a strong encryption algorithm and it is impossible to 'crack' them. I admit, I gave it a try. But the only tools available, e.g. for re-recording using a 'virtual audio cable', always require at least one server connection. So, the only thing left to do was to move the files to the trash bin. While this is inconvenient for me, it is acceptable as I was never promised anything else, and I can now start over using the new software version.

But actually, this happened to me for the second time. When the first legal music-downloading platform called 'Phonoline' was introduced in Germany in the mid-2000s, I became a customer and learned to handle protected

WMAs for the first time. For example, those were tied to a specific device and needed to be re-licensed after upgrading your computer. Now guess what: the server and the whole company ceased to exist and the music-files are lost. This time, I felt somewhat betrayed, because I had paid for the music and had never been advised there would be an expiry-date.

Sure enough, this will not happen to the music from RAC which is distributed in an open file-format as I mentioned in the introduction. At the same time, I do understand that – for the sake of fair use – musicians and companies alike may require a kind of protection. Nowadays, the most prominent examples are e-books, which are typically not circulated in open PDF-format for the same reason. I was thus surprised to hear a rather one-sided talk from Molly de Blanc (2017) about DRM at last year's Chaos Communication Congress in Leipzig. In her view, DRM is a mere instrument of power exerted by rightsholders. If society does not oppose to the growing use of DRM, we are supposed to lose the following eight options: 1. accessibility; 2. art; 3. convenience; 4. education; 5. free speech; 6. repairing and not replacing devices; 7. sharing experience as human connection; 8. translations. Of course, I support the notion that all these are desirable options for the public. Then again, the very history of copyright itself makes it clear that there needs to be a balance in interests between creators and users of works. If the former do not get rewarded by the latter, they lose their motivation and the result is a decline in innovation and originality. So, in the light of DRM, which can be seen as the latest tool of copyright-enforcement, the argument should be that again the interests of creators/rightsholders and users need to be carefully balanced. In my view, this would mean we need international agreements and/or laws which impose expiry-dates on the DRM-restrictions themselves instead of the objects protected. In other words, after a defined period of time not dissimilar to the classical protection terms from copyright, DRMs should dissolve automatically and the object would become freely usable. This would be the moment to dig my WMA-files out of the trash bin!

In the context of this article, it is easy to guess what I would like to suggest. If – as the examples have just shown – it can be assumed that companies and servers handling DRM-licenses have a certain half-life-period, it would make a lot of sense storing these in the form of smart contracts on publicly available blockchains instead. As I said before, a blockchain cannot forget. This would mean, we are out of danger that artistic or technical objects digitally go dead without external reasons. We have already heard of cars being trashed not for rust or engine damage, but because there was no one left to unlock the obligatory service-intervals or theft-protection in old-timers…

Research strategies:

11. Write a history of DRM and its general legitimation.
12. Describe the various techniques involved and how these could be implemented in smart contracts on a blockchain (possibly include

experts for this purpose).

13. Add to the public awareness of the danger that art- and non-art-objects could digitally be going dead and the need for updated copyright laws on this issue. Address the media for this purpose.
14. Inquire deeper into the mechanisms of smart contracts, e.g. the limitations of re-adjusting prices or modes of usage once the contract has been placed on the blockchain.

e. Licensing Models and the Role of Performance Rights Organizations (PROS) and Collecting Societies

It is now time to devote more attention to collecting societies or performing rights organizations and their future role in the light of blockchain technology. If artists themselves in fact became able to secure rights and terms of licensing for their creations on the blockchain, and to also receive the beforementioned near-instant micropayments, it seems there will be no more need for collecting societies in the future. And if the establishment of cryptocurrencies continues, we might eventually not need banks anymore, at least not in the traditional sense. Early commentaries on blockchain technology almost celebrated the fact that these kinds of intermediaries could soon become obsolete. Weren't those the ones chipping fixed percentages off our money transactions or off artist's royalties while both we and they would have deserved to keep more if not all of the original amount? Well, this argument is only partially true, as collecting societies and banks alike did and do, I should add, offer valuable services and are of course entitled to charge according fees. This is why collecting societies were set up by composers themselves starting in the mid-19th century (Hemming, 2016, pp. 384-386). Many of the traditional collecting societies including the German GEMA (Remus, 2016; Spiegl, 2017), the Canadian SOCAN (Raine, 2017) as well as the American ASCAP, French SACEM and British PRS (Levine, 2018, p. 8) are already aware of the new challenges and many of them are experimenting with blockchain-based services for the future. For them, the technology could be useful for many of the transactions because administrative fees could be reduced. As some of them built up their catalogs over centuries, it remains uncertain if they will make these available on publicly accessible blockchains. This relates to the question of the value of the information stored on a Blockchain. At the same time, since most money in the music industry is currently not made with new releases but with the "long tail" in the back catalog (Hemming, 2016, pp. 419-420), it is unlikely that building up new databases along with the introduction of new file formats with much-improved handling of metadata will be successful without the support of the PROs. This relates to the questions of who will actually be sustaining the blockchain? Who will pay those who administer and verify the transactions? Even if they do receive

a percentage of the cryptocurrency, its value is currently not stable at all. In addition, some claims (e.g. regarding so-called orphaned works) can only be handled by collecting societies, and some forms of usage cannot be licensed by smart contracts.

In fact, many of the traditional institutions of the music industry continued to act rather stubbornly and in a conservative fashion, given the changes the music industry already had had to face since the early 2000's. It is only recently that their set of services is being offered on a more liberal basis with various options to choose from, and the standard-royalty-deal (Byrne, 2012, pp. 213-253) is not the only available model. Similarly, some collecting societies such as the German GEMA have resisted opening up for new licensing models usually referred to as 'Creative Commons'. While those are static, they for example enable authors to grant licenses for the free use of their work as long as their name gets mentioned (known as the 'cc-by'-license) or if the purpose is non-commercial ('cc-nc'). An introduction into creative commons licenses can be found in Klein, Moss, and Edwards (2015, pp. 60-61).

While there has long been a coexistence of the two PROs ASCAP and BMI in the US, most countries have only one PRO which as a consequence acts as a monopoly. A large initiative in Germany saw the need for change here and acquired €119,000 in a crowdfunding campaign and the support of many institutions including the European Union. In 2013, the 'Cultural Commons Collecting Society' (C3S) was set up as an alternative to the GEMA, eventually aiming at becoming a European collecting society. The main difference to existing PROs was the inclusion of the aforementioned creative commons in the license model. While all legal and administrative tasks were successfully completed, the C3S still hasn't begun to operate. The reason is that it was too high of a risk for many musicians making a living on royalty payments to switch from GEMA to C3S, and overall, too few musicians, as well as musicians with no significant economic potential remained in order to be granted permission by the German Patent and Trademark Office. Meanwhile, this has become known as the 'critical mass problem' affecting many startups. It is quite likely that music and blockchain-related initiatives will have to take the same hurdle in order to be successful. However, people like Imogen Heap are in no way discouraged by this restriction:

> "So all those people who were like, 'Haha, she's trying to change the music industry and she didn't even sell 200 copies…' that was the point where it was, 'Look, it is possible — let's think about the future.'" (Heap, 2018, pp. 9-10)

As a matter of fact, the existing collecting societies and their databases may play the key role regarding the introduction of blockchain-services into the music industry. Eventually, instead of becoming obsolete in the near future, there have been rumors in the air that a new age of collecting societies is about

to begin.[5] Another idea is that new collecting societies acquire licenses from the traditional ones to obtain the critical mass. Those could be the ones transforming the internal lists of works, authorship and rights into a blockchain, not dissimilar to many banks which are working on implementing blockchain services into their business models.

The same might be true for new services. As will have become clear from the above, blockchain technology is quite complex, so placing one's own rights management there directly is not within reach for most artists. This is why we have seen the emergence of a number of competing blockchain-based services such as Ujomusic, Peertracks, Revelator, DotBC, Musiconomy etc. Other than in the age of monopolized collecting societies, the customers – music users, but creating artists first and foremost – will then be able to choose the service which offers the best conditions and which best matches their needs. Also, musicians will be able to keep track of their rights, royalties and payments even if they decide to switch to a different service provider (see section 5.3).

Research strategies:

15. Inquire about the readiness of PROs/collecting societies to adopt these services (e.g. by attending panel discussions or PRO's main assemblies).
16. Try to reveal internal strategies, e.g. through interviews with relevant people.
17. Look out for upcoming political initiatives aiming at further alignment of the PRO's practices within the European Union.

f. Crowdfunding: Turning Social Into Economic Capital

In the past decade, crowdfunding became a widely accepted and sometimes very successful way of fundraising for all kinds of projects. It was already mentioned that the initiative for an alternative collecting society in Germany was largely based on this mode of financing. The difference between a simple donation campaign is that a reasonable target sum needs to be set for a specific project first, which only gets started if the required money can be raised. In the opposite case, it is returned to the donators. Crowdfunding is typically administered by Internet-services such as Kickstarter, Indiegogo or PledgeMusic, which can again be identified as new intermediaries and services in the music business. An outstandingly successful project by the American singer-songwriter Amanda Palmer is reported by Medeiros and Dias (2017). She had requested $100,000 from her fans to release and distribute her latest album, which had already been recorded. More than 10 times

[5] Personal communication with Wieland Reißmann, long-year member of the GEMA-advisory council and my colleague at Kassel University.

of this amount was able to be raised by about 24,000 fans within the defined period of time, and the project was successfully completed. For one thing, this shows that Amanda Palmer has a large base of true and faithful fans. Next, these people were addressed in specific modes not only by personal contact at concerts but also through a specially created video and all kinds of social media activities. The campaign itself offered various kinds of rewards depending on the height of the donation, of course, only if the whole project would turn out to be successful: from $5 for the "deluxe download" of the album, $25 for a limited edition of the CD, $50 for the vinyl-album, etc. up to $10,000 for "art-sitting and dinner" with her.[6] However, it remains an open problem what to do with surplus donations as in the current case or if an album turns into a huge commercial success.

The idea to become independent from established structures of the music industry has been around at least since the late 1970s and formed the basis for the DIY-movement, which originally relied on independent production and mail-order distribution (Strachan, 2007). Crowdfunding appears to take this one step further by including the options the Internet has to offer. From the perspective of cultural studies, successful campaigns make it obvious what the whole idea is really about: the transformation of social into economic capital (D'Amato, 2016). And the process can also be reversed to increase the faithfulness of fans once they actually do spend money. When I purchased the album from RAC, I was rewarded with the following words:

> "By participating in a seminal moment in both music and technology, you've firmly planted your stake in the ground as a pioneer. Exploration at the edge has led to the discovery of a one-of-a-kind EGO badge to commemorate your tireless pursuit of an open music platform — for this, we thank you. An Ethereum ERC-20 token, it can never be duplicated or destroyed, and before long, the EGO badge will never be found in the wild again. This record of purchase will be claimable by early supporters' MetaMask wallets within a week of the release.
>
> In supporting the RAC x UJO project, you've identified yourself as someone who believes that a better world for creators exists somewhere out there and isn't afraid to venture out into the digital frontier in order to find it […]" (Ujo, 2017c)

At the time, I didn't really have an idea what this token-thing was to be all about, and the idea is still only building up in my mind. Again, Ujo offers further explanations of the system on their website:

> "Possession of this token in your Ujo Music persona lets Andre [i.e. RAC] know that you are a bonafide supporter of his work, signals to NinjaTune

[6] https://www.kickstarter.com/projects/amandapalmer/amanda-palmer-the-new-record-art-book-and-tour [26.04.2018]

> that you are a supporter of one of their artists, and lets other fans know that you have similar tastes in music. Wouldn't it be exciting if you could skip the line at the next RAC show in your local city or access a special Ninja Tune tent at the next festival with this badge? How cool would it be if, upon meeting a stranger at the show, you were able to view each other's music badges and trade them? What if RAC could send a message to all holders of both EGO and Strangers badges to clue them in on the after-party?" (Ujo, 2017a)

I think there is no need to again hint at the fact that a blockchain would of course be a useful tool in handling these kinds of rewards – tokens, as they are now called – for customers and fans (de Filippi, 2016, p. 11). While Ujo has already begun to do so, I am sure that many of the services offered by the generic crowdfunding-platforms mentioned above will be equally effective. Other platforms such as PeerTracks make use of internal currencies called "artist coins" in this case. Then again, PledgeMusic is run by the same person that stands for the ".BC"-initiative: Benji Rogers. This makes it clear that there is more than one interconnection between the idea of crowdfunding and the possibilities offered by blockchain technology. I would like to sum this up in the sober words of Imogen Heap: "when you clean up the value chain, then fans could become your investors or patrons." (2 Heap, 2018, p. 12).

Research strategies:

18. Follow-up the development of crowdfunding-platforms suitable for music
19. Is the usage of crowdfunding for realizing music projects a growing or declining sector?
20. Will the existing crowdfunding-platforms be implementing block-chain-technology, and in turn, will existing blockchain-based services be adding crowdfunding-functionalities?
21. What is the perspective of the traditional institutions of the music industry on this development?

g. The Debate About Transparency

We now need to return to the issue of transparency. It might have to be brought to mind again that a blockchain by itself is no warrant for transparency. First of all, as was outlined in section 2, blockchains can be operated in a closed circle by authorized companies and institutions only – a blockchain is not automatically or necessarily open to the public. Next, recorded transactions need not but can be encrypted and thus become invisible for those not holding the corresponding keyphrases. For the case of Bitcoin, while all occasions when a specific Bitcoin has been used in a financial transaction can theoretically be traced back, it remains invisible who actually 'owned' this

specific Bitcoin and what she or he spent it on.

Music-related payments and transactions can and will be processed in a similar fashion. The degree of transparency is then up to the various players involved. It has already been stated that not all musicians will be opting for complete transparency, just as many companies in turn might have a genuine interest in at least revealing ownership-rights in order to enable proper processing of royalties. Thus, somewhat similar to the treatment of DRM in section 5.4., the debate around transparency needs to consider both sides of the coin to eventually balance interests. Imogen Heaps speaks of an "Internet of agreements" here. This includes her vision to reverse user data to the artists to adjust their work: "I would like to have things like number of streams, maybe the regions or countries they're in, and roughly the age group could be useful, to help… Services get this data anyway, so if they could pass that on…" (Heap, 2018, p. 11).

It is true that those currently benefiting from a lack of transparency could turn out as the major obstacles in the further integration of blockchain-technology in the music industry (Raine, 2017, p. 7). So, we will need to ask who this could be, and if their own arguments are appropriate. Benji Rodgers proposes the following persuasion-strategy: "Those who currently profit from a lack of transparency, slowing down, or the diminishment of payments to artists, will find that that becomes more difficult […]. But if they add value, they will make 10 times more money from the efficiencies in the system than they will from the lags in legacy." (cf. Raine, 2017, p. 9). In any case, blockchain-technology incorporates the democratizing potential for more transparency and simply more fairness in the music industry. We will soon see on what degree of transparency the parties involved agree upon.

Research strategies:

22. Keep monitoring the debate about transparency in the music industry, also when it is not blockchain-related.
23. Critically evaluate and comment on the future degree of transparency not adopting a one-sided view, but considering the interests of all parties involved.

Conclusion

At the moment, no one is able to tell if Blockchain-technology will be integrated in the music business at all, or if at least some of the many options discussed here will prove to be relevant in the future. At least within academia, it seems a critical mass has already been reached, given the many researchers from all kinds of disciplines addressing blockchain-topics. Still, the primary task for researchers will remain to critically monitor, dig deeper and discuss the current developments. This may require an interdisciplinary as well as a cumulative approach, to be able to publish results without too much

delay. The main research questions are as follows: How will the music industry change when blockchain-technology is implemented? Which services do exist, and which ones should be developed with regard to the overall needs of authors, music users and rightsholders? What do authors and artists know about blockchain-technology and/or cryptocurrencies and are they willing to make use of them? Finally, I think many people advocating for blockchain-technology in one way or the other can be considered a kind of digital hippies, sometimes dreamers, but all aiming at a better and fairer world, now with the means of the 21st-century. I am one of them.

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