Gateway of Sound:

Reassessing the Role of Audio Mastering in the Art of Record Production

— Feature Article —

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Abstract

Audio mastering, notwithstanding an apparent lack of scholarly attention, is a crucial gateway between production and consumption and, as such, is worth further scrutiny, especially in music genres like house or techno, which place great emphasis on sound production qualities. In this article, drawing on personal interviews with mastering engineers and field research in mastering studios in Italy and Germany, I investigate the practice of mastering engineering, paying close attention to the negotiation of techniques and sound aesthetics in relation to changes in the industry formats and, in particular, to the growing shift among DJs from vinyl to compressed digital formats. I then discuss the specificity of audio mastering in relation to EDM, insofar as DJs and controllerists conceive of the master, rather than as a finished product destined to listening, as raw material that can be reworked in performance.

KEYWORDS: record production, sound, dynamic compression, electronic dance music, senses, participant observation, participant listening

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A New Visibility for Audio Mastering

Between 2008 and 2012, *MusicTech*, one of the most popular magazines for music production, dedicated four of its special issues *Focus* to audio mastering. Until that moment, each *MusicTech Focus* had been devoted to a different DAW.[1] Quite significantly, the first special issue on mastering "proved to be the best-selling Focus to date" (Pettengale 2009: 3). This example might appear somewhat arbitrary, if it weren't for an apparent proliferation of printed and online publications on audio mastering, including manuals, specialist magazines, YouTube tutorials and forum discussions targeted at professionals, amateurs or both, witnessing to a sudden interest in a phase of record production that has been traditionally given scant attention.

This leads to at least three observations. In the first place, and quite ironically, mastering, as the final step of record production, has become visible concomitantly with a gradual process of dematerialisation of the music itself brought about by digitalisation, from vinyl records and cassettes, through CDs and digital files—a development that is especially manifest when we look at the most recent changes among DJ practices in EDM.[2] If mastering originally could be identified mainly with the process of cutting the vinyl master, now more emphasis is placed on what is sometimes called pre-mastering, that is, the EQ and dynamic treatment that is applied before physically obtaining the master version. Inevitably, mastering engineers have to cope with changes in the technology for music production, consumption and distribution as well as with changes in audio formats; hence, the study of their strategies of adaptation to a continuously transforming landscape can be especially insightful for music studies at large.

In the second place, those same technological transformations have offered musicians and producers a shortcut for releasing their songs directly through the Internet, freeing independent artists, among other things, from the need to pay for a professional mastering service. As Williams (2012: online source) suggests, this tendency involves musicians' choices as well the consequences that these choices, in turn, have on sound engineers: "For many musicians, the promise of total control over the recording process, and the liberation from studio hierarchies provides the incentive for investing time and capital in mastering DAW recording technology". The roles of music practitioners can hardly be expected to remain untouched.

In the third place, mastering has a special significance for EDM in that the product of mastering, regardless of the type of format, is re-actualised into a performance in the hands of the DJ. In this regard, the shift from vinyl records to digital formats in many DJ scenes and the appearance of new digital formats for DJs have encouraged new practices also among mastering engineers, whose targets are not only music listeners but, specifically, music performers as well.

Finally, music software and hardware companies have promptly capitalised on these new opportunities, using the specialist press to launch and promote dedicated products pitched at a wide range of users. In fact, magazines and websites not only review existing consumer

products, creating synergies with the music manufacturing industry, but they also have to rely on existing products, that readers can mostly recognise, in order to illustrate the procedures of audio mastering.[3] In short, mastering has become a viable way to sell audio processing software.

The Relevance of Audio Mastering for Music Studies

While other aspects of record production have been given significant scholarly attention from music scholars, audio mastering has remained out of the radar, with a handful of publications—mostly theses and dissertations—being notable exceptions (Nardi 2005a, Nardi 2005b, Nardi 2007; Papenburg 2011; Shelvock 2012). One reason for this absence might be the methodological difficulty of investigating a practice that is normally performed individually inside the studio. Lack of access to a hidden domain plus complications in recognizing and evaluating empirically the concrete acts of and motivations behind sound manipulation add to this difficulty. Moreover, emphasis on technical rather than musical skills relegates mastering engineers to the domain of science rather than music, hardly calling for academic interest from a scholarship that too often remains entangled in discourses of artistic integrity and authenticity. Not surprisingly, then, the very specific contribution of mastering to the art of record production and, concomitantly, its influence on consumption practices is rarely acknowledged if not even noticed at all by both music listeners and music scholars. Nonetheless, as Frith and Zagorski-Thomas (2012b: 3) rightly point out, "in the studio technical decisions are aesthetic, aesthetic decisions are technical, and all such decisions are musical". Mastering, in particular, is a crucial gateway between production and consumption insofar as it consists of the final step of sound manipulation before a product is released for sale, and as such it deserves wider consideration.

Overlooking the study of audio mastering does not just mean neglecting an integral aspect of record production, but also failing to identify the clues that it can offer to understanding ongoing transformations across the music industry at large. One of these transformations is immediately apparent if we look at what Théberge (1997) and Taylor (2001), among others, describe as a major shift in music making in relatively recent times, namely, the progressive convergence between music production and reproduction as allowed by digital samplers, synthesizers and sound banks, and the use of turntables and audio mixing consoles as performing instruments in their own right.[4] Tools such as digital vinyl systems and software for live electronics have further emphasised this convergence insofar as they considerably rely on pre-existing libraries of music made of songs, loops, instruments and templates. For all these reasons, the emergence of DJ culture suggests that the relevance of mastering, as we have seen, expands well beyond music consumption, exercising a significant influence on performance as well.

The relationship between engineering techniques and aesthetics is worth further scrutiny at least for two reasons. Firstly, sound engineers manipulate sound according to rules that

define the higher or lower appropriateness of techniques in relation to the kind of material, including music genre, the identification of defects to correct, the kind of listening context that is predicted, and so on. Needless to say, these rules are affected by and in turn affect music aesthetics, just as suggested by Frith and Zagorski-Thomas in the quote above. Secondly, the role of mastering engineers finds itself at the intersection of what is widely acknowledged as the moment of creation, which is normally identified with songwriting, arranging, performance and—at least since the growing acknowledgment of the studio as a creative environment—production, and the moment of consumption.

As such, the audio engineer acts as an intermediator between music makers and music consumers, offering insights to research about the functioning of the music industry at large. Indeed, this position places the audio engineer as a crucial mediator of meanings, technology and social roles at various levels of analysis. This is especially true for music genres, such as house or techno, which assign great importance to sound production aspects like dynamic compression and stereo sound field, which are partly achieved at this stage of production.

Whilst not denying that there is an important, possibly predominant technical component of mastering engineering, my aim is to highlight both the arbitrary facets of this component, which are also noteworthy, and the constructed nature itself of the "technical" within the broader purpose of audio mastering. With this I don't mean to neglect the objectivity of the physiology of hearing and of the physicality of acoustics, on which most techniques are based, as they are fundamental to the ability to predict listening conditions and experiences, but rather to stress the cultural dimension of hearing and sound as a defining characteristic of mastering engineering. In particular, I want to underscore the connections between techniques and aesthetics, based on the assumption that the former are never neutral but are always entangled in cultural meanings and social relations, while the latter require formalized techniques and procedures in order to be expressed through cultural products and practices. The benefits of this kind of interest can be especially fruitful if we look at the responses of mastering engineers in relation to changes in music formats and technologies as a partial and yet significant snapshot of current transformations of the music industry at large.

Aims of Research and Methodology

This paper pursues three aims, exploratory, interpretive and epistemological respectively. In the first place, it investigates the practice of mastering engineers in the context of EDM production. This task involves the consideration of the skills and techniques required to operate successfully within the domain of the mastering studio, as well as the capacity to interface with clients, the ability to empathise with audiences and, essentially, a comprehension of how the music industry works. As a consequence, audio mastering practices ought to be set in relation to the larger aesthetic and economic demands of EDM, including pressures derived from current patterns of music consumption and trends in technology manufacturing, promotion and consumption.

In the second place, it reassesses the creative role of studio techniques within the broader process of record production, following the path paved by the Association for the Art of Record Production and works such as Kealy (1979), Hennion (1989), Meintjes (2003), Porcello (2003), Warner (2003), Green and Porcello (2005), Frith and Zagorski-Thomas (2012a). While too often the assumption of a fixed divide between art and technique is taken for granted, this kind of approach has proven effective in disclosing the ideological nature of some (popular) music studies. Moreover, it sets the techniques adopted and the aesthetic goals pursued in relation to each other and to existing ideologies of record production, in order to give account for the economic dimension of the art/technique divide and the forces that shape it.

Finally, considering that audio mastering greatly consists of implicit knowledge produced individually inside secluded spaces and embodied in everyday practice—knowledge, furthermore, that can hardly be grasped by mere verbal account or disengaged observation—the object of research poses relevant obstacles to ethnographic observation. This consideration brought me to design a participant approach that, in combination with interviews with practitioners, could ensure both analytical detachment and an empathetic understanding of the process of mastering. Stemming from this experience, I will briefly discuss the epistemological concerns that frequently characterise research about music production and sound engineering, suggesting ways to obtain effective data from ethnographic work.

Regarding the methodology, data for this study has been collected in three ways, namely, through semi-structured interviews (in English, Italian and German), participant observations and secondary sources. Interviews took place in two different periods. In 2004 and 2005 I met various mastering engineers in Berlin, Bologna and Trento; I interviewed them and I interacted with them in the studio, adopting a style of participant observation that I will describe later. This data constitutes the basis for the exploratory section of this paper.

In November 2013 I interviewed two of the same mastering engineers, Mauro Andreolli of das Ende der Dinge (Trento) in person and Bo Kondren of Calyx Studio (Berlin) through Skype; the interview with Kondren was conducted in English while the interview with Andreolli was conducted in Italian and then translated by me in English. In these interviews, parts of which are presented as transcripts later in this article, we discussed four topics: (i) the gradual shift from vinyl to digital formats and, in general, the emergence of new formats, such as iTunes Plus and Traktor Remix Sets; (ii) trends in dynamic compression techniques and aesthetics; (iii) any other significant changes in mastering aesthetics and techniques; (iv) professional mastering vs. DIY mastering. This longitudinal research design allowed me to look at the changes that had happened in the time-lapse between the two data collections, specifically highlighting transformations in audio formats and practices among EDM DJs.

The data collection in 2004 and 2005 also included observant participation. As I mentioned earlier, ethnographic work on audio mastering and sound engineering practices faces at least two interrelated problems, precisely, it being performed in private space and

mostly through individual work. Related to this, and notwithstanding the significant volume of specialist literature on mastering, direct accounts are, as for most social practices, sometimes vague if not mystifying.[5] In fact, the extreme detail and precision of acoustics and the physics of sound (the "science") is not always matched by the same exactness when setting determined choices in relation to different aesthetics of sound (the "art"), and these aesthetics to specific ideologies of music production. If we think of audio mastering as a kind of musical practice, we will agree with Théberge (1997: 167), who borrows from Bourdieu the concept of *habitus* to describe how such practice is learnt:

> In music . . . the *habitus* takes the form of that unconscious yet fully structured system of sounds, gesture, meanings, and conventions that we commonly refer to as a "style". . . . Style, then, for the musician, is something that is acquired only through an extended *process* of learning through practice.

In short, the practice of audio mastering requires the acquisition of "techniques of the body" (Mauss 1935)[6] that are strictly codified by culture as much as they are hardly verbalised by discourse. The aim of participant observation is to mirror the same kind of gesture between the observer and the observed, that is, to pursue a "full-bodied understanding of culture and experience" (Howes 2005: 1; see also Drobnick 2004) that can allow the ethnographer to recognise cultural practices from within.

Accordingly, I adopted a participant approach that got me to interact with mastering engineers as they performed their activities in the studio. In particular, the object of research was the process of manipulation of the music tracks that I had brought into the studio for the mastering process, which allowed me to observe the practice of sound engineering in its development rather than simply based on verbal explanations, detached visual observation or critical listening. To sum up, the aim of this ethnographic approach, which involves as much participant observation as participant listening, is to (i) rely less on discourse and more on practice; (ii) bypass some of the limitations of detached observation and second-hand accounts in favour of a kind of "participant listening" (Forsey 2010); (iii) place sound—its objective reality as sound waves endowed with musical meaning—at the centre of research. This ethnographic experience and its findings, therefore, are the starting point to discuss the relevance of sensory skills and dispositions in doing popular music research and, more extensively, how this approach could benefit other domains of research, too.

A wide range of secondary sources, including specialist press, Internet forums and video tutorials on DVD and Internet platforms were consulted. While initially noticing what seemed less a growing awareness than a sudden burst of interest for this aspect of music production, I explored more carefully the following issues: techniques that are given most attention; how specific techniques are set in relation to particular aesthetics, including genre aesthetics; discussions about how formats affect the mastering process; explicit and implicit considerations on the skills and purpose of mastering, paying attention to markers such as "craft", "art" and "technique"; considerations of the distinctions between professional and amateur mastering.

Technology and the Senses: The Practice of Audio Mastering

Whether audio mastering is a matter of art or technique is perhaps not the best way to put it, because both aspects are evidently involved. Art and technique are not two ingredients that can be weighted out in separate parts; instead, they are two aspects of the same process. Moreover, the definition of what is art and what is technique is far from undisputed as it changes with time and context. Needless to say, the role of technology further complicates the issue. Given these difficulties, I will take an emic perspective to examine how actors employ the concept of art to denote a subjective contribution to music production as opposed to technique as the methodical application of predefined procedures. I will apply what Lysloff and Gay (2003: 2) call "ethnomusicology of technoculture", an approach that "is concerned with how technology implicates cultural practices involving music". Concurrently, I will also set these uses in connection to claims made by the engineers when addressing specific aims. More generally, I will try to challenge the dualism art/technique by stressing the subtleties of the practice of audio mastering, highlighting the interrelation between the two aspects rather than their polarisation. For this purpose, I start considering two interconnected aspects, namely, the use of technology and the role of sensory faculties in defining audio mastering skills and knowledge. Later I will give voice to the mastering engineers that I interviewed in 2013 to discuss two case studies.

Mastering engineers not only mediate between music makers and music listeners, but they also negotiate between technology, human agency in general and creativity in particular on a daily basis. A widely accepted understanding of the role of mastering is that, although it is a necessary aspect of record production, it admits a limited level of discretional intervention. In this sense, the mastering engineer intervenes at a stage in which the artistic product has been already crafted. His or her[7] aim is that of enhancing qualities that are already in the mix, albeit often *in fieri*. Common metaphors, which can be found in countless websites and forums, include the conviction that the mix is a "rough gemstone" for the mastering engineer to "cut and facet", or that mastering is just the "cherry on top" that can "make a mix glow" but it cannot, in any case, "turn shit into gold".

The position of mastering at the end of the chain of record production means that the engineer needs to be able to manage relationships with musicians and producers while keeping in mind music consumers' expectations. More precisely, the engineer needs to translate the client's requests, which can be more or less specific, into particular sound treatments. These requests can range from correcting certain defects in the mix to achieving a master that can get the better of other records.

As far as the client demands a competitive product, the capacity to relate to the final consumer is paramount for the engineer. Knowledge of acoustics, human physiology and digital compression allows one to anticipate different listening experiences and to set the proper adjustments to the musical material. For instance, by testing the master on a different range of speakers, including mobile phone speakers, the mastering engineer tries to achieve the best compromise so that the master will have an optimal performance on different audio

equipment. This knowledge also brings to awareness the limits of the engineer's body as an evaluating instrument, and, therefore, helps to deal with issues of stress and fatigue. Finally, it consents to integrate technology with critical listening fruitfully, adopting visual meters to both compensate for structural shortcomings of the human hearing and keep it under control, that is, under a condition of stability.

This contradicts the common supposition that the adoption of sophisticated technology can be a substitute for the human capacity to evaluate sound in its components and as a whole. In fact, only a few tasks are achieved exclusively through the use of technological devices—for instance, the treatment of those frequencies that are beyond the range of the human ear—as critical listening is largely predominant. More interestingly perhaps, they refute an equally common misunderstanding of the functioning of the senses, namely, that seeing would be more objective than hearing. In fact, as we will see, the ear can be employed to form rational judgments thanks to the implementation of specific techniques of listening within a controlled environment.

In fact, ethnographic data and personal testimony show that mastering engineers place more trust on their sense of hearing than in any visual representation or prosthetic device. Although this is a sense that has been refined through years of practice, whether by trial and error or, more often, by more structured training, in the end it comes to constitute a rational method. I will borrow from Sterne (2003) the periphrasis "techniques of listening" to define these sensory strategies. Sterne contends that the development of ways to get aural information from the stethoscope and the telegraph proved to be especially efficient in a historical context in which the rational method had imposed itself on a broad range of human activities. In turn, a similar attitude was adopted with early versions of the phonograph as an efficient way to discriminate auditorily between information and noise. In a similar way, sound engineers adopt strategies to evaluate audio signal by ear—what is normally called "critical listening", which generally occupies a major part in audio engineering manuals. What characterises most of these procedures is that they generally frame their object between two known objects, or, in other words, they evaluate sound or elements of sound in comparison to a given standard. An example of this is the use of reference material, such as a song of the same genre, against which the master is compared.

A different kind of strategy involves the capacity to recognise, under certain circumstances, particular defects of the audio signal, such as resonances and clicks; in this case, the engineer identifies the problem by emphasising, respectively, the frequency range or the time frame in which the undesired phenomenon appears. It is also worth noting that, since digital processing allows for non-destructive operations, it is possible to compare the processed version with the unaltered event, once again operating on the basis of comparison. All these approaches resemble the simulation of a laboratory experiment in many ways, insofar as the minimisation of environmental interference, the use of reference material and the possibility to bypass the audio processors helps to assess which variable is actually affecting another variable while keeping potentially confounding variables under control.

A second important aspect of mastering engineering is the capacity to *listen as* other people. With empathetic skills I refer to a kind of expertise that is as important as the techniques above illustrated and yet diverges significantly in terms of structure and application. One way to understand the divergence between techniques of listening and empathetic skills is through a dichotomy. The first are analytical in that they isolate discrete elements of sound events and treat them separately with the purpose of issuing objective evaluations. The second, on the other hand, are synthetic in that they evaluate sound comprehensively: their terms of reference are, more explicitly, specific genre conventions or more general conceptions of sound aesthetics. Empathetic skills also are acquired mainly through practice, reading and talk, rather than through formal learning. This is a kind of knowledge that involves the capacity to abstract from the particular situation of the mastering studio and imagine concrete listening experiences. Accordingly, the mastering engineer has to show proof of being able to step into somebody else's shoes. In this sense, audio mastering is a role-play where the engineer has to put his or her own musical taste aside so that it does not interfere with judgements while trying to anticipate that of the listener. It is just this capacity to take the perspective of someone else—precisely, clients and different types of consumers—that is fundamental in order to reach a comprehensive evaluation of musical events.

Nobody will deny that music is something different than just an audio signal as it is invested with particular meanings and values. Therefore, the fact that an engineer has his or her own taste about music, provided that it does not interfere with the evaluation, is not a hindrance to but rather a prerequisite for empathy as far as it reveals the capacity to understand the musical qualities of sound and not just its strictly acoustic properties. In this sense, the periphrasis "sound engineer" is somewhat misleading insofar as it neglects the musical knowledge and skills that are constitutive of the profession. Although mastering engineers address actual value judgments more or less explicitly, the latter are still relevant due to the special matter they are confronted with.

It is important to stress that both analytic listening techniques and empathetic skills, being aimed at the same purpose, are often applied in synergy. Not only do they both require certain environmental conditions, but, quite significantly, even scientific tasks demand that the body, hearing included, is set in an optimal state to operate properly. More significantly, also techniques of listening, as well as conceptions about audio treatments, conform to specific aesthetics. It is true that visual meters provide objective measurements of acoustic events, nonetheless not only do these measurements occur in an environment that abstracts from a wide range of variables that characterise more realistic listening situations, but they also are in the service of a certain conception of the "object", i.e. music. In fact, the capacity to manipulate sound characteristics such as dynamics and equalisation responds first of all to a qualitative idea of how dynamics and equalisation should sound, while their quantification through equalisation curves or dynamic range diagrams is actually a way to help achieve that idea *ex post facto* in a consistent and efficient way.

I will now illustrate the process of audio mastering in more detail with data collected from the 2013 interviews focusing on two case-studies: dynamic compression and audio formats.

CASE-STUDY I: DYNAMIC COMPRESSION

In order to illustrate the permeation between techniques and value judgements I will introduce the topic of the so-called "loudness war", the much-hyped race to make the average loudness of records higher and higher in order to beat competition and gain more exposure. While this race had already started with the development of vinyl records, especially 7-inch singles destined for juke-boxes, it gained new ground in public attention with the advent of the CD and digital processing, which not only allowed for higher dynamic headroom but also objectified dynamics in the visual representation of the LPCM (linear pulse-code modulation) encoded sound wave. In recent years, however, several critical voices have raised concerns over this trend, so that more subtle dynamic treatments are more common nowadays.

What contributes to the interest around this debate is that the concept of loudness is subjective in itself, while the "war" is apparently fought on an objective basis, namely, dynamic range compression and, hence, reduction. The dynamic range of a track is especially relevant for EDM, as mastering engineers have to consider that the DJ will further manipulate a track; accordingly, they will put a threshold on certain aspects of audio processing—just as producers leave a few bars with the beat for the purpose of beatmatching, mastering engineers should keep some dynamic compression headroom for the DJ to balance the level of tracks uniformly.

Kondren regards the "loudness war" to be an equivocation that belongs to the past. He explains that it was not about loudness in particular but rather about "smashed and un-dynamic loud records" where everything is "squeezed together":

> The loudness war was a problematic situation especially due to . . . badly done loud records. It was not about loudness in general . . . the music was overwhelmed, the music was losing all its dynamics it lost space and those things. Of course, nobody wants to have something like this, nobody wants to go to somebody and ask for a service if the service is not done well.[8]

He also asserts that nowadays it is not issue:

> Nowadays for a good mastering studio or for somebody who is trying his best and is using the best available techniques, what we have called "loudness war" is not that much an issue anymore. . . . Today if somebody is using available modern techniques of gain reduction, dynamic reduction, expanding and microdynamic treatment, he should be able to achieve a tremendous loudness without having as many artifacts as before.[9]

He insists on a qualitative change, where the aim of loudness is still achieved but not at the expense of other unwanted effects:

> It is possible to produce loud records without having the perception or the impression of something that is stuffed together . . . even some of the house producers aren't

looking for loud records anymore, because, they say, for my music it's much better if it is more dynamic, good pumping and pushing around, and not having that huge overall average level.[10]

Kondren notices a significant improvement in terms of techniques and tools for mastering. He also perceives a change in the aesthetic approach, which is more respectful of dynamic depth and definition:

Nowadays we are working more with decompression than with compression. . . . That means that the snare is still punchy, the drums are still kicking out a little bit so that it is moving your ass or whatever, that you have a shiny and transparent appearance of the highs, not those smashed highs, therefore it is very often necessary nowadays to decompress, to de-limit material, and bring back a certain dynamic stage, what we call mostly microdynamics, which means that the music is still very loud but inside of the music the specific parts, the instruments, still have something that is appearing as if it were more dynamic that it is in the end.[11]

He specifies that this applies to EDM as well:

Especially for those kinds of music it is important that we maintain the basic dynamic structure that was in the track before the master. We must find a way so that, after the mastering, the dynamic relationship between the different instruments is more or less the same, yet much louder, much more glued, much more like an ensemble, so that everything is working better together . . . but still with a lot of dynamics in each instrument. This is the aim, this is the special goal of what we have to do in mastering today.[12]

Kondren is keen to say that these results can be obtained also without the equipment of a professional studio. He asserts that, on condition that you work very hard, you are smart enough to find the right plug-ins, you have an optimal monitoring situation and you have enough time, then you might achieve the same results as a professional mastering studio.

Dynamic treatment depends considerably on the format. In the digital domain, the higher the quality, the more appreciated dynamic range is. As Andreolli further clarifies:

I need to compress [iTunes Plus files] less. In an mp3, with a DR4 [Dynamic Range] I obtain a lot of artifacts, but with a better resolution I can push it more because the resulting files are supposedly indistinguishable from a WAV file. It is like the tale about the blanket that is too short, either you cover your nose or your toes, therefore you have to make some choices. As a consequence, when you know that that track goes only on a CD you clear the way from possible options and you aim at obtaining the ideal DR for that kind of format. On the other hand, if you know that it is going to go on iTunes you set up the dynamic treatment differently.[13]

The matter is not dynamic compression in itself, but how one applies it and for what purpose. Andreolli complains about Apple's SoundCheck, a feature of the iTunes player

that automatically adjusts playback volume of different tracks at approximately the same level: "This thing implies a lot of collateral effects. . . . The first is that you cut off the artist from control on his music, which is an important issue".[14] He personally disagrees with Bob Katz when he declared that Pink Floyd should have the same loudness as Pink:

> You are actually removing a fundamental instrument of expressivity, because it is the artist's decision, even within a single album, if a single episode has to have a different kind of dynamics than another. This choice belongs to the artistic sphere, not to the technical only. It is as if in the visual arts someone would say, "What is this mess? From now on, all paintings have to be 90x120". . . . We have come to a paradox, it is all in the hands of these people that should make computers who are deciding the size of paintings for painters.[15]

Case Study II: Audio Formats

Both Andreolli and Kondren notice a growing request for new digital formats. Kondren explains that, overall, 30–40% of the releases have a special master reworked for iTunes but for EDM this figure is slightly lower. He ascribes this difference with the role that Beatport plays for EDM,[16] which might suggest that it is not only technical considerations about the quality of the format, its storage capacity or the listening situation that determine the success of a format over another, but also its channels of promotion and distribution. At the same time, the success of digital formats does not always result in the older formats becoming obsolete. In this regard, both engineers admit that the demand for vinyl is growing. On the other hand, the availability of a certified service for iTunes Plus does not necessarily mean that the implementation of the format is straightforward. Andreolli highlights some problems he has encountered:

> Since about a year I have been offering certified iTunes Plus mastering. I give clients two separate masters, one for iTunes and one for CD. . . . To release your music on iTunes you generally need an intermediary, so-called aggregators, such as CD Baby or TuneCore. Unfortunately, many aggregators . . . still don't know how to manage high-resolution masters. . . . While I am careful to apply the correct kind of algorithm, they perhaps ask a secretary to do the work between an invoice and an email or they use a five-year old software. . . . It is frustrating to offer this service because I conform to the specifications communicated by Apple but, as things stand at the moment, there are still issues in implementing these standards.[17]

It should also be mentioned that formats affect the mastering process only up to a point. As Andreolli explains:

> When a client requests a mastering service for both vinyl and digital release, the engineer does not need to make two completely separate jobs, as the root is common. The first step is obviously to listen in order to identify finalities, expectations, signature and a series of things . . . to understand the design to give to the mastering process.

Elements like timbre are common . . . if there are resonances on the drums those have to be adjusted anyway. The preparatory phases and settings are common, when mastering for vinyl it is more a matter of cuts rather than applying a different EQ.[18]

Especially since we are looking at EDM, discussion about formats cannot leave music genre out of the picture. However, mastering engineers generally assume that a mix already adheres to particular genre norms in terms of style, balance, sound and so on. Consequently, music genre does not affect directly the mastering process insofar as its aim is already defined by the attempt to highlight and improve features that are already in the mix rather than to mould it according to genre aesthetics:

When I master a record, I suppose that the artist or producer has already considered the kind of listener and that the product has been crafted accordingly. Therefore, my approach to mastering is not significantly affected by these considerations, as far as, when I get a mix, I suppose that there is a certain degree of sync between the music and the listener, also in relation to music genre. On the other hand, I am more concerned about any limitations of the format and the kind of use. Some choices have already been made before the mastering.[19]

Regarding dynamic compression, it is true that different genres are associated with different treatments, yet some features are normally in the mix already, so that the engineer needs just to go along with the original choices of the artists or producers. As Andreolli explains, it is of foremost importance to pitch a service at a particular product, rather than to apply a standardized set of processing steps:

Sometimes, instead, things are done in a serialized way or through standard procedures, but, inevitably, something gets lost about the specific characteristics of the music that is being processed in that moment. This is also a betrayal of those who have worked on the preceding phases of the work.[20]

At the same time, aesthetic issues are an integral part of the job:

Generally, who contacts me already knows my kind of approach and my engineering history. . . . Although I work with a wide range of music genres, these are mostly works that lend themselves to an artistic and subjective approach on my end, because mastering is not only a technical issue but there are also aspects that appeal to personal taste and therefore when I have some concrete inputs [from musicians or producers] I obviously take them into account. Whenever there is something that can be achieved by using my sensibility, I don't back out.[21]

Ideally, new formats develop from the encounter between musicians' demands and the new technological possibilities that manufacturing companies can offer. Due to their role as gateways, mastering engineers can play a part in mediating between the two. Based on the assumption that more DJs are using Native Instruments Traktor rather than DVS like Serato, Calyx has created a new format called Traktor Remix Sets in partnership with

Native Instruments. This is a form of stem master with separate tracks that, once imported in Traktor, can be mixed, looped and processed by the DJ in ways that a simple stereo mix would not allow. Kondren sees it as a chance for producers to deliver a new kind of product and for DJs to increase their control of their mix, and states, quite emphatically, that this is "the first new digital improvement" in digital music:

> . . . you have a wider space, you can do more. . . . Other digital formats have just something like a better resolution, or a worse resolution like MP3s and the likes, or better resolution like Super Audio CDs with higher sampling rates ... Traktor Remix Sets is the first new creative format . . . which brings to the DJ totally new possibilities which he didn't have before.[22]

When I asked Kondren if the awareness of doing a master aimed at performers rather than listeners changes his approach, he initially admitted that he had not thought of the issue from this perspective. Nevertheless, he remarked that Traktor Remix Sets have a higher resolution and a special handling of dynamics (i.e. much less sound limiting) purposely in order to allow further treatments by the DJ.

These brief observations should be sufficient to hint at the existence of a complex network of practices, ideas and discourses in which formats are encapsulated. It goes without saying that, insofar as the aim of mastering is to produce an object that can be used to produce a limitless amount of copies, music formats are of central concern. Mastering engineers have to keep pace with changes in the ways music is brought onto the market, with audio specifications of different formats and with the listening contexts that they are more or less closely associated with. EDM has always been characterised by certain apposite formats. Mastering engineers have started to pitch their services directly to DJs at least since the advent of the 12-inch single. In more recent times, the diffusion of digital vinyl systems, DJ software and live electronic practices among EDM performers has further emphasised this alliance. In this regard, it is worth noting that mastering for performance introduces a new significant dimension to the profession of audio mastering that, hopefully, will attract further scholarly attention in the years to come.

Participant Listening

The distinguishing features of the practice of mastering engineering recommend that specific methods of research be undertaken with this object of study. As we have seen, mastering requires implicit knowledge that, as much as it is effective in practice, is still quite unsystematic verbally. At the same time, a thorough "training of the senses", which is achieved through first-hand experience, is an irreplaceable aspect of the profession. Whilst the objectivity of judgement, which is provided by such implicit skills, complements the explicit knowledge of the fields of acoustics and physiology, the frequent fuzziness of its intellectual conceptualisation instates an aura of mystification about discourse on mastering.

A tendency to juxtapose body techniques with rationality, besides, can be found in several aspects of modern societies, music included.[23] The actual role of the audio engineer, therefore, is constantly split between science and art as well as between different domains of knowledge that are kept separate and often even hierarchized. The fact that most mastering tasks are accomplished by individuals who work in isolation inside the studio makes it even harder to demystify this knowledge in its practice and recognise any interconnections between discursive, aesthetic, technical and economic aspects that it involves.

A precondition for opening this "black box" is to fully acknowledge audio mastering as part of a larger chain of record production, thus disentangling its technical aspects and putting them in relation to the values and aesthetics that are shared by music makers, mastering engineers included, and audiences alike. For this purpose, alongside interviews, detached observation and critical listening, I adopted a particular ethnographic approach that has allowed me to sidestep some of those obstacles. By bringing musical material into the mastering studio and discussing with the engineers about the manipulation of that specific material rather than about the mastering process in abstract, I managed to enter into a professional relationship, albeit partly simulated, with the engineer,[24] thus enacting the typical roles of the client/engineer interaction and enhancing the collaborative and relational aspects.

Also, it should be remembered that the process of mastering is about that transitory phenomenon that we call sound as much as it is about the result of that process, i.e. the master. Put differently, mastering deals with sound but also with its objectification in the form of a specific input format and a more or less correspondent output format: most of what occurs between the mix, which is submitted by the client, and the output object, manifests itself *as* sound. Therefore, at least from the engineer's perspective, sound—and the capacity to listen to it critically—is a primary tool to enable the transformation of an object into another that is qualitatively superior through value-laden evaluations. This understanding of sound resonates well with Sterne's (2003: 11) stance:

> You can take the sound out of the human, but you can take the human out of the sound only through an exercise in imagination. . . . The hearing of the sound is what makes it. My point is that human beings reside at the centre of any meaningful definition of sound.

With this article I wanted to emphasize how audio mastering involves aesthetic sensitivity, creative thinking and decision-making as integral aspects. While moulding frequencies, dynamics, the stereo sound field, dither, and so on, the mastering engineer does not simply operate within the "cold" domain of acoustics, but, ultimately, deals with sound, or, better, with music.

Notes

1   *MusicTech* also publishes a monthly printed issue and a website, <http://www.musictech. net/>.

2   Regarding the contested terrain that constitutes the current and recent relationships between DJ practices, formats and EDM scenes, see Farrugia and Swiss (2005), Montano (2010), Attias (2013), Yu (2013).

3   In truth, freeware is sometimes presented in such magazines and websites. However, the disproportion between reviews and discussions of free software as compared to non-free software, together with the emphasis on the key role of consumer products for available commercial music, ends up substantiating the superiority of the latter.

4   Both Théberge and Taylor emphasize the centrality of digital technology in this convergence. In particular, Théberge (1997: 2–3) stresses that "digital musical instruments are hybrid devices: when one plays (or programs) a drum machine, synthesizer, or sampler, one is not only engaged in the production of sounds and melodic or rhythmic patterns but in their technical *re*production as well"; Taylor (2001: 16) contends that "digital technology is helping to challenge—even, in some instances, break down—the difference between production and consumption".

5   A noticeable example of this style can be found in Katz' (2007) landmark work on audio mastering, which, on the one hand, repeatedly reinforces the art/science divide and, on the other, riddles the text with jokes, aphorisms and even an original poem entitled "At Last", "a contemplative poem, my hopes and dreams of our musical and audio future" (14).

6   According to Mauss (1936), a technique of the body consists of a mostly implicit set of rules and procedures, which are accepted by a community and are transmitted through training. A technique of the body is aimed at performing a certain recurrent intellectual or physical activity.

7   Normally *his*: the substantial gender bias of audio mastering is a topic that would need further attention.

8   Bo Kondren, interview with the author, online via Skype, 26 November 2013.

9   Bo Kondren, interview with the author, online via Skype, 26 November 2013. The concept of microdynamics has been brought to the wider public by Katz (2007[2002]: 109–10): "The art of manipulating dynamics may be divided into Macrodynamics and Microdynamics. I call music's rhythmic expression, integrity or bounce, the *microdynamics* of the music. I call *macrodynamics* the loudness differences between sections of a song or a song-cycle. . . . If you think of a music album as a full-course meal, then the progression from soup to appetizer to main course and dessert is the macrodynamics. The spicy impact of each morsel, is the microdynamics."

10 Bo Kondren, interview with the author, online via Skype, 26 November 2013.

11 Bo Kondren, interview with the author, online via Skype, 26 November 2013.

12 Bo Kondren, interview with the author, online via Skype, 26 November 2013.

13 Mauro Andreolli, interview with the author, Trento, 13 November 2013.

14 Mauro Andreolli, interview with the author, Trento, 13 November 2013.

15 Mauro Andreolli, interview with the author, Trento, 13 November 2013. Earlier he
    mentioned that he liked Apple more when they were making just computers.

16 Beatport is currently the main online music store specializing in dance music.

17 Mauro Andreolli, interview with the author, Trento, 13 November 2013.

18 Mauro Andreolli, interview with the author, Trento, 13 November 2013.

19 Mauro Andreolli, interview with the author, Trento, 13 November 2013.

20 Mauro Andreolli, interview with the author, Trento, 13 November 2013.

21 Mauro Andreolli, interview with the author, Trento, 13 November 2013.

22 Bo Kondren, interview with the author, online via Skype, 26 November 2013.

23 To quote Théberge (1997: 161) on this issue: "The tools and the practice of music are thought
    of as distinct from the discourses of knowledge about music. We are thus presented with two
    systems of 'logic': One concerned with the practical—a world of skill, dexterity, immediacy,
    expressive action, style, and subjectivity—and the other, with knowledge—analytic,
    methodical, detached, formal, structured, and objective".

24 The audio engineers were aware both of my role as a researcher as well as of the aims of my
    research.

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