

The turntable: the musical instrument of hip-hop

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1 Introduction

The disc jockey was and still is the music provider of hip-hop. This means doing everything: playing the popular tracks, finding the music for dance, being the rappers background band, having the equipment, producing the beats, laying the scratch solos, and, creating the sound for a whole cultural movement. To accomplish this nontrivial task DJs have overstepped the limits of what was the intended use of tape recorders, drum machines, samplers and, above all, record players. When hip-hop and its music have evolved, music technology has followed.

In this chapter we will look at the DJ roles, some of the settings for performance, the impact DJs have had on the outside world and examples of scholarly interest in DJ practices. But most importantly we will describe the turntable as a musical instrument.

2 History of the DJ

In 2012, Mark Katz published *Groove Music*, a truly comprehensive history of the hip-hop DJ. This was not the first of its kind, but it is a work that goes beyond the myths and legends, some more than 40 years old; stories that other authors have simply retold. Yet, even with the ambition to get the story straight, Katz find the DJ history to be convoluted: “Although I would’ve liked to establish the facts definitively, the existence of competing claims turns out to be more interesting than a simple answer, for it reveals the high value DJs place on innovation and the differing roles of the individual and the community in the world of the hip-hop DJ” (Katz, 2012, p. 8). And Katz digs deep to unravel which DJ was first to come up with this or that technique, exposing invaluable facts from the creative process along the way.

Katz and many others date the birth of hip-hop to August 11, 1973, when Kool Herc held his “Back to School Jam”. The music that was played at this party was soul, funk and rock, without breakdancing and without scratching or turntable trickistry. On the handwritten party invitation flyer it is written “a DJ Kool Herc party”, so undeniably the meaning of DJ was well known before this, not least from the disco movement. The notion *disc jockey* first appeared

in print in *Variety* in 1941 (Fisher, 2007) and has been used inconsistently and with varying spelling the following decades (Poschardt, 1998). However, within hip-hop the terms *DJ* and *disc jockey* are generally settled, and we leave further discussions behind. This chapter presents the DJ as being the person responsible for creating a musical backdrop to hip-hop culture, and this music is primarily accomplished using turntables as instruments.

DJing today is a sophisticated art of mixing different music styles. It is well-known that the Jamaican dance scene influenced hip-hop DJs like Kool Herc, but Katz experienced from his interviews that this connection has become somewhat overrated. Primarily, it was the massive sound systems from Jamaica, not the songs, that found their way to the Bronx. The Latin music inspiration is mentioned to be more important, for instance coming from DJ Disco Wiz, Grandmaster Caz and Charlie Chase, who could mix in salsa records in a set. Disco and hip-hop evolved with mutual impact on each other. Disco records were played at hip-hop parties, and both genres used breaks heavily, while the most notable difference was how hip-hop DJs soon took to scratching the records; more about breaks and scratching below.

From the second half of the 1970s, the DJ performance became progressively more intricate. Hip-hop jams where the winner was the one with the loudest sound system instead became battles in skill and showmanship, and the battles soon became ruled-based competitions. At the same time, the MC (rapper) caught more of the limelight as rap music entered the popular music hit lists. This led partly to a clearer definition of role for the DJ, and partly to a desire to perform music even without the rapping. This was showcased with Herbie Hancock's 1983 MTV video hit *Rocket*, starring the DJ Grandmixer D.ST, but no MC.

A decade later, in 1995, DJ Babu started using the terms “turntablist” and “turntablism” to describe what kind of DJ he had become and where the art form was going (he was probably not the first though). Meanwhile, rap music continued to grow, and other genres embraced and spread the sounds of the DJ through bands and artists like Sugar Ray, Beck, Portishead, Ozomatli and John Zorn. Arguably, turntablism as a movement peaked around ten years later: there has even been less use of the word. It is not incidental that the fiercest development in new technology for DJs happened around this time. To speak about turntablism while changing the setup to CD players and laptops became rather ambiguous.

Since 2011, even the longest-living, most popular—and also conservative in many respects—DJ competition, the DMC Championships, allows digital vinyl systems where a turntable is only used for controlling the playback of a sound file on a computer. The acceptance of digital vinyl reflects a time where being a DJ is no longer a privileged vocation for serious record collectors: this single advance in technology has at the same time made every recording available to DJs in an instant without even pressing it on vinyl, it has effectively lowered the threshold for starting to play, both in terms of costs and equipment, and the addition of visual feedback in form of waveform representations has made mixing a great deal easier. Arguably, today's DJs have the potential to reach the

minimal level of skill necessary for performing in public faster, with a blooming number of not-quite-professional performers as an immediate consequence, but also potential for the skilled professional to reach even further.

2.1 The role of the DJ in hip-hop

It is clear from the review above that there are different kinds of DJs, or that they can have different roles. At one end is the turntablist who often improvises with virtuoso playing styles, alone or with other musicians, but more seldom with rappers or playing for a dance floor. This is the kind most would consider to use the turntable exclusively as an instrument. At the other end, unsophisticatedly generalized, is the DJ who specializes in mixing tracks together either to create a seamless set of songs or to conjugate two tracks to form a new piece of music. In both cases, the mixing DJ enriches the performance with playing techniques, like equalization and amplitude and speed changes. Somewhere between these two is the DJ who backs up a rapper, creating beats and a musical foundation.

Common to all DJs is the essential ability to select tracks to play; the Jamaican DJ was often called the “selector”, and many of the early DJs were famous for their massive record collections. Unlike the other elements of hip-hop, a substantial investment was needed to build up a sound system and a record collection. Katz argues that the choice of tools for making music cannot be explained by the availability at the time of turntables as the ordinary households had in best case a cheap player, either unusable or unattainable for the prodigal DJ. He mentions the turntable’s power and the desire to break the rules by mistreating the delicate vinyl, comparable in many ways to the punk aesthetics, as a driving factor for why turntables ended up to be hip-hop’s instrument.

From the elements of hip-hop, the DJ can understandably be seen as the more orderly of the lot. While the rapper can display unconventional vocal use and explicit language, the dancer has powerful and inimitable moves, and the graffiti artist has a reputation of tainting others property, the DJ provides the soundtrack to this, a soundtrack based on now highly regarded soul, funk and disco classics. Seen from the DJ’s perspective, there are many that compete for the front stage position. To have a chance besides the music, DJs have long incorporated *body tricks* and other crowd-pleasing novelties in their performances.

3 The turntable as a musical instrument

Today, it appears that the concept of turntablism is more important than the actual medium, the vinyl record, and we can without problem carry out the discussions in this section knowing that the music can be performed not only on turntables but on other devices too. For the same reasons, the remainder of the chapter will use the word DJ in the definition musician or instrumentalist (remember that turntablists were defined as musicians playing the turntables

and would be so even if playing CDs—just like pianists playing digital pianos are still pianists).

Like any other instrument, we should describe it by looking at its parts: the equipment, the sound production, the interaction, playing techniques and the musical result. To keep to a reasonable scope we will only consider the most technical, major playing styles in the following. Also since the turntable developed to the instrument it is exclusively in hip-hop music, any historical and experimental uses are left out here (for more about other developments, see for instance Hansen, 2010; Katz, 2010; Ferguson and Marclay, 2003; Griffiths, 1994).

3.1 Classification

Turntables have been classified as musical instruments with different approaches and characteristics. Miles White (1999) regarded the turntable as a manual analog sampler, coded 521.21 in the Generators and Modifiers of Electronic Sound extension to the Sachs-Hornbostel classification system (Bakan, Bryant, Li, Martinelli, and Vaughn, 1990). By “manual”, White referred to the possibility of manipulating the playback of the sampled sound, and he divided this manipulation into six different ‘techniques’: backspinning, scratching, cutting, mixing, and punch-phrasing.

This chapter’s author previously wrote that it is mainly scratching and beat juggling that defined the turntables as instruments, which suggests a strong emphasis on technical virtuosity (Hansen, 2002). Katz mentions two attributes for what constitutes an instrument—the instrument construction and handling—and even lists five conditions that all must be met:

1. It involves real-time sound manipulation
2. It has a body of techniques developed specifically for it
3. It has its own distinctive sound
4. The object itself is either specifically designed or modified for making music
5. The sound it generates is considered to be music by a community of listeners

These conditions are more elaborate than usually found in the literature. For instance, a musical instrument is defined by the Cambridge Dictionary as “an object, such as a piano, guitar, or drum, that is played to produce musical sounds” and by Oxford Dictionary simply as “an object or device for producing musical sounds” (both leaving out the definition of what musical sounds are). Even if these five conditions cannot be used for classifying an instrument in general, they help us in understanding *why* turntables are instruments. For most circumstances, just the first condition suffices, and many instruments could easily be said to violate all conditions but the first. In fact, turntables violate the

fourth condition which is idiosyncratic for hip-hop DJs: that you use something absolutely *not* specifically designed or modified for purposes of creating music.

Another interesting point of view was expressed by Charles Mudede (2003) who insisted based on ideas from Walter Benjamin (1968) that the turntable is a ‘repurposed object’ for creating ‘meta-music’ and thus no musical instrument. Now, more than a decade later, few argue against classifying turntables as instruments, either if used as a solo instrument, as a backing instrument, or in general for creating new music from existing recordings. And we can safely say that the *intended* use of the turntable was simply to play back vinyl records.

3.2 Playing styles: scratching and beat juggling

It is difficult to discuss playing styles without having described the equipment and interaction yet, but the two main ones, scratching and beat juggling, are so important in the following sections, that they must at least very briefly be introduced at this point. Scratching has become a layman term because it is a distinct sound and a very strong metaphor. Many will doubtlessly make a scratching gesture when asked how a DJ plays. While the meaning of the word and the experience of how turntables work suggest that the needle is dragged across the record to make a scratching sound, in reality the sound comes from the speeding up, slowing down and reversing the platter’s rotation speed by hand. As such, scratching can be achieved with other playback devices than turntables, for instance cassette tapes, but the simplicity of adjusting the speed, as well as the tactile sensation and sensory feedback of handling the vinyl, makes turntables perfect for this task.

Scratching can be compared to how violins are played: each of the two hands controls different parameters of the sound. The left hand of the violinist adjusts the pitch, or tone height, but no sound is coming until the bow, controlled by the right hand, touches the string. Similarly for scratching, one hand is on the record and controls the playback speed, or in other words the pitch or tone height. The other hand controls the volume slider on the mixer which turns on and off the sound.

Beat juggling has no parallel in other musical instruments. Here, the DJ controls two turntables and the volume slider to alternately play from each of two records. Katz gives an example (p. 188) from DJ Steve Dee, one of the originators of the playing style, where two copies of an Erik B and Rakim track with the text *This is how it should be done* are played in alteration to create a new composition:

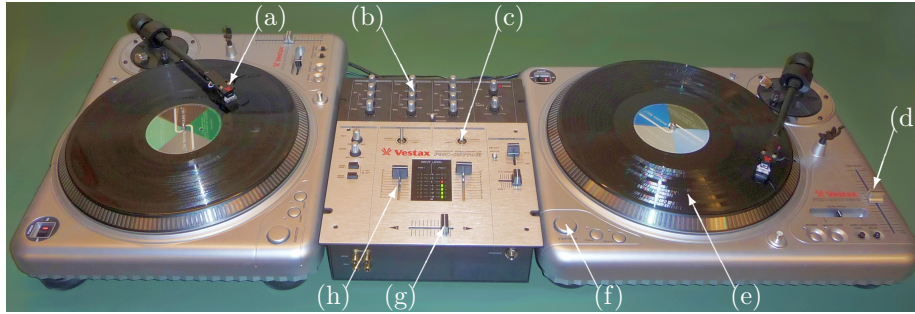


Figure 1: The DJ instrument set-up optimized for scratching and beat juggling with the mixer (Vestax PMC-5 ProIII) placed between the turntables (Vestax PDX-2000 MkII), and the left turntable rotated to keep the tone-arm away. The controllers are (a) the tone-arm and pick-up, (b) EQ tone control, (c) line switch, (d) pitch control, (e) skip-proof battle record with repeating grooves, (f) start-stop switch, (g) crossfader, and (h) line fader.

Turntable A	Turntable B
This is how it should be	This is how it should be
This is how it should be	This is
how	how it sh
shou	should be done

3.3 The equipment

The instrument consists of several components, and not all are strictly necessary. Basically, a DJ only needs one record player, but often there are two turntables and also an audio mixer to set the output volume of each. Figure 1 shows a typical set-up with the most important controllers pointed out. The turntables have pick-ups with a stylus (fig. 1:a) that converts the movement in the reel to an electrical signal. The design of the stylus or needle is crucial for allowing the record to move backwards (a hi-fi stylus tip is elliptical while a DJ stylus tip is spherical in shape). The other features that separate a purposeful turntable in this context from a home hi-fi one are the strong direct-driven motor (as compared to belt-driven) and a slip-mat that reduces friction between the vinyl and the platter. Manufacturers have whole product lines aimed at DJs, but at the same time the turntable has remained largely unchanged since the Technics SL1200 model was released, using pick-ups and needles made for radio DJs.

In contradiction, the audio mixer which may seem to be of less importance has undergone great changes, often based on ad-hoc solutions by electronics-savvy DJs who needed new features. The mixer has very few controllers: a crossfader

(fig. 1:g) for gradually lowering the sound volume from one turntable (channel) and increasing the sound from the other, a volume fader for each channel (fig. 1:h), and tone controls for each channel (fig. 1:b). Because the playing techniques more and more depended on switching the sound rapidly on and off, the crossfader have become much easier to move, and it is possible to set the distance needed to travel for turning the sound from on to off (fading curve), and also to reverse the direction of the fading, useful for certain techniques. In scratching it is preferable to have the fading curve very steep, making the travel from sound-off to sound-on only around 1 mm.

Although most DJs would concur that the vinyl record is the very soul of turntablism, the format is not always convenient. Records are heavy, prone to wear and physical damage, and they can be hard to find. *Digital Vinyl Systems*, or *DVS*, have become the new standard for DJs. Rotating discs such as a record player with a time-coded vinyl or a CD player with a jog wheel are used to control the playback of sound files on a computer. This way, the whole music library can be stored and accessed digitally with many additional benefits: quick changes of tracks, loading the same track on both decks, no reduction of sound quality, visual representation of the track on a computer screen, setting cue points to find specific parts of a track, and much more. But in the end the DVS and the standard turntable are quite similar from the instrument perspective.

3.4 Sound production and sound material

To produce sound with an acoustic instrument, the player must input some energy and cause movement in the system (an air jet stream, a vibrating string, scraping two objects against each other). The turntable is not so different: sound is created when the needle follows the notched groove of the record. By changing the rotational speed, the pitch of the sound (or tone) is changed. A fast movement means a high pitch, a slow movement means a low pitch. The audio mixer does not produce any sounds, but it modifies the amplitude and timbre of the signal from the record player.

Some sounds, or recordings, are more suitable than others to play with. For scratching, the most popular sounds (samples) to manipulate are without any doubt *Ah* and *Fresh* from the sentence “ah this stuff is really fresh” (Change the Beat; Fab Five Freddie), and *Scratching* from “all that scratching is making me itch” (Buffalo Gals; Malcolm McLaren And The Worlds Famous Supreme Team). These are very short spoken utterances located on since long iconic records (read more about the fascinating history in Katz). In general, any short sound will do just fine, and apart from the classics such as the ones just mentioned, various hard-to-trace drum beats, instrument tones and special sound effects for instance from games and not least other vocal phrases are frequently used. From an acoustical point of view, there are some common characteristics: sounds often have a strong noise component, a sharp onset, and quite seldom tones with a distinct harmonic quality.

In beat juggling the sound material comes from two records, either two copies or different ones. The origin of beat juggling lies in mixing the break of a song:

a part where all vocals and instruments pauses and the drum player continues the beat. With increasingly sophisticated techniques, each record is played for shorter and shorter time. A few beat juggling routines have become famous for their sound selections, such as performances using *Rock the Bells* (LL Cool J) or *Tom Sawyer* (Rush), but like for scratching, almost anything goes. Musically, it is an advantage that the recording has a distinct rhythm with gaps between each onset, and that other sounds match in tonality.

The *ah* and *fresh* samples come from a 12" single, released by the small company Celluloid Records. How it is possible that each and every DJ uses these samples when there could hardly have been pressed enough copies of the vinyl? Before the possibility to play digital files, these increasingly rare vinyls with infamous sounds, samples and breaks were reissued on *break collections* and *battle records*. One battle record alone can have hundreds of scratch-friendly sounds. This made life much easier and cheaper for the DJ, but at the same time many complain that it removed the mystery (and even compare it to cheating). The DVS with time-coded vinyl took this controversy to its extreme as it is no longer necessary to change the record during an entire performance. There are two assumptions that DVS challenge: first, the DJ as a musically knowledgeable authority with a matchless record collection, and second that the artistry of DJing derives from changing records. From a musical instrument playing technique perspective, changing records could however be compared to changing sounds on a synthesizer: it can either be an art in itself, like Keith Emerson of ELP would demonstrate with his modular synths, or simply an act of selecting between presets.

3.5 The interaction, playing gestures and parameter mapping

All that is needed to perform is to control record speed, playing position of the needle and the output volume of each turntable. Unlike the many instruments where the player is unconditionally limited by their physical design, for instance wind instruments with tone-holes that must be precisely covered, or fretted instruments with strings that must be carefully depressed, the DJ have great liberty in how to produce and control sounds. Any movement that changes the playback speed of the record is possible. For instance, grabbing the vinyl toward the center or by the edge determines how long part of the sample that is played in one gesture; a gesture close to the center means that a higher pitch is achieved than the same gesture close to the edge would. As a result, and unlike many other instrument practices, one can quickly conclude that hand positions and ways of moving the vinyl and faders are very individual between DJs.

Figure 2 shows a DJ performing with different hand positions: in examples a-e the right hand is always occupied by controlling the vinyl, while the left hand moves between faders and performs other gestures. Arguably, DJs develop a much higher degree of ambidexterity than other musicians because it is necessary to learn how to perform all techniques with the left hand on the fader and the right on the vinyl, and vice versa; this is shown in figures 2a and 2f.

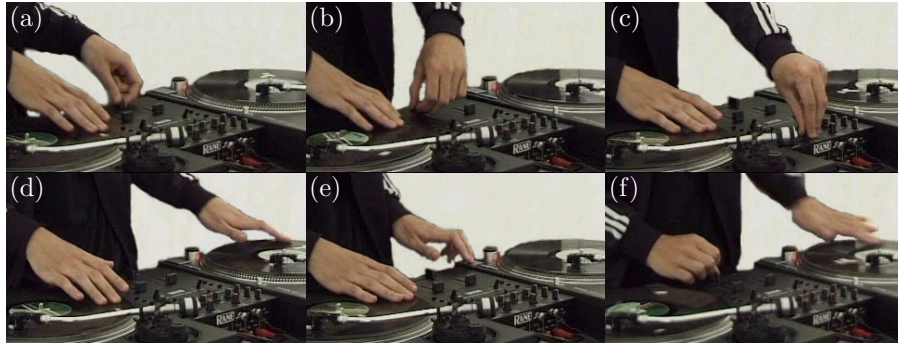


Figure 2: Images showing a short sequence of typical gestures from a performance. The DJ uses both hands to control the two turntables and the mixer: In the top row, the right hand is on the record, and the left hand goes to (a) the crossfader, (b) the channel fader, (c) the tone controls, and in the bottom row to (d) the other turntable and (e) its stop button. In (f) the hands are switched so that the left goes to the vinyl and the right to the crossfader.

Any musician’s gestures can be divided into two groups: sound-producing and sound-modifying gestures, and ancillary, sound-accompanying and communicative gestures (Wanderley, Vines, Middleton, McKay, and Hatch, 2005; Godøy and Leman, 2010). The last group contains all gestures and movements that do not directly affect the sound, for instance when a pianist expressively moves the upper torso. These movements have from the beginning been a fundamental ingredient in the DJ performance in the form of *body tricks*. Playing two records in quick alternation and backspinning them to the same starting point requires remarkable arm and hand control, and this spectacular playing style became soon distinctive for the performers and popular to the audience. Backspinning evolved into an elaborate practice of body tricks on its own, with arms behind the back, moving the vinyl with the forehead or with objects, and climaxing with DJ David doing handstands and more on the turntables in the DMC Championships 1990 and 1991. Another side of body tricks and ancillary playing gestures found in competitions or battles are the gestures accompanying “disses”, or humiliations of combatants.

At the level of sound-production, the turntable is rather complex. Consider moving the vinyl forwards and then backwards in a simple hand gesture. How many onsets are produced and how will it sound? That depends on several factors: the sample, the starting position, the place of returning the record, the extent of the movement, and the crossfader movement. The frequency of onsets is higher in scratching than compared to other instruments, and if the sample has more than one onset, a gesture will trigger each onset (e.g., moving the record forward and back through the sample “its fresh” will produce four onsets). The pitch of each tone is also much less stable than for other instruments because every movement is comprised by the hand accelerating and decelerating,

performed on a sample whose pitch in turn can be unstable.

In contradiction to the complexity described above, the relationship between the gesture we see and sound we hear is apparent. The transfer of energy from the body of the performer to the instrument directly affects pitch and tone quality: a speeding movement results in a rising tone. In other words, the *mapping* between control parameters (what the DJ does) and the sound parameters (how the instrument sounds) are on one hand complex, but to the audience, it appears simple (see Kvifte and Jensenius, 2006).

4 Performances

Turntablist performances can take place either in the classic solo DJ hip-hop setting, or in situations involving other musicians. As an instrument, the turntable has many limitations. For instance, playing sustained tones is very hard and often undoable, and likewise to produce stable or defined pitches (such as “play the note C”) is a great challenge. Regardless of the impracticalities for playing melodies, scratching is often successfully performed in different circumstances. In contrast beat juggling has developed into a style of building complex compositions that leave no room for other musicians.

DJ battles have been the primary outlet for artistic creativity, where skills, originality and showmanship are judged. In the DMC competition each DJ prepares a six minute set and performs it live; another popular competition form is the head-to-head duel where two DJs play alternately. The sets normally include scratching, beat juggling and other elements like body tricks and dissing opponents with word play from records. Musically, the sets are perhaps mainly appreciated by initiated listeners, but have had great impact on all aspects of the art form. Typically, new techniques, playing styles and tricks are first shown in battles, such as when beat juggling, the crab scratch, transforming, and team routines caught the audience’s attention.

While the task of being a backing musician to the rapper is unquestionably one of the most essential to the DJ, it is not where the music has got the spotlight. Instead the (sometimes elongated) DJ introductions became the moment to expose the bigger public to more than playing hit songs. Their rapping partners complement the performances by calling out the DJ’s name, proclaiming the techniques, praising the skills, and not least reassuring that the music is made using two turntables.

After *The Invisibl Skratch Piklz* entered the DMC competition (1992/1993) not as single performers but as a rehearsed turntable group, so-called DJ *teams* started to take the form of a typical band consisting of drums, bass and solo instruments. One DJ would play scratching solos, while the others created the background from single drum beats and instrumental samples. This playing style requires meticulously composed pieces (Smith, 2006) and carefully synchronized movements. As a result, team performances have a musical appeal that is hard to match in individual performances, and became so popular that competitions soon included a team category.

The team composition style, which basically meant to create drums, bass lines, melody and text from short samples, worked very well also in conventional album recordings as compared to the improvisation- or mix-based tapes. Full length turntable albums started to appear during the 1990s, either by groups (The Executioners, The Invisibl Skratch Piklz), or by single DJs composing in the same style (Rob Swift, DJ QBert, Mix Master Mike).

5 Impact outside hip-hop

The cultural impact of the scratching hip-hop DJ is notable, like graffiti has influenced art and design and breakdancing has influenced areas from exercise classes to modern dance. While graffiti is persistently portrayed as vandalism in newspaper articles and rappers are accused of having criminal and hostile inclinations, the DJ generally appears more harmless and nerdy. Also, the DJs became solo instrumentalists and fitted in with other musicians in a different, more autonomous way than rappers, graffiti artists, breakdancers or beatboxers could within their areas. Very soon, already from Herbie Hancock's *Rockit*, the scratching DJ was featured in jazz, rock, experimental and pop music situations.

The scratch metaphor is even so strong that the sounds are imitated by conventional instruments, for instance Tom Morello's guitar playing with the band Rage Against the Machine. This completes the circle: turntables developed into a musical instrument within a small musical genre by imitating other instruments—now they are inspiring new interfaces and playing styles performed by non-DJs far beyond the hip-hop community.

6 Further reading

For interested in the history of the DJ, turntablism and the turntable, the book *Groove Music* by Katz that has been cited throughout this chapter is a wonderful read providing an unparalleled overview and links to sound and video examples. Katz covers the ground from the early days of hip-hop to the recent-day transition from turntables to new technology. The book is based on finding first-hand accounts of the legendary events, which have up until now been retold in writings in their mythical glory often without sufficient critical distance. Katz has done an outstanding job getting the record straight.

Katz also included a chapter on the main DJ battles—the New Music Seminar, the DMC and the ITF. Competition is very likely one of most interesting areas for further studies of turntable-made music. Although not *further reading* per se, the documentation and available material from these battles are either good or excellent as most of the events have been video-taped by production companies. The recordings are all by the world's top DJs who prepared and trained long for a short 5-6 minute performance. DJ battle material could be applied for studies and analyses in musicology, performance studies, interaction design, culture studies and music technology, just to name a few.

In *Vinyl: A History of the Analogue record*, Richard Osbourne closely examines the development of the vinyl records including the reasons behind the surprising and uplifting trends in record sales since 2000. Although there is little about hip-hop specifically, the book is still an essential read for everyone with interest in the DJ world.

In Hansen's thesis (2010), freely available online, a number of academic studies involving DJs are presented. These include expressive performances in scratching, the contribution of the sample in performances, modeling of scratch techniques, experimental interfaces, and more. The text is augmented with links to sound and video examples.

A more scholarly and musicological approach to turntablism can be found in Alexander Sonnenfelds' dissertation *Bewegungslehre*. Here, he proposes a complete notation system for turntablism, called S-Notation.

Readers who want to stay updated on new technology for DJs are encouraged to browse the contents of the major conferences in the sound and music computing area. These include the New Interfaces for Musical Expression, the Sound and Music Computing conference, the International Computer Music Conference, the CHI conference and Advances in Computer Entertainment Technology. The proceedings of papers from these and other conferences are often free for download. A fairly thorough review of scratching and related technology with a more scientific approach up until early 2010 can be found in (Hansen, 2010).

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