4 DJs and turntablism

KJETIL FALKENBERG HANSEN

Introduction

The disc jockeys (or DJs) who founded hip-hop music created the soundtrack for an entire cultural movement. A hip-hop DJ's roles can be multifaceted: finding the music for dancing, playing the popular tracks, being the rapper's background band, having, maintaining, and providing the equipment, producing the beats, and not least improvising instrumental solos. To accomplish all this, DJs have creatively adopted and adapted the technology available, and have been less mindful of the intended use of that technology – from tape recorders, amplifiers, drum machines, samplers to, above all, record players. But this has not been a one-way relationship: when hip-hop music has evolved, music technology has changed along with it.

This chapter investigates how the turntable has become a musical instrument, investigating the different DJ roles, some of the conditions for performing with turntables, the impact DJs have had on the outside world, and examples of scholarly interest in DJ practices.

A history of the DJ

In 2012, Mark Katz published *Groove Music*, a truly comprehensive study of the hip-hop DJ.[1] Although not the first of its kind, the book explores in depth the myths and legends which characterize the more than forty years of DJ history.[2] With the ambition to once and for all get the story straight, Katz accepts that the DJ history remains 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."[3] Katz succeeds in unraveling the origins of playing techniques, musical styles, and technical advances, exposing the creative processes along the way.

The terms "DJ" and "disc jockey" were established long before hip-hop. Arising from the radio broadcast industry, the notion "disc jockey" first appeared in print in *Variety* in 1941 and was used inconsistently and with varied meaning in the following decades.[4] Katz and other scholars date the

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birth of hip-hop to August 11, 1973, when DJ Kool Herc held his party, the "Back to School Jam."[5]

A handwritten party invitation flyer had the text "a DJ Kool Herc party," so unquestionably the meaning of "DJ" was generally known and already connected to what was to be hip-hop. The music that was played at this party, however, was soul, funk, and rock, without breakdancing, rapping, or turntable tricks. Now within hip-hop, the terms "DJ" and "disc jockey" have been firmly settled, along with derivations like DJing and deejay (and for music video, the VJ).

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 claims that this connection is somewhat overrated and simplified. For instance, arguments suggest that it was primarily the massive sound systems from Jamaica, not the music, that found their way to the Bronx.[6] The Latin music influence is arguably more important, for instance music from DJ Disco Wiz, Grandmaster Caz and Charlie Chase, who could mix in salsa records during their sets. Disco and hip-hop evolved in parallel and with mutual impact on each other. Disco records were played at hip-hop parties, and both genres used breaks to a large extent,[7] while the most notable difference was how hip-hop DJs physically manipulated the records (using them as musical instruments) instead of just letting them play.

One of the most important landmarks in DJ history – it is the hip-hop DJ's most canonical myth – is how and when the most widespread playing style called "scratching" was "invented." Generally the DJ community acknowledges Grandmaster Flash's student and collaborator Grand Wizzard Theodore for creating this around 1976. Theodore's story has been accounted for in detail, but after reviewing it thoroughly, Katz found it to be *mostly* correct, although inconclusive. Like many other innovations in our society, it seems reasonable to assume that the discovery was accidental, originating from systematically compensating for artifacts of the technology in use, and will also most realistically be the product of a confluence of factors and individuals rather than the entire invention of one person.[8]

In 1981, Grandmaster Flash released *The Adventures of Grandmaster Flash on the Wheels of Steel*, the single most important DJ composition which set the course for the subsequent turntablist movement.[9] Performed live using three turntables, it firmly demonstrated what a DJ was capable of. But at the same time the MC (rapper) was the one who caught the limelight as rap music entered the popular music hit lists, moving the DJ into the background.[10] The growing popularity of the MC led partly to the proliferation of hip-hop music, partly to a clearer definition of role for the DJ, and partly to a desire to perform hip-hop music even without rapping.

This was showcased with another momentous release; the MTV video hit for *Rockit* by Herbie Hancock, which featured DJ Grandmixer D.ST as a solo musician.[11]

From the second half of the 1970s, DJ performances had become progressively more intricate. Hip-hop jams where the winner was the one with the loudest sound system now turned into battles of skill, and those battles evolved into ruled-based competitions. The three most important battles were the N.M.S., D.M.C., and I.T.F. international competitions.[12] The D.M.C. competition (founded in 1985 in London), which soon became known as the D.M.C. World DJ Championships, is the most influential.

The D.M.C. Championships have had an enormous impact on the development of playing skills. The six-minute long routines performed in the competition need to be perfectly executed and technically advanced for the competitor to stand a chance. The D.M.C.'s impact on the music itself is less straightforward, but the quintessential battle aesthetics are clearly noticeable in conventional album releases as well.[13] In recent years the D.M.C. has expanded from individual six-minute battle performances to include a head-to-head style battle and a team performance category.

While rap music continued to grow in the pop charts, many rock, jazz, and experimental musicians collaborated with DJs. Especially in jazz, the curiosity about the new instrument led to recordings that exposed the DJ as a musician.[14] Through artists such as Sugar Ray, Beck, Portishead, Ozomatli, Buckshot LeFonque, and John Zorn, the hip-hop DJ found new ground; for the most part the DJ got to play a short scratch solo to contribute with the cool "wicky-wicky" sounds.

It was only in 1995, almost two decades after DJs began to use their turntables as instruments, that DJ Babu pronounced the terms turntablist to describe what kind of DJ he had become and turntablism about where the art form was going.[15] Many feel that turntablism as a movement peaked around ten years later; even the use of the word "turntablism" seems to have decreased. Not incidentally, the fiercest development in new technology for DJs coincided with this popularity peak with innovational digital devices tailor-made for the DJ market. This can partly explain why the word got outdated somehow: it was paradoxical to talk about "turntablism," the word a derivation of the vinyl record player, while the DJ set-up was changing more and more toward using CD players and laptops.

Since 2011, the D.M.C. Championships have allowed digital vinyl systems (DVS).[16] The acceptance of DVS signals that being a DJ is no longer a privileged occupation only for dedicated record collectors. Moreover, this advance in technology has made every recording instantly available to DJs without it even being pressed 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 the form of waveform representations has made mixing a great deal easier. Assisted by technology, today's DJs have the potential to reach a critical skill level faster. The field has thus opened up for a blooming number of not-quite-professional performers, but it has also given new possibilities for innovative artists to advance even further.[17]

The role of the DJ in hip-hop

The overview above suggests that we can categorize different kinds of DJs rather than simply defining a monolithic DJ archetype. At the one end of a continuum is the practice of mixing tracks together either to create a seamless set of songs or to combine two tracks to form a new piece of music.[18] In the middle is the practice of backing up a rapper by creating beats and laying a musical foundation. At the other end lies turntablism with improvisational playing styles – solo or with other musicians. This is the practice most would consider as using the turntable exclusively as an instrument.

The DJ has always had the role of being a record collector and having the knowhow to select music to play, for instance the original radio disc jockey who recreated the ballroom feeling, the Jamaican DJ who was often called the "selector," and the early hip-hop DJs like Afrika Bambaataa who were famous for their massive (and eclectic) record collections. Unlike in other elements of hip-hop, a substantial capital investment was needed in order to build up and maintain a sound system and music library.

The turntable as a musical instrument

Katz argues that although turntables were common in households, they were not necessarily available or usable for the aspiring DJ: the equipment could be kept out of bounds, or was of too low quality for DJing. Instead he sees – comparable in many ways to punk music aesthetics – that the driving forces behind turntables becoming hip-hop's main instrument are partly the power they embody, and partly how you break the rules by misusing the delicate vinyl.[19]

There have been different proposals for how to classify turntables as musical instruments. Miles White regarded the turntable as a manual analogue sampler, coded 521.21 in the generators and modifiers of electronic sound extension to the Sachs-Hornbostel classification system.[20] By

"manual," White referred to the possibility of manipulating the playback of the sampled sound, and he divided this manipulation into six different "performance techniques": on a single turntable backspinning, scratching, and cutting, and on two turntables mixing, blending, and punch-phrasing. I have written elsewhere that it is mainly scratching and beat juggling that defined the turntables as instruments.[21]

Charles Mudede expressed a different point of view.[22] Based on ideas from Walter Benjamin, he argues that the turntable is a "repurposed object" for creating "meta-music" and thus not a musical instrument.[23] 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.

Playing styles: scratching and beat juggling

It is difficult to discuss playing styles without having described the equipment in detail yet, but the two main ones, scratching and beat juggling, are so important in defining the instrument that they must at least 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 doubtless make a scratching gesture with their hand waving in the air 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 playback devices other 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, made turntables perfect for this task.

Scratching can be compared to how, for instance, a violin is played where each hand controls different parameters of the sound. The left hand of the violinist adjusts the pitch, or tone height, but no sound comes 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 to turn the sound on and off.

The beat juggling playing style 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 from DJ Steve Dee, one of the originators of the playing style, where two copies of an Erik B and Rakim track with the lyrics "This is how it should be done" are played in alternation to create a new composition (see Table 4.1).[24]

Table 4.1 *DJ Steve Dee beat juggling routine*

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

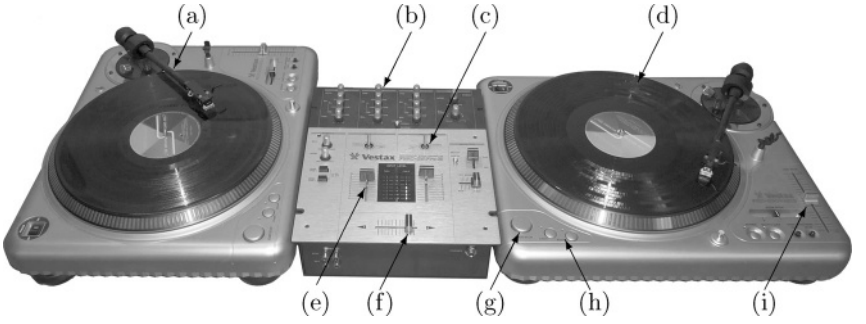

Figure 4.1 The DJ instrument set-up optimized for scratching and beat juggling with the mixer (Vestax PMC-5 ProIII) placed between the turntables (Vestax PDX-2000 MkII), and the left turntable rotated to keep the tone-arm away. The controllers are: (a) the tone-arm, pick-up, cartridge, and stylus; (b) EQ tone controls; (c) line switch; (d) skip-proof battle record with repeating grooves; (e) channel volume fader; (f) crossfader; (g) start–stop switch; (h) 33 or 45 rpm speed selector; and (i) pitch control.

The equipment

While a DJ only needs one turntable, strictly speaking, it is customary to use two turntables with an audio mixer placed in between to control the sound levels. Figure 4.1 shows a typical set-up with the most important controllers labeled. The turntables have pick-ups with a stylus (a) that converts the movement in the reel into an electrical signal. The design of the stylus or needle is crucial for allowing the record to move backwards (a hifi stylus tip is elliptical while a DJ stylus tip is spherical in shape). The other features that separate a purpose-made turntable in this context from a home hifi one are the strong direct-driven (as compared to belt-driven) motor 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,[25] using pick-ups and needles made for radio DJs.

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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: most important is the crossfader (f) for gradually lowering the sound volume from one turntable (channel) while increasing the sound from the other. Next, used to somewhat lesser extent are for each channel the line switches (c), the volume faders (e), and the tone controls (b). Because playing techniques depend increasingly on switching the sound rapidly on and off, the crossfader has been made almost frictionless, and it is possible to set the distance needed to travel for turning the sound from on to off (fading curve). 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. There is also an option to reverse the direction of the fading, useful for certain techniques.[26]

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. As mentioned above, the DVS have therefore set a 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. In 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 due to wear, 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.

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 as sound is created when the needle follows the notched groove of the record, which generates a vibration that is amplified by the pick-up. By changing the rotational speed, the pitch of the sound (or tone) changes as it is played faster or slower. A fast movement means a high pitch and 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 "ah" and "fresh" from the sentence "ah this stuff is really fresh,"[27]

and "scratching" from "all that scratching is making me itch."[28] These are very short spoken utterances located on iconic records.[29] In general, any short sound will do just fine, and apart from the classics such as those 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 acoustic understanding, 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 identical copies or two different records. The origin of beat juggling lies in mixing the break of a song: the part where all the vocals and instruments pause and the drum beat continues. With precise techniques, the records are played alternately from several bars down to very short durations. A few beat juggling routines have become renowned for the choice of sound material, such as performances using *Rock the Bells* (LL Cool J) or *Tom Sawyer* (Rush), but just like for scratching, almost any sound is applicable. For playing purposes it is an advantage that the recording has a distinct rhythm with gaps between each onset, and that the sounds can be matched in tonality.

The "ah" and "fresh" samples come from one 12″ single, released by the small company Celluloid Records.[30] How is it possible that each and every DJ uses these samples when there are not even remotely enough pressed copies of the vinyl? Before the DVS made playing digital files an option, desirable samples and breaks were collected on break collections and battle records.[31] One battle record alone can have hundreds of scratch-friendly sounds (with little respect for copyright clearance). This made life easier and cheaper for the DJ, but at the same time many still complain that it removed the mystery of the art and even compare it to cheating. Time-coded vinyl and DVS took this controversy to its extreme as it is no longer even necessary to change the record.

Interaction and playing gestures

On a basic level, all that is needed to perform the turntable is to change record speed, the playing position of the needle, and the output volume of each turntable. It is, however, almost impossible to create steady tones as on a traditional instrument, to play a scale for instance. Nonetheless, pitch variations are a crucial component of performances, and changing the pitch means varying the playback speed of the record. The connection between physical movement and sound is immediately comprehended.[32] As a result, and quite uniquely for this instrument, performers have individual hand positions and gestures.

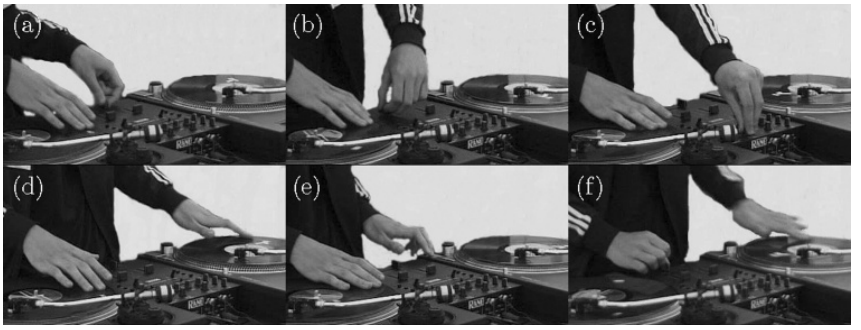

Figure 4.2 Images showing a short sequence of typical gestures from a DJ performance. The DJ uses both hands to control the two turntables and the mixer. In the top row, the right hand is on the record, and the left hand goes to (a) the crossfader, (b) the channel fader, (c) the tone controls, and in 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.

Figure 4.2 shows a DJ performing with different hand positions: in Figure 4.2(a)–(e) the right hand is always occupied with controlling the vinyl, while the left hand moves between faders and performs other gestures. Arguably, DJs become much more ambidexterous than other musicians because it is an advantage to master all techniques with the left hand on the fader and the right on the vinyl and vice versa; this is shown in figures 4.2(a) and 4.2(f).

Any musician's gestures can be divided into two groups: sound-producing and sound-modifying gestures, and ancillary, sound-accompanying, and communicative gestures.[33] 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. As discussed earlier, such movements have become a fundamental ingredient in the DJ performance in the form of body tricks. Playing two records in quick alternation and backspinning them to the starting point (to create loops) requires remarkable arm and hand control, and this spectacular playing style quickly became distinctive for performers and popular with 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 strange objects, and climaxing with DJ David doing handstands on the turntable in the D.M.C. Championships.[34] Another example of ancillary playing gestures found in battles is the (mainly rude) gestures used to accentuate the "disses" that humiliate the opponent.

Even at the lowest level of sound production when creating only one tone the turntable is surprisingly complex. Consider moving the vinyl forwards and then backwards in a simple hand gesture. How many onsets are produced and how will it sound?[35] That depends on several factors:

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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 with 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 over the word "scratching" will produce *four* onsets). Because every movement comprises an acceleration and deceleration, the pitch of each tone is also much less stable than for other instruments; furthermore, such pitch changes are performed on a sample whose own pitch in turn can be unstable as well.

In contradiction to the complexity described above, the relationship between the gestures we see and sounds 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 technically complex, but to the audience it appears simple.[36]

DJ performances

Turntablist performances can take place either in the classic solo DJ hip-hop setting, or in situations involving other musicians. As discussed above, the turntable instrument has many limitations. For instance, to produce defined pitches ("play the note C") is a great challenge, and playing sustained tones is almost impossible. Regardless of the impracticalities for playing melodies, scratching is often successfully performed in different settings involving a harmony-based musical background. 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 typical battle, a perfectly prepared and rehearsed set is performed live. 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 beat juggling, the crab scratch, transforming, most body tricks, and even team routines).

While the task of being a backing musician to the rapper is unquestionably one of the most essential to the DJ, this is not where the composition has had its main focus. Instead the (sometimes elongated) DJ introductions offered the opportunity to expose a bigger public to more than hit songs and beats. 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.[37]

After the Invisibl Skratch Piklz entered the D.M.C. competition in 1992 as a synergetic turntable group, so-called DJ teams started to adopt the form of a typical band consisting of drums, bass, and solo instruments. One would play scratching solos, while the others created the background from single drum beats and instrumental samples. This playing style requires meticulously composed pieces and carefully synchronized movements.[38] As a result, team performances have a musical appeal and complexity that can hardly be achieved in individual performances, and this explains why competitions for many years have included a team discipline.

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

The cultural impact of the scratching hip-hop DJ is remarkable, comparable to the way in which graffiti has influenced contemporary art, typography, and design, and how breakdancing has influenced modern dance, fitness exercise classes, and even clothing. While newspapers uncritically and repeatedly connect graffiti to vandalism and rap music to violence, the DJ is generally portrayed as more harmless and nerdy. DJs were also allowed to blend in with other musicians in a different, more autonomous way than rappers, graffiti artists, breakdancers, or beatboxers seemed to do within their respective areas.

It is also noteworthy that the scratch metaphor is so strong that the sounds even are imitated by other instruments, for instance in Tom Morello's guitar playing with the band Rage Against the Machine.[39] And this completes the circle: turntables developed into a musical instrument within a small musical genre by imitating and replacing other instruments – now they are inspiring new interfaces and playing styles performed by non-DJs far beyond the hip-hop community.

Further reading

For those interested in the history of the DJ, turntablism, and the turntable, the book *Groove Music* by Mark 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.

Katz also included a chapter on the main DJ battles. The battle culture is one of the most interesting areas for further studies of turntable-made music. Although not further reading as such, the documentation and available material from these battles (on YouTube, for example) are either good or excellent. Most of the events feature world-leading musicians filmed by professional production companies. DJ battle material could be applied for studies and analyses in musicology, performance studies, interaction design, culture studies, and music technology, to name just a few.

In Kjetil Falkenberg Hansen's thesis,[40] a number of academic studies involving DJs are presented and it gives a thorough review of scratching and related technology with a scientific approach up until early 2010. The topics 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 different scholarly and musicological take on turntablism can be found in Alexander Sonnenfeld's dissertation *Bewegungslehre*.[41] Here he proposes a complete notation system for turntablism, called S-notation. This system has recently been employed in teaching at the respected QBert Skratch University.[42]

Justin A. Williams recently published a book covering the sampling tradition in hip-hop, in both the narrow sense of digital sampling and the broader sense of musical borrowing.[43] Here, the DJ has played a major role, both adding cultural references from other genres and areas, and also establishing within-genre citations as a musical mannerism.

In *Vinyl: A History of the Analogue Record*, Richard Osborne closely examines the development of the vinyl record, including the reasons behind the surprising and uplifting trends in record sales since 2000.[44] Although there is little about hip-hop specifically, the book is still an essential read for everyone with an interest in the DJ world.

Readers who want to stay updated on new technology for DJs are encouraged to browse the contents of the major scientific conferences in the sound and music computing area. These include the New Interfaces for Musical Expression,[45] the Sound and Music Computing Conference,[46] the International Computer Music Conference,[47] the CHI Conference,[48] and Advances in Computer Entertainment Technology.[49] The proceedings of papers from these conferences are often free for download.

Notes

1 Mark Katz, *Groove Music: The Art and Culture of the Hip-Hop DJ* (New York: Oxford University Press, 2012).

2 Katz uses multiple sources, often primary, to check and more reliably confirm the many historical accounts that have been presented

previously, for instance in such pioneering works as Bill Brewster and Frank Broughton, *Last Night a DJ Saved My Life: The History of the Disc Jockey* (New York: Headline Publishing, 2006); Jim Fricke and Charlie Ahearn (eds.), *Yes Yes Y'all: The Experience Music Project Oral History of Hip-Hop's First Decade* (Cambridge, MA: Da Capo Press, 2002); Steven Hager, *Hip-hop: The Illustrated History of Breakdancing, Rap Music, and Graffiti* (New York: St. Martin's Press, 1984); Ulf Poschardt, *DJ Culture*, trans. Shaun Whiteside (Hamburg: Rogner & Bernhard GmbH & Co. Verlags KG, 1998); David Toop, *Rap Attack 3*, 3rd edn. (London: Serpent's Tail, 2000); and also in films like *Wild Style*, dir. Charlie Ahern (First Run Features, 1983), and *Scratch*, dir. Doug Pray (Palm Pictures, 2001).

3 Katz, *Groove Music*, p. 8.

4 Marc Fisher, *Something in the Air: Radio, Rock, and the Revolution that Shaped a Generation* (New York: Random House, 2007), p. 13. See also Poschardt, *DJ Culture*.

5 Katz, *Groove Music*, p. 17.

6 *Ibid.*, p. 26.

7 "Breaks" refer to what was later called breakbeats, and referred to the instrumental break of a record, looped by the earliest hip-hop DJs for b-boys and b-girls to dance to, and became the fundamental building block of hip-hop beats. See also Chapter 2 in this volume.

8 For the full story see Katz, *Groove Music*, p. 59 and Steven Hager's interview with Grand Wizzard Theodore, available at youtu.be/4-JBa6w0OHI (accessed December 10, 2013). Indeed, several DJs have come up with the idea of scratching during the forming years of hip-hop, either accidentally or as a creative way to deal with noise from backspinning the record caused by imprecise crossfader control. Earlier experiments by the *musique concrète* pioneer Pierre Schaeffer could have had some impact, but this seems unlikely. See Kjetil Falkenberg Hansen, "The Acoustics and Performance of DJ scratching: Analysis and Modeling" (Ph.D. dissertation, KTH Royal Institute of Technology, 2010), p. 40.

9 Grandmaster Flash, *The Adventures of Grandmaster Flash on the Wheels of Steel* (Englewood, NJ: Sugar Hill Records, SH-557, 1981). Available at youtu.be/gXNzMVLqIHg (accessed December 10, 2013).

10 Katz, *Groove Music*, p. 73.

11 Herbie Hancock, *Future Shock* (New York: Columbia: FC 38814, LP, 1983). Available at youtu.be/GHhD4PD75zY (accessed December 10, 2013).

12 The N.M.S. (New Music Seminar) was held between 1981 and 1994, the I.T.F. (International Turntablist Federation) between 1996 and 2005, and the D.M.C. from 1985 until the present. See www.dmcdjchamps.com and Katz, *Groove Music*, p. 108.

13 Compare, for instance, the *X-Ecutioners* showcase from the 1999 D.M.C. in typical battle style with the 2008 album release from the related all-turntable band Ill Insanity. Available at youtu.be/5YuteDF7Tig and youtu.be/ukwbx4rONRQ (accessed December 10, 2013).

14 Jazz has always had a big influence on hip-hop music, and vice versa the vocal style of rapping and the unconventional sounds made by turntables has attracted jazz musicians; see, for instance, Justin A. Williams, "The Construction of Jazz Rap as High Art in Hip-Hop Music," *The Journal of Musicology* 27/4 (2010): 435–459.

15 DJ Babu was probably not the first to use these terms, but they were widely accepted after his usage. See Katz, *Groove Music*, p. 280, n. 3.

16 In DVS, time-coded records played on the turntable are used to control the playback of a sound file located on a computer. DVS also allow other types of controllers, such as CD players and computer input devices.

17 An example of how to take advantage of new technology can be seen in the 2011 D.M.C. showcase by the five-time Team Champions, Kireek. During the whole performance, they never change the records as these only control the music on the laptops placed on the sides, and they play with techniques impossible to accomplish using traditional equipment. Available at youtu.be/XNpiwZHv1KY (accessed December 10, 2013).

18 Consider here the performance practice and playing styles being scaled from having a low to high level of virtuosity, although this is a simplification.

19 Katz, *Groove Music*, p. 62. The concept of turntablism is more important than the actual medium, the vinyl record, and we can acknowledge that such music can be performed not only on turntables but on other devices too (e.g. iPads).

20 Miles White, "The Phonographic Turntable and Performance Practice in Hip Hop Music," *Ethnomusicology OnLine* 2 (1999): 1–6; see also Michael B. Bakan *et al.*, "Demystifying and Classifying Electronic Music Instruments," *Selected Reports in Ethnomusicology* 8 (1990): 37–57.

21 See Kjetil Falkenberg Hansen, "The Basics of Scratching," *Journal of New Music Research* 31/4

(2002): 357–365. The two latter terms cover White's techniques for, respectively, one and two turntables. This list of playing styles is nevertheless inconclusive: for instance, DJs can do drumming, needle drop, no-input fading and physical vinyl manipulation, to name but a few techniques.
22 Charles Mudede, "The Turntable," *CTheory* 4 (2003): 1–8.
23 Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," in *Illuminations*, trans. H. Zohn (New York: Schocken Books, 1968), pp. 217–251.
24 Katz, *Groove Music*, p. 188.
25 The SL1200 was introduced in 1972, while the SL1200 Mk2 that became the definitive standard turntable for scratching was produced (with some design updates) from 1979 until 2010.
26 This set-up was first called hamster style by DJ Quest, who had connected his mixer incorrectly. This is another example of an accidental use of technology that changed music technology: the hamster style became so widespread that from then on the mixer manufacturers included a reverse switch.
27 Fab 5 Freddie, *Change The Beat* (New York: Celluloid Records, CEL 156, 12″ EP, 1982).
28 Malcolm McLaren and the World's Famous Supreme Team, *Buffalo Gals* (Island Records, 0–99950, 12″ EP, 1982).
29 The history of the different samples is covered in Katz, *Groove Music*, p. 89.
30 See www.celluloidrecords.net (accessed December 10, 2013).
31 Available at youtu.be/gVE-mbdzeDc (accessed December 10, 2013). This example also includes a skip-proof section starting from 11:20 where a one-rotation-long sample is repeated for several grooves.
32 Specifically, a fast movement produces a higher pitch than a slow movement; grabbing the vinyl toward the center or toward the edge determines how long the part of the sample is that is played in one gesture; a gesture performed close to the center produces a higher pitch than the same gesture performed close to the edge.
33 Marcelo M. Wanderley *et al.*, "The Musical Significance of Clarinetists' Ancillary Gestures: An Exploration of the Field," *Journal of New Music Research* 34/1 (2005): 97–113; see also Rolf Inge Godøy and Marc Leman (eds.), *Musical Gestures: Sound, Movement, and Meaning* (New York: Routledge, 2010).
34 Available at youtu.be/49hlyhkFLGI (accessed December 10, 2013).
35 The start of a tone is called an onset.
36 See Tellef Kvifte and Alexander Jensenius, "Towards a Coherent Terminology and Model of Instrument Description and Design," in *Proceedings of the Conference on New Interfaces for Musical Expression* (Paris, 2006), pp. 220–225.
37 See, for instance, Katz, *Groove Music*, p. 70.
38 For more on DJ teams, see Sophy Smith, *Hip-Hop Turntablism, Creativity and Collaboration* (Aldershot: Ashgate, 2013).
39 Tom Morello MTV Interview, available at youtu.be/ESVDU5BViA8 (accessed December 10, 2013).
40 Hansen, "The Acoustics and Performance of DJ Scratching." Available at bit.ly/KFH-thesis.
41 Alexander Sonnenfeld, *Bewegungslehre* (Berlin: Alexander Sonnenfeld, 2011).
42 Available at www.qbertskratchuniversity.com (accessed December 10, 2013).
43 Justin A. Williams, *Rhymin' and Stealin': Musical Borrowing in Hip-Hop* (Ann Arbor: University of Michigan Press, 2013).
44 Richard Osborne, *Vinyl: A History of the Analogue Record* (Aldershot: Ashgate, 2012).
45 Available at www.nime.org (accessed December 10, 2013).
46 Available at www.smcnetwork.org (accessed December 10, 2013).
47 Available at www.computermusic.org (accessed December 10, 2013).
48 Available at www.sigchi.org/conferences/chi/ (accessed December 10, 2013).
49 Available at www.ace-conf.org (accessed December 10, 2013).