More DJ techniques on the reactable

Kjetil Falkenberg Hansen
Speech, Music and Hearing
KTH - Royal Institute of Technology
Stockholm, Sweden
kjetil@kth.se

Marcos Alonso
Music Technology Group
UPF - Universitat Pompeu Fabra
Barcelona, Spain
malonso@iua.upf.edu

ABSTRACT

This paper describes a project started for implementing DJ scratching techniques on the reactable. By interacting with objects representing scratch patterns commonly performed on the turntable and the crossfader, the musician can play with DJ techniques and manipulate how they are executed in a performance. This is a novel approach to the digital DJ applications and hardware. Two expert musicians practised and performed on the reactable in order to both evaluate the playability and improve the design of the DJ techniques.

Keywords

reactable, DJ scratch techniques, interfaces, playability

1. INTRODUCTION AND BACKGROUND

It is well known that scratch DJs acquire very specific skills and learn a more or less defined set of playing techniques. One recent example of formalizing the techniques can be found in the DVD by DJ Q-bert [6], one of the leading musicians in the field. In the DVD, about one hundred different "scratches", or techniques, are demonstrated. These techniques are interesting for several reasons: They represent a natural starting point for studying how turntable musicians—or turntablists—play expressively, they define what a new (non-vinyl) DJ interface should manage, and they offer an approach to perform complicated playing gestures with simple actions.

Since turntablism peaked in popularity in the late nineties, many solutions for scratching and DJing without using vinyl records and a turntable have surfaced. These are mentioned in several earlier papers, see eg. [2, 10, 13]. Such hardware include, among others, the CD scratch decks (e.g. Pioneer CDJ1000), time coded vinyl controlling sound files stored on a computer (e.g. Final Scratch), software simulations (e.g. TerminatorX and FruityLoops), various "scratch pads" and jog wheels, and also controllers found on keyboards.[1] Common for all these directions is that they mimic or model the speed manipulation of a turntable. To our knowledge, there are no commercial products that take advantage of using the above mentioned DJ playing techniques directly.

On the software side, we have seen some attempts at using scratch techniques to simplify the process of sounding like a real DJ. For example, with Scratcher[2] the user can manually draw speed and amplitude envelopes and play them back, making scratch patterns on audio files. This opens the possibility of coming up with new techniques, to experiment with the sounds or to compose music for the turntable. The disadvantage of drawing envelopes is the lacking real-time control for performance situations.

Another path is seen in Skipproof,[3] where scratch techniques can be assigned to hardware or software controllers. Here, all the techniques are based on models derived from analysis of real DJs' movements [7]. The user affects the playback of the techniques by the action and gesture assigned, for instance can the speed of the scratch be controlled by the effort of the player. Skipproof have been used in combination with the Radio Baton, gesture sensors, MIDI devices and computer input such as Wacom tablet. However, it has been desirable to treat the techniques as individual building blocks in a scratch performance.

The presented work builds on the Skipproof application in combination with the reactable.

The reactable instrument

The reactable is by now a well-known novel electronic musical instrument, with recent massive exposure in all kinds of media, especially since the artist Björk gave it a pronounced position in her stage shows and compositions. It is a versatile instrument that works in a similar way as tools like Pure Data, Max/MSP or Reaktor. It was designed to meet artistic and musical demands not catered for by other interfaces,[4] and it follows a well-defined principle for developing the behavior of its physical objects that are handled on the table top [11, 12].

Integration of DJ techniques on the reactable was started a while back with the development of a few objects that could provide some of the functions from Skipproof [1]. These

[1]These are examples from the many emerging products. For instance, CDJ1000 was not the first CD scratch player, but it represented a market break-through.

[2]http://web.ics.purdue.edu/~afaulsti/skrasms/

[3]http://www.csc.kth.se/~kjetil/software.html

[4]There are however a number of interfaces with a similar approach; most of those are listed on the reactable project website: http://reactable.iua.upf.edu/?related

NIME08, Genova, Italy

were later combined with a different approach to scratching by Dimitrov [4, 9]. Although these objects worked, some improvements remained to be done, and a formal evaluation of the scratch functionality was needed.

Within the SID initiative[5] the development that started in 2006 could continue. Main aims were to get better scratch possibilities on the reactable, and to investigate how a trained DJ could interact with familiar techniques in new ways. Our method included to let musicians into the design loop and receive their feedback and expertise, and to let them evaluate the playability. Given the latency introduced by a system based on video recognition, we never expected the system to be responsive enough for performing real scratch gestures comfortably. For this reason, our main focus was on the higher level of control and let the users control scratch models instead of scratching directly.

2. METHOD

For the reactable, the development of the objects is done in Pure Data (Pd) patches. This allows for fast prototyping and can even be done in run-time. The video projection that is used to provide visual feedback on the table is also the user environment that is displayed on the computer screen, called the virtual environment. Working with the objects in real life (moving, twisting and turning them) is very different than working with the objects in the virtual environment. During the design phase, the virtual environment was used for editing and simple testing. The new patches were then tested on the real table by the developers, and parameters were adjusted to correspond to the objects.

The underlying concept of the scratch objects on the reactable is that some of the patterns that DJs play on their turntables and crossfaders are used as control models that are triggered and manipulated by new gestures and actions. The mapping between gestures and control is the most critical part of the design process. By assigning control properties and behavior to physical objects and by making connections to sample playback functions, we came up with a totally new method of "scratching"—and as a consequence, with new conventions for playing. We made an effort to respect the reactable principles in designing the objects, although we needed to make some compromises.

Given a virtually endless number of possible functionalities and mappings to test, a few were settled on.

Since there are only a handful of reactable instruments and the number of performers is accordingly very limited, we decided to use two experts for testing. One was a professional reactable musician, and the other an experienced scratch DJ. By using experts from different fields, we aimed at highlighting important aspects of DJ and reactable domains respectively.

Two sessions were arranged for each subject. In the first session, a 30 min rehearsal was followed by a 45 min performance, while the second session only had a 45 min performance. Some tasks were given, for instance to explore all objects, to perform scratching with and without backing music and to try beat juggling (another common DJ technique), but the subjects disposed the time as they wished.

For the performance sessions, the musicians were left alone and undisturbed in a rehearsal room, and listened to their own performance through loudspeakers. The second performance was videotaped. While practising, they had the possibility to get help and ask questions (however, they both preferred to practise without help).

For evaluating playability, the DJ and reactable player answered to a questionnaire and an open interview following each of the performances, including the rehearsal.

The questionnaire was a modified version of the TAI-CHI evaluation questionnaire proposed by Bornand et al. [3] for testing two different interfaces. Our modified version, which added a few questions directly concerning the reactable scratch objects, was not used to make comparisons between interfaces (the reactable and standard scratch tools, for instance), but rather improvement within-subject for the performance sessions and differences between-subject.

The interviews tried to isolate specific problems subjects faced while playing, or any other comment not accounted for in the questionnaire. As a last part of the interview, the subjects suggested possible improvements to the objects and their behavior. Between the two sessions, most of their suggested improvements could be addressed and implemented.

3. RESULTS

The reactable objects developed in a previous phase of the project [1], were only slightly modified for the first session. In addition to the existing sample player, the vinyl movement models object, and the crossfader movement models object, we introduced a "manual crossfader" that changed from on to off when moved, and a second sample player that used a different playback function. After the first session, the functionality of these two new objects were integrated in the crossfader object and sample player, respectively.

As the development followed an iterative process, the results from the first session of evaluation naturally affected the objects used in the second session. Not only the parameters were adjusted between the sessions; even the functionality and mapping were changed and improved. The following section describes the state of the objects at the final stage.

One important improvement between sessions was achieved by moving to a new reactable software version that increased the time resolution of the video recognition from around 30 fps to 60 fps.

3.1 New reactable objects

Figure 1 shows the three different objects active in the virtual environment. The *Loop player object* plays back an audio file and has visual representations of the track progression (ii) and sound level (iii). A wave form (i) is "travelling" from the object towards the *Out*. The *Crossfader object* applies a crossfader movement pattern (B) to the sound, resulting in the chopped-up sounds typical for scratching. The sound level the Loop player will get (graphically represented by A) moves out from the Crossfader object. The *Movement speed object* changes the sample player's speed in some defined patterns (3) and beat subdivisions (2) synchronized with the current bpm of the table.[6] The speed alteration enforced on the audio playback is shown with (1)

[5]SID is the acronym for COST IC0601 Action on Sonic Interaction Design, http://www.cost-sid.org. The presented work is the result of a Short Term Scientific Mission of two weeks granted by SID, reported in [8].

[6]There is a global bpm object in the normal reactable setup that is not included in Figure 1. The metronome is visualized with a wave (a) propagating from the Out.

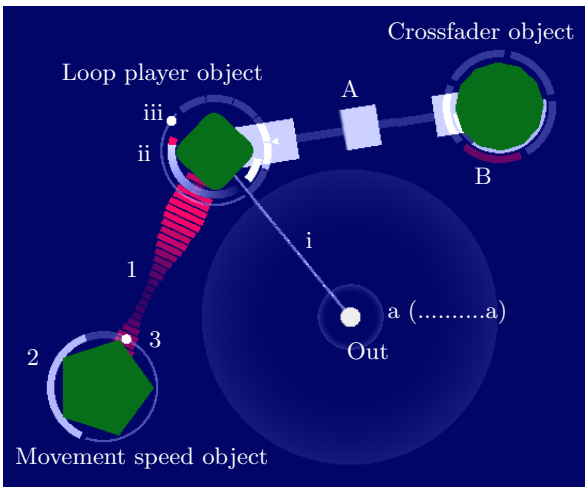

Figure 1: Screenshot from the reactable virtual engine. The three finalized scratch objects and the table's "output" are shown. All labels, letters and numbers are added for explanations. Some visuals are continuously changing (1, A, i, ii, a), while some show the state or setting of an object (2, 3, B, iii).

which travels toward the Loop player.

For all objects, parameters can be adjusted through for instance movement, rotation or distance to other objects. The final implementation is described in more detail in [8].

For the loop player, short sampled sounds are easier to use. When the movement model object is connected, the playback speed typically oscillates between ±150% for normal scratch sounds and up to several times that for the fast scratches. How large portion of the sound that is scratched (similar to extent of hand movement) is decided by distance between the movement speed object and the sample object. The subjects pointed out that for DJs it is important to have control over "where" the sound is at all times, and especially the start of a sound. Therefore, rotation of the loop player should change the sound position when connected to the movement models.

Additionally, the sampler's playback speed could be manually altered just like pushing and pulling the vinyl.

The movement speed object makes the playback speed of the loop oscillate when connected. Although the DJ normally can vary the speed freely with the hand, the most common action is to move it steadily back and forth to the rhythm, resulting in the so-called *baby*-scratch. The second most common movement is the *tear*-scratch, where either the push or the pull is divided in two strokes. Here, the player can move gradually from baby to tear scratch by adjusting the object's parameters.

Initially, the crossfader and movement objects were synchronized for always guaranteing a 'perfectly' performed technique. However, the testers would rather like to have both objects synchronized to the global beat and to note durations derived from that bpm, but independent from each other. This makes sense compared to how many techniques are varied by DJs. In normal performances, there is a large number of different crossfader patterns, and those patterns also defines most of the techniques. For the crossfader object, it was found that having too many patterns was confusing, and a few were chosen, including the *chirp*, the *flare* and a muting of the vinyl's return movement.

Also for the crossfader object, a manual mode was included where the sound was constantly on or off. Moving the object would produce a very short silence or burst of sound, like moving the crossfader between the fingers.

3.2 Evaluation

Figure 2: One of the test subjects playing with the objects.

There was a difference between the subjects in their initial attitude toward the interface. The reactable expert (RE) was, as expected, trying out the objects systematically and quickly experiencing the limitations that differentiates these from the regular reactable setup. The DJ, on the other hand, tried to find how the connection between his scratching techniques and these experimental objects could be made, and experienced that it was not very easy to scratch with models. In general, their attitudes changed over time. The RE became more positive about the interaction with the objects, while the DJ became more pessimistic, especially towards the control of the models.

For the RE, the biggest problem was that playing with the models was not like playing with other reactable objects. He learnt the new objects fast enough, but got frustrated and the enjoyment of playing did not increase. Somewhat contradictively, he felt more and more that he would be willing to use it in a concert situation, and that the possibility to express himself musically grew with practise. For the DJ, most aspects showed a negative trend. Still, he maintained the impression that with practise, it was possible to play something musically meaningful, and he felt overall that the outcome of his actions were predictable.

The DJ was at first very positive towards playing with models and patterns, but when he got to learn them better, he wanted a specific behavior. This was made clear only after the last performance, so no improvements could be made to the objects before evaluation. The RE liked the crossfader model, but not so much the movement model. Compared to the reactable environment, the crossfader object fitted more closely to any expected behavior than the movement model.

To the enthusiastic ears of the authors, performances by both testers sounded quite nice.[7] It is perhaps not overly convincing as real scratching, but it might very well match and exceed the outcome of a total novice's first few attempts

[7]And it sounded even better in an unplanned jam session after the experiment that also demonstrated the reactable's capacity as a collaborative instrument.

with turntables. With proper training, as seen in the evaluation, performances will improve greatly.

Musically, the most interesting result could probably be found in the meeting between a skilled DJ and the easy access to the techniques normally used, with the added dimension of manipulating their parameters in real-time with unfamiliar means.

4. DISCUSSION

This is the first major test of performing with scratch techniques, or the combination of synchronized crossfader patterns and oscillating movement patterns. The advantage of this approach, as compared to modeling the turntable and mixer, is that even non-experts can perform rather intricate and correct techniques without much practise. Results from the evaluation show that the non-expert felt confident with playing with the models. Given some more development, this approach can provide realistic-sounding scratching for various types of interfaces.

Today, the reactable is mostly used for either beat-based or more freely structured experimental electronic music. Visually, the performances are very exiting as the blocks on the table creates dynamically changing images. To see it being played in traditional DJ-style demonstrates another side of the graphical feedback, where the visualizations aid the musician in performance. Traditionally, turntablists mark their records with stickers or notice the position of the center label to find the right spot in the music. Here, we experimented with other representations, and both subjects were able to use them to their advantage.

For real virtuoso playing, the reactable implementation of scratching cannot match real turntables, but by manipulating the models the musician can on the other hand effortlessly go beyond what is normally possible to accomplish, for example very fast scratches.

After the evaluation (and unscheduled jam session), the two musicians and the reactable team suggested a number of improvements to the objects. For the main part, the suggestions involve making the interaction smoother and easier, not changing the way they are designed.

Working with the reactable has proved to be a helpful opportunity for testing how specific playing styles and musical ideas can be transferred to unfamiliar interfaces. The fast and easy means for prototyping and testing have many advantages. High latency and slow response time, determined by the frame rate and processing of the video image, might pose a problem. For manipulating techniques and patterns this was not troublesome, but for more direct manipulation of playback speed and amplitude, the instrument was as foreseen far too slow for expert performances with our implementation.

As mentioned in the Introduction, there was also a related project by Dimitrov, who connected the reactable scratch objects to physics-based models of friction sounds [9, 5]. Although not tested extensively, it was clearly possible to use friction models instead of sampled audio as sound source for scratch patterns.

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