A Multi-Touch DJ Interface with Remote Audience Feedback

Lasse Farnung Laursen[1], Masataka Goto[2], Takeo Igarashi[1]
[1]The University of Tokyo, 7-3-1 Bunkyo-ku, Hongo, Tokyo, Japan
[2]National Institute of Advanced Industrial Science and Technology (AIST), 1-1-1 Umezono, Tsukuba, Japan
gazoo@42.dk, m.goto@aist.go.jp, takeo@acm.org

ABSTRACT

Current DJ interfaces lack direct support for typical digital communication common in social media. We present a novel DJ interface for live internet broadcast performances with remote audience feedback integration. Our multi-touch interface is designed for a table top display, featuring a time-line based visualization. Two studies are presented involving seven DJs, culminating in four live broadcasts gathering and analyzing data to better understand both the DJ and audience perspective. This study is one of the first to look closer at DJs and remote audiences. We present useful insight for future interaction design between DJs and remote audiences, and interface integrated audience feedback.

Categories and Subject Descriptors

H.5.2 [**User Interfaces**]: Graphical user interfaces (GUI); H.5.5 [**Sound and Music Computing**]: Systems

Keywords

Touch Interface; Music Interface; Crowd-based Interaction;

1. INTRODUCTION

Live broadcasting of video and audio streams via services such as YouTube Live, Ustream, and Twitch.tv, has become easy and popular. This type of self-broadcasting is an attractive and natural way for disc-jockeys (DJs)[1] to remotely reach a bigger audience. Traditionally, DJs inhabit a local performance space together with their audience, often involving a significant amount of direct and indirect communication in-between them. This includes subtle visual cues, such as head nodding, smiling, dancing and even occasional verbal communication [4]. However, in the online performance space, new methods of interactions have established themselves. DJs have access to chat rooms where they can directly communicate with the audience, and in some cases even receive a video stream from individual listeners [9].

[1]In this paper we refer to radio/club DJs who play and blend multiple musical compositions sequentially, rather than a hip-hop DJ who uses turntables in a more instrumental way, via percussive scratching sounds.

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We propose a novel DJ multimedia interface that integrates state-of-the-art multi-touch table-top DJ controls with communication functions, inspired by modern social media platforms. The interface utilizes a time-line based visualization, supporting intuitive drag and drop element interaction for easy audio cueing. Time-line elements are shown in detail or aggregated, as the user zooms in or out, respectively. This allows for both an overview or in-depth look as needed. Our system supports both a planning style visualization mode, where audio elements remain static during playback, or a more dynamic visualization mode, where audio scrolls by during playback. Both modes can be switched between in real-time to suit the DJ's current mood and needs.

The supported audience feedback includes a discrete positive 'like' which signifies a fondness for a particular occurrence in the performance, detailed comments from individual audience members, and an audience size histogram. All incoming feedback is displayed along audio elements, in the DJ interface in real-time. We explore the new potential offered by fusing feedback delivered by an unseen audience directly into the multimedia interface of the DJ, shedding light on the interaction both from the perspective of the DJ and the audience.

A pilot study was conducted with volunteer DJs testing an early version of the interface, and participating in qualitative interviews. The positive response lead us to conduct four live two-hour remote broadcasts with four DJs and a volunteer remote audience providing real-time feedback via our system. We gathered quantitative feedback from the audience and conducted qualitative interviews with the DJs. Every show featured a minor, yet engaged audience, submitting feedback directly into our DJ multimedia interface. All DJs showed a strong interest in receiving this feedback during their remote performance, and some offered ideas as to how it might improve their local performances, as well.

2. RELATED WORK

Nielsen ratings form the foundation of audience feedback collection, covered by Beville [2]. However, Nielsen ratings and most of the traditional systems described by Beville are passive in nature. Feedback is evaluated posthumously and not in the context of a live performance. A more recent live audience feedback system is 'The Cinematrix Interactive Entertainment System' [3] presented at SIGGRAPH in 1991, and further expanded upon by Maynes-Aminzade et al. [7]. Although audience feedback is handled in a live context, there is no active performer involved other than the audience itself. In this regard, our work more closely resembles that of Barkhuus and Jørgensen [1]. They present the 'Cheering-Meter' used in free-style rap competitions with live performers. However, contrary to our work, Barkhuus and Jørgensen do not consider interaction with a remote audience.

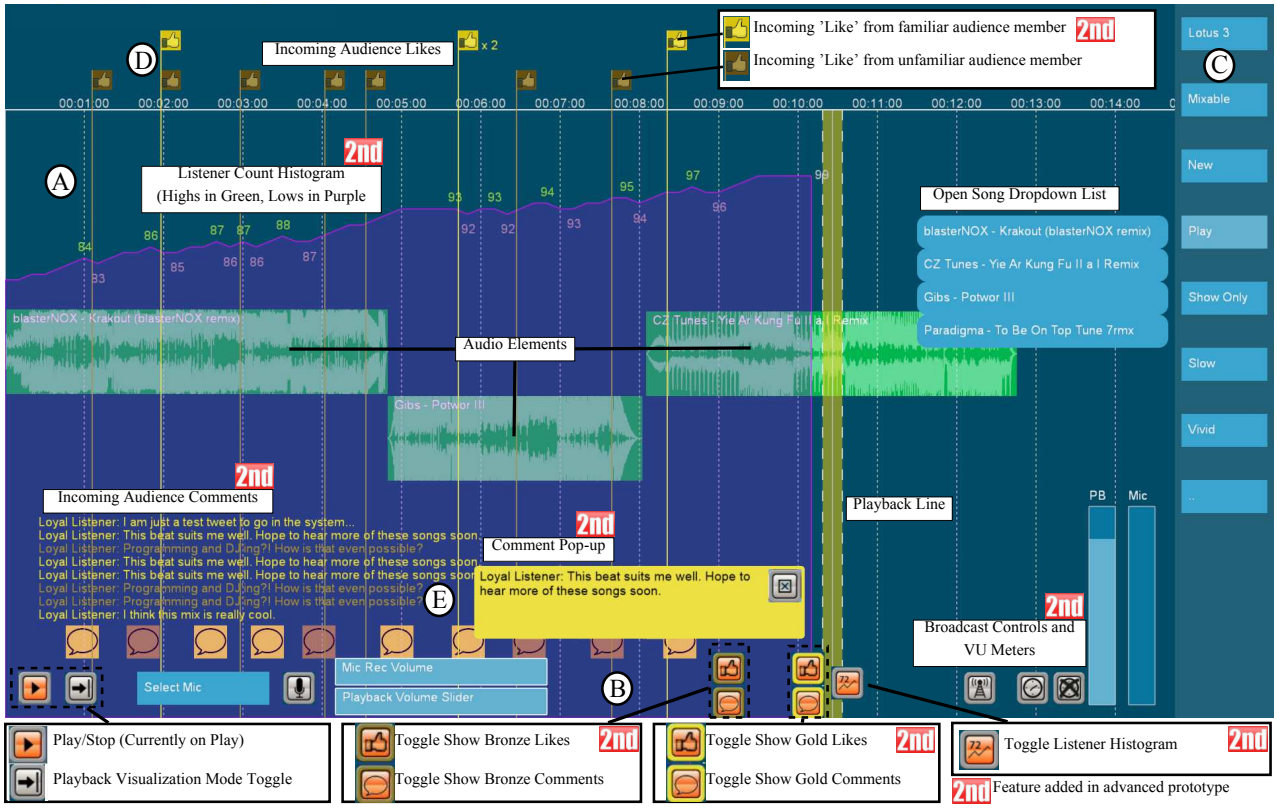

Figure 1: The advanced prototype DJ Interface. Significant additions from the early prototype interface are highlighted by the [2nd] marker.

Contemporary DJ instruments indirectly support remote audience feedback via existing online broadcasting portals. However, this feedback is presented out of context, in a separate interface, dividing the DJ's attention. Shamma et al. [9] investigate remote DJ performances on such a portal, the now defunct Yahoo! Live website. They focus on the community and social aspects of a shared online presence, rather than concrete interactions during live performances.

Gates et al. [4] analyze how DJs gain audience awareness during local performances and present a set of principals for how technology should support this activity. Their principals have influenced our design, despite the fact that their findings are based exclusively on local DJ performances.

Hook investigates interaction design for live performances [5], and provides a comprehensive look of many related live performance interfaces. However, performer-audience interaction is left as future work.

Sgouros [8] presents an interaction framework, enabling multiple users to take part in a performance either as a player or spectator and influence the outcome in real-time. This work shares conceptual similarities with ours, but focuses more on the technical aspects of the system rather than an evaluation of their users experience thereof.

Karnik et al. [6] present an ethnographic study of how DJs use social media as part of their work. In contrast to our work, their focus is exclusively on the use of social media outside of a live performance context.

A vast number of audience response systems also exist in the educational sector. It is important to note that although our work shares similarities with these types of systems, the context for our work is fundamentally different, e.g. a higher focus on cognitive workload and presentation is essential for our interface.

3. INTERFACE DESIGN

Over the course of this work, our interface was tested at two significant stages of its iterative development. Here we describe general features of the interface. Differences between the early- and advanced prototype versions are detailed further below. The advanced prototype interface is depicted in Fig. 1, with significant additions - from the early prototype - highlighted.

The interface consists of a common audio time-line visualization (referred to as the mixmap) marked Ⓐ, general playback and visualization controls at the bottom marked Ⓑ, and a set of drop-down menus for loading audio marked Ⓒ. The entire mixmap supports pinch gesture zooming for an ease of overview and/or detail. All loaded audio elements support intuitive drag-and-drop style interaction. Two modes of visualized playback are supported; static mixmap with a moving playback line, or moving mixmap with a static playback line. The former is ideal for planning ahead and setting up audio elements in advance. The latter mode of visualization is a more dynamic 'on-the-fly' style interaction mode. Switching between the two modes is possible at any time to suit the DJ's current mood and needs.

Differences between the early- and advanced prototype versions are detailed here. Changes were made to better accommodate live internet broadcasting, improve integrated audience feedback, and reflect the DJ's feedback on the early interface. In the early prototype, integrated user feedback consisted of four types of discrete feedback, which would

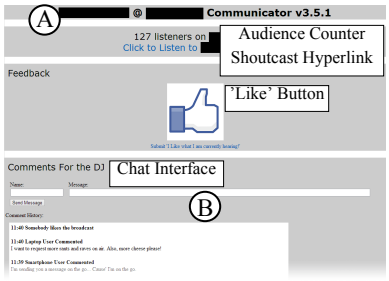

Figure 2: The web-based audience interface.

appear in the area marked Ⓓ. Audience members could send the DJ a 'like', 'dislike', 'volume up', and 'volume down' message. The advanced prototype interface simplified this feedback, retaining only the 'like' feedback, as the DJs mostly commented on its particular usefulness and were wary of overwhelming negative feedback. In accordance with the feedback obtained during the pilot study, the advanced prototype supports categorized listener feedback. Feedback from unfamiliar and familiar listeners are now distinctly displayed in bronze and gold, respectively.

To more faithfully replicate existing online self-broadcasting portals, we also chose to implement support for user comments (similar to Soundcloud) in the advanced interface, marked Ⓔ. The mixmap was also enhanced to include an integrated listener count histogram visualizing local minima and maxima. This provides the DJ a clear overview of the highs and lows of their performance, based on the size of the audience.

The advanced interface also supports feedback filtering as our pilot study indicated a strong preference for this. Audience histogram, bronze and gold 'likes' and comments can each be turned on and off as needed in real-time. The drop-down menus were also improved to enable drag-and-drop interaction, allowing users to easily drag unloaded audio on to the mixmap. Zooming was improved to aggregate discrete 'like' feedback into larger chunks, to ease the DJ's overview, as shown in Fig. 1 (where two gold likes are aggregated). Finally, the advanced interface also adds support for microphones allowing the DJs to respond to any audience feedback and further interact during a performance.

For the live broadcasts, a web-based interface was implemented to enable audience participation, shown in Fig.2. Submitting a 'Like' or a comment produces a drop-down message at the top of the page (marked Ⓐ) informing the user whether or not it was delivered successfully. Comments are submitted anonymously if the user refrains from entering a username in the interface, marked Ⓑ. During a pilot study, audience members expressed interest in viewing fellow listeners comments, which we added support for.

4. EARLY PROTOTYPE PILOT STUDY

Previous work [4, 5, 6] indicates that DJs have an innate desire to please audience members through their performance, and as a result gather both indirect and direct feedback by observing them. Although some forms of more direct feedback (e.g. song requests) are generally frowned upon. During a remote performance, however, the DJ and the audience no longer inhabit that same performance space, and almost all feedback becomes direct as a result.

To further investigate this and related issues, we conducted an in-lab local pilot study of an early prototype version of our interface with five DJs, between the ages of 26-37; four veterans each with 5 to 15 years of experience DJing live in clubs, and one newcomer.

Qualitative feedback was gathered via think-aloud usage sessions, where the DJs were encouraged to freely explore the interface. Given that the performance was not broadcast, audience feedback was simulated by an on-site researcher. Each DJ was interviewed to get insight into their perception of receiving feedback in general, and how local/remote performances differ in terms of wants/needs.

We define *local feedback*, as being traditional types of audience feedback present during a local performance (e.g. dancing, smiling, head nodding, verbal communication, etc.). *Remote feedback* is defined as digital audience feedback commonly found in modern social media (e.g. text messages, likes/dislikes, other discrete expressions of opinion).

All DJs professed a strong interest in receiving *remote feedback* during a remote performance, and merely tentatively interested in receiving it during a local performance. This is not surprising, given the lack of traditional means of feedback gathering when performing remotely. One DJ noted that he had a high interest in knowing where the feedback originated from and consequently how credible it was (random listeners vs. friends/other DJs), corroborated by Karnik et al [6]. All DJs preferred more vague *remote feedback* during a local performance (i.e. like/dislike), as opposed to precise ratings (i.e. 3/5), partially due to the already high number of distractions in a nightclub setting.

As to whether the DJs were likely to change a local performance based on *remote feedback*, some DJs stated they were likely to disregard it completely. Others valued any and all information they were given. Surprisingly, a few DJs stated they were even less likely to react to *remote feedback* during a remote performance.

Phillip Huey: *"I wouldn't do a live [remote] mix, and then get some negative feedback, and [...] just switch genres. I might do that at a [local] club."*

The DJs' opinions also varied in regards to how useful *remote feedback* was, compared to traditional *local feedback*.

Matthew Gammon: *"A like/dislike is very binary and too simple. Seeing someone dancing [...], there are so many non-verbal and verbal cues we can read off of individuals, [...]. Having a lot more to draw from, makes the interpretation easier to go through. [...] With [(likes/dislikes)] you don't know how much they like it or how much they don't like it."*

DJ Modality: *"The feedback was helpful. Particularly if I was doing an online set, that would be really useful. [The feedback] is more direct. If we use a dance floor analogy; People will leave the dance floor [due to fatigue or to get a drink,] not cause they don't like the music [...]. [...] So in that way, dancing is kind of an imprecise metric."*

Despite the fact that previous research paints a very dim view from DJs regarding direct song requests from the audience, some of our volunteers still expressed an interest in receiving them via *remote feedback*.

5. LIVE BROADCAST STUDY

We conducted a live broadcast study with four male DJs, two returning participants, between the ages of 28-33; each with 2 to 11 years of experience DJing live in clubs. Each DJ

participated in a live 2 hour internet broadcast show (airing 20:00 local time) broadcast from our lab, and acting as the proverbial host, being in control of the interface for the duration of the performance. An on-site researcher was present to aid the DJ in any issues that might arise unexpectedly, as well as setup and shutdown the broadcast. No other people were in direct attendance and the stations 'regular' audience tuned into the broadcast via the internet. Audience interaction was encouraged vocally as part of the broadcast, and access to the web-based interface was provided via general link on the internet radio homepage. Friends of the DJ were individually directed to a unique link, distinguishing them from other listeners. Interviews were conducted with each DJ both before and after the live broadcast to collect qualitative data. Audience members were asked to fill out an online survey after the conclusion of the broadcast.

We observed the DJs having a preference for the more dynamic visualization mode, as only one of them used the alternative static mode for the majority of their broadcast. Our interfaces were well received by both the audience and the DJs. Both parties frequently engaged one another for the duration of the broadcasts.

Every DJ specifically commented on the usefulness of receiving direct feedback (i.e. likes/comments), as well as indirect feedback (Nr. of listeners) during the shows.

> Mark Jackson: *"It gives you inspiration and energy. [...] It works. I was surprised."*

The DJs generally preferred comments to 'likes', noting it showed more of an effort on behalf of the audience members, and leading to more informed performance improvements.

None of the feedback was toggled off during the live broadcasts. Our observations and quantitative data, shown in Table 1, indicate that the feedback never became overwhelming, and thus required filtering. Its persistent use during broadcasts is an indicator that the DJs found it to be neither intrusive, nor annoying. Some DJs also professed an interest in receiving *remote feedback* during a local performance, although one provided a more hesitant response.

> Matthew Gammon: *"It's interesting to see how people react and what they do. Will it heavily influence what I do? I don't think so."*

One of the DJs saw a strong potential in data mining the collected *remote feedback* to learn more about the audience, even after a local performance. Karnik et al. [6] corroborate this point.

> Dj Vivid: *"It would help me understand my audience better, know what they want to hear, which could lead to better parties or sets. That's important. [...] I can see a lot of uses for that."*

Another DJ hypothesized that some audience members who would normally not provide direct *local feedback*, would be more inclined to provide *remote feedback*.

Our expectation that DJs value feedback differently depending on the origin (random listeners vs. friends/other DJs), was not strongly confirmed. Only one DJ professed an interest in distinguishing the origin.

During the shows we observed an engaged minor portion of the audience, as indicated by the gathered quantitative data in Table 1. This is consistent with social media platforms such as YouTube and Soundcloud, where the more

Day of_Show	Min	Max	Avrg	Likes (B/G)	Com. (B/G)	ALS
Sunday	96	111	104	38/4	96/28	14
Tuesday	121	152	134	13/4	84/8	7
Thursday	131	157	145	29/1	85/21	12
Sunday	94	122	104	14/15	58/52	13

Table 1: Quantitative audience data showing the day of each show, Min/Max/Average number of listeners, Nr. of likes and comments (bronze/gold respectively), and Nr. of answered listener surveys (ALS).

passive views/listens far outranks the NR. of likes/comments. Contrary to these sites, however, our audiences delivered far more comments than likes. Just like the DJs, the audience survey answers indicate comments being preferred to 'likes'. Apart from a single listener, all who participated in the surveys expressed an interest in providing the DJ with feedback. Their interest in providing a local live DJ with similar feedback was present, but less strong.

6. CONCLUSION

We performed two qualitative studies, presenting a novel multimedia DJ interface, and a closer look at how DJs perceived *local* and *remote feedback*. Our work builds upon previous research and shows a more nuanced landscape in terms of the DJs wishes/needs for this evolving technology. Every DJ showed a clear interest in receiving integrated feedback during *remote* performances. Some DJs also expressed an interest in receiving this feedback in a *local* context. We believe *local* feedback integration is most useful in situations where direct interaction with individuals is limited, such as larger concerts or festivals. Similar to Barkhuus and Jørgensen [1], we posit that the area of audience-performance interaction is ripe for further exploration.

7. ACKNOWLEDGMENTS

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