

# Spinning Online: A Case Study of Internet Broadcasting by DJs

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## ABSTRACT

Personal video streaming websites have become common on the Internet. They are increasingly used by broadcasters, bands, and entertainers as performance spaces and community gathering places for “fans”. In order to understand how such live broadcasting sites fare as venues for gigs and for the maintenance of fan communities, we studied a video streaming site that is home to a vibrant DJ community. We spent time as audience members, analyzed site usage data, interviewed and charted the online presence of DJs who perform regularly on the, and talked with the site designers about their vision for the site. We found DJs use a number of tools to maintain close connections with three communities—their peers, with sources for new music and for related show content, and with their fans. When streaming live performances, DJs use visual interface cues to gauge audience reaction and tailor their sets accordingly. DJs talked about the broadcast channel as ‘a place’, and reported close social connection with invited and regular audience members. We conclude our paper with observations regarding the nature of community involvement on performance centered webcasting sites.

## Categories and Subject Descriptors

H5.3. [Group and Organization Interfaces]: Collaborative computing, synchronous interaction.

## General Terms

Design

## Keywords

Video, music, audience, chat, broadcasting, DJs, media space, Internet, performance, live streaming, crowd-based interaction, field study.

## 1. INTRODUCTION

Internet video streaming tools are growing in popularity. Moving beyond the ‘upload and watch’ model popularized by YouTube, several websites now allow individuals to set up and broadcast publicly on Internet sites using simple webcams. Often such sites offer synchronous chat rooms alongside the streamed video content where viewers can converse with each other. While the

social interaction around synchronous and asynchronous sharing of packaged video content has been discussed within the HCI community [2], [7], the construction of live performances by broadcasters, and how communities are formed and maintained around such performances has not been discussed. Therefore, in this paper, we address the methods and practices of live Internet broadcasters, and address how they seed, grow and maintain a community of active viewers and fans.

## 1.1 Studying performance

A review of Internet video broadcasting sites reveals many different categories of performance; examples include cooking shows, home improvement demonstrations, dance performances, solo music renditions, and so on. Our interest is in the performances of DJs who have adopted streaming sites as venues for their gigs. We are interested in the ways in which DJs seed, grow and maintain a community of fans, and how they connect with those fans while performing live. For the latter issue, creating and maintaining real time connection, prior work has documented that in physical clubs, DJs are constantly alert to many cues in the construction and performance of a set; they read technical, venue and audience factors [9]. In physical club settings, the DJ’s role is to create an ambiance, and to bring people up to the dance floor or keep them happy while they sit at the bar. When performing on the Internet, DJs are entertaining people who are not immersed in the same physical performance space, and the DJ’s role in terms of initiating engagement and inviting action is very different. We are interested in understanding the nuances of managing engagement in this online setting—that is, in how DJs create and manage performances while remotely connected to their audiences. Our objective in developing insights into these community factors is to more deeply understand design opportunities for synchronous and asynchronous community connection and maintenance mechanisms for Internet-based live performance sites.

## 2. RELATED WORK

Currently, there are many webcam video streaming websites. Examples include Justin.tv, Blogtv.com, Stickam.com, UStream.tv, and Yahoo! Live. These media streaming sites differ from standard video uploading websites as they implement the broadcast streams as a potentially always-on ‘channel’, rather than offering a collection of recorded clips. Broadcast channels are often coupled with live chat features, and with additional textual and graphical material uploaded by the “owner” of the channel.

Prior research has addressed how people create and share video clips and streaming video. For example, Kirk et al. studied how people record, edit, and share video clips on various devices [12]; the streams studied were not live. Weisz et al. [23] examined how

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Figure 1. A live channel from Justin.tv with its chat room.



Figure 2. A channel from Yahoo! Live with the attached chat (to the right) and the video cam tray (on the bottom right). Chatters with video feeds appear in bold in the list to the right.

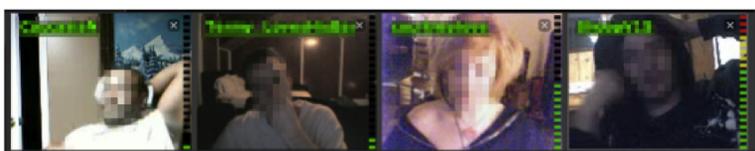


Figure 3. A detail of the video cam tray showing audio levels for each cam.

people chat while watching videos. The authors looked at the playing of recorded feeds, essentially as a non-pauseable stream, and found media were more enjoyable when people could chat with others while they watched. Shamma et al. [17] studied video sharing and social diffusion of media sharing through several synchronous watch and chat prototypes embodied in IM clients, chat rooms, and web pages. Frequent users of these systems reported an increased feeling of closeness to remote friends and family as a result of the synchronous watching experiences [18].

Regarding DJs specifically, technical support for performances is getting more sophisticated. Laptops and digital music are replacing records and CD crates. Serato Scratch LIVE [16] and Virtual DJ [22] are the two popular software choices for DJs, allowing the selection and missing of MP3 tracks on laptops using

an analog-mixing device. Both systems use special time-coded media (CDs or vinyl records) to simulate mixing on a traditional turn table.

Recent research has explored other avenues for potential DJ tools. D'Groove [3] provided multi-modal interaction for DJs. The DJammer "air-scratching" tool [19] provided a remote control for DJs to leave their booth. However, in trials, DJs felt uncomfortable leaving their setup. Barkhuus and Jørgensen [2] engaged an audience by adding a crowd meter to let viewers feel more like part of the show. A common finding is that tools that support DJs should not interfere with the integrity or intimacy created by their performances [3], [9]. These tools offer interventions that truly disrupt performance rather than those that

provide enhancement while not interfering with the practices and sensibilities of DJs.

In terms of creating connections with others through always-on video channels, much work has been carried out on the use of “media spaces” [20]. Media space research has tended to focus on creating links between physical places like offices using large displays [4], [14], or between members of an organization or a community of practice [7], [10], [21]. While the production of audience-centered, live performances has been studied in graphical worlds like Second Life (music) [1], in physical theatres (comedy) [15], and using large displays in public spaces (collaborative games), little work has been carried out on the production and maintenance of a connection between performer and their audience via web-based, video streaming sites that are designed for desktop/laptop displays. Further, while most media space work either assumes an existing community or has been designed to enable or enhance a fleeting exchange between strangers, to our knowledge there has been little focus on the development of a sense of community around a performer.

Echoing much of the research into media spaces, we are not simply interested in a usability analysis of what DJs actually “do” with webcasting technologies. Our interest is in adaptation, in reflecting on the role of the technologies, in the process of community building and in how online performances draw upon or enhance offline performances.

### 3. YAHOO! LIVE

Yahoo! Live (Y!Live) was a 10 month prototype designed to explore social webcasting. The site allows anyone with a webcam to stream live video; the live video content is shown in a window on a webpage, with an associated chat room. Set-up is easy, requiring selection of a log in name and the creation of a channel—from there broadcasting is instantly possible. The selected channel name becomes part of the chat room URL that can be shared via IM services or linked to from other pages. The video portion of the channel (except chat) can be embedded in other sites like personal web pages, MySpace profiles, etc. (see Figure 4). Unlike other sites that offer a similar service, this specific technology allows other users to join in with video chat in addition to the text chat should they wish to do so. Chatters with video feeds appear in bold in the list to the right in Figure 2. The broadcaster, as well as each user, can adjust who they want to see; selected people can be seen in a *tray* (see Figure 3). Additionally, each video feed in the tray has a volume slider that can be adjusted. Therefore, each person in the channel can mix in audio from the other people’s webcams if they choose, and thus voice chatting is possible between remote audience members while they watch a broadcast by a performer.

Regarding viewers, most found interesting channels serendipitously by browsing thumbnail pictures of the live stream from the main application home page or through personal recommendations. Channels are not indexed and therefore are not searchable and do not show up as a result of general web searches.

While it was available, Y!Live hosted a very active DJ community, in part as a result of direct promotion on the part of the sites designers and developers. To illustrate, the site designers made direct contact with several DJs nation wide and San Francisco area DJs were invited to attend the site’s launch party.

The attending DJs broadcast sets in their own channels to cover the first 24 hours of the service being live.

For our study we began with some basic use analysis, talked to the site designers and carried out participant observations where we watched DJ shows ourselves. Usage data was obtained via the Y!Live public API and reflects broadcast data between May 19<sup>th</sup> 2008 and August 2<sup>nd</sup> 2008. In this time, the number of broadcasters ranged from 2,783 to 1,245 per week. We also spoke with the site’s designers to see how they differentiated its design from static video upload sites. From this conversation, we developed an understanding of their relationship to their DJ subpopulation. It became clear the practice of DJs represented much of what the designers were trying to address and accomplish. Our own observations consisted of several hours of watching performances by selected DJs until we were familiar with the various performance styles and with the features of the site itself.

## 4. FIELD STUDY: INTERNET DJING

To discover how DJs express themselves online through live performances, and how they manage and create communities of audience members, we gathered data from four sources. We spent time in participant observation as audience members, observing DJs performing online. We spoke with the designers of an Internet video broadcasting site, Y!Live, described above, and analyzed usage and performance data from site logs. Following this, we conducted interviews with 4 DJs who broadcast frequently on Y!Live. For the purposes of this paper, we will focus on our interviews with the DJs; however, our selection of interviewees, our interview protocol and our analyses draw on the three other data sources.

### 4.1 Interviews with DJs

In order to recruit suitable participants for our study, we reviewed the basic statistics of the DJs featured on Y!Live. We identified 20 active and returning broadcaster DJs. The statistics of each DJ (number of total viewers, number of total broadcasts, and total time live) are available on their profile page. From this list, we directly contacted several DJs in the San Francisco Bay Area.

Based on this initial correspondence, we selected four DJs to interview. We selected DJs with varying styles, and with a range of broadcast numbers; our four participants represent the top, middle and bottom of the distribution of top 20 active DJs when ranked by number of broadcasts and total broadcast time. Table 1 shows the participants and their broadcasting statistics. During our 10-week sample of overall usage for these four DJs, we see an average of 9.6 viewers at any given time. This number is higher than the average of 5.5 viewers overall on the website. We also note that this average viewer count includes time when the DJ was not actually present in the channel, so it in fact represents a lower number than was usually present for live performances.

Given our interest in the DJs’ practices and the technologies they use when performing, we aimed to interview them where they perform and stream. Although all 4 DJs perform in and stream from their homes, as a result of scheduling problems, we only managed to interview two of the DJs in their homes; we interviewed one by phone and we met the fourth at our office.

**Table 1. DJ interviewees and their broadcasting statistics from February 2008 to September 2008 as collected from their public profile pages.**

DJ	Style	Live Viewers (total)	Broadcasts (total)	Time live (days)
DJ DooLow	House, Hip Hop, Reggae	16,884	126	1.7
DJ BackSide	Hip Hop, R&B	33,364	148	4.6
DJ BuzzKill	House	35,523	116	4.4
The Sly Show	Show Host	226,617	2,225	77.1

Interviews lasted between one and two hours, and were semi-structured and conversational. We reviewed their overall online presence including their video-casting activity on Y!Live as well as looked at sites that they use for social networking and/or promoting their gigs. All interviews were audiotaped and, where possible, we also videotaped them. In all cases we were given permission to use their actual DJ names in the reportage of our study. Three of the participants only play records (DooLow, BackSide, BuzzKill). The fourth participant moved from a Hip-Hop radio-style DJ to running a larger production show (The Sly Show).

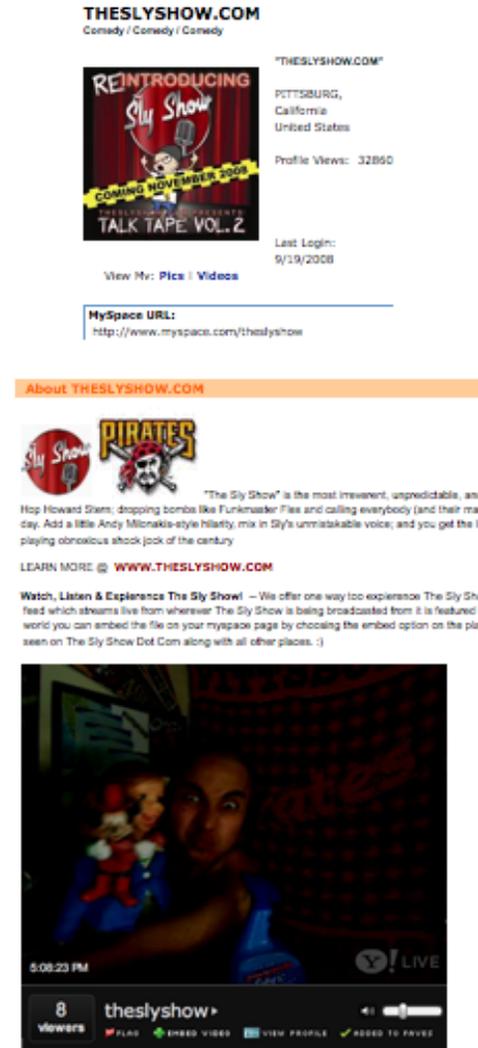
Our interview questions addressed five issues:

1. discussion and review of the features provided (or not) by Y!Live, and by other sites that the DJs had used;
2. reflections on differences and similarities of performing in a physical venue and online performing, including the issue of producing a public performance from a “private” home space;
3. how to foster, develop and maintain an in-the-moment connection with a remote audience;
4. how to foster, maintain and grow an active fan community, including promotion of upcoming gigs; and
5. the maintenance and development of their DJ craft.

## 4.2 Findings

Of the four DJs we interviewed, three, Buzzkill, Backside and Sly, were initially introduced to the Y!Live site by the designers of the site. BackSide and Sly were recruited via their MySpace pages. Backside plays shows in the San Francisco and Los Angeles area, has a monthly syndicated radio show, a daily blog updated with music, and approximately 96,000 MySpace friends on her DJ page. Prior to web video casting, Sly had an iTunes radio show. Before his iTunes radio show, he streamed his radio show from his webpage. His web page show had 2 million unique downloads. BuzzKill was recruited through a DJ discussion mailing list. Based in San Francisco, he plays casual shows and friend’s parties. None of his sets are online. DooLow, a DJ based in Oakland, began using Y!Live following a recommendation from Backside.

Sly is most active on the Y!Live site, often broadcasting at all hours of the day. The only time slot Sly did not begin a broadcast in the 10-week sample period was from 7 am to 8 am Pacific



**Figure 4. Interviewee DJ Sly’s “The Sly Show” channel embedded in a MySpace page. DJs wanted to grow and maintain a fan community, and understood the importance of maintaining a presence on multiple Internet sites and driving traffic between them using mechanisms like video embeds.**

standard time. The other DJs generally spin sets live after dark; DooLow occasionally broadcasts beginning at 1pm or 3pm for one hour. The DJs varied in the amount of preparation they did before a show, with Sly putting in most time and DooLow the most likely to improvise in the moment.

Three of the DJs play sets in clubs; the fourth DJ, Sly, runs radio-only shows. The club performing DJs use a variety of systems to play songs. When playing in physical venues, all are particular about their setups—this manifested in behaviors ranging from bringing their own needles to attach to club record players to insisting on personal laptops running highly specialized software.

The DJs discussed features offered by the live broadcasting site to interact with a remote audience. All were clear about the importance of the connection that is created with the audience. This was deemed to be the success of live streaming, and as one interviewee DJs, Sly, put it “imagine when they have like 50,000

people watching all the channels...can you imagine what's gonna happen with my show, like it's gonna be crazy man."

In the next sections we key issues that emerged from our interviews. We focus in particular on issues on the community creation and affiliation that DJs discussed, and on the ways in which the technology fosters and/or intrudes on performances and on DJ-audience connection.

#### 4.2.1 Peers, mentees and sources

All the DJs were well aware of other DJs who operate in similar areas, style-wise. We saw evidence for this in the way knowledge of Y!Live itself spread. For example, DooLow became interested when he saw BackSide broadcasting. He contacted her on MySpace:

*DooLow: I told her 'hey that was a good show you did and I'm thinking about doing the same thing' an she encouraged me with like 'yah go for it, do it and I'll come and support you and whenever, just let me know when you're on'.*

BackSide described her large circle of peers, as well as those she inspires. She regularly actively advocates DJing online:

*BackSide: It's not necessarily that I'm a leader or that people follow what I do ... I feel like there are a group of people out there that are kind of like watching what I'm doing and saying oh yeah as a DJ this path is open for me to like do Yahoo Live, and this is something new, I like this, DJs can do this. So yah I'm starting to realize that, definitely.*

All the DJs use current Internet communication technologies to make contact with other DJs, and with potential sources for fresh material and ideas for their shows. After she began webcasting, BackSide said she started to expand her online presence by blogging daily and started using Twitter. She reported that, as a DJ, her livelihood is centered on online media, in particular the search of online music. She remarked that she has access to a wealth of music that is shared for free, stating "Music is (becoming) like water. It is going to be everywhere for free; if you want it you can get it". Every now and then you will "pay for that fancy water in the bottle because you want it" but generally you can get water just about anywhere at no cost. She also follows recommendations from peers, people "in the music business" and audience members. Much of the music comes from the online collaboration with other DJs, music blogs, and some directly from record labels. She informed us that most semi-pro DJs can receive royalty free, professional music through online sites and forums supported by the artists and labels. To illustrate her points, Backside says she downloads at least 40 songs every morning—checking for new material is part of her everyday routine from which she selects the "few good tracks" for her mixes and performances.

DooLow uses several different sites to connect with other DJs. He first mentioned discovering his mixing software, VirtualDJ, from reading community forums where people gave it high praise. After obtaining a copy of VirtualDJ, he found that being active on the forums was a good way to help get answers to questions, as well as, provide answers yourself. In addition to physically hanging out with other DJs and music lovers in his local neighborhood, Doolow uses Y!Live and MySpace to connect with DJs, his peer community, and with enthusiasts in other

metropolitan areas. They provide songs, support, and venue information for traveling DJs. He reports his primary source for new music being his DJ connections on MySpace and on the Virtual DJ forum.

*DooLow: It's almost like a little fraternity. You know brotherhood of DJs.*

To find new music and get inspiration, DooLow says "I'll check with my pool" of friends and just see if someone has the track he's looking for. Differentiation also matters to the DJs we talked to. While DooLow consults his peers for music recommendations, when selecting videos to play, he uses web search, following links he finds online. He does not consult his community of DJs.

#### 4.2.2 Connecting with the fan community

The DJs all saw value in social communities on sites like MySpace and understood how MySpace friends advocate and recommend performers to new people and friend connections—and how a fan base can be established and kept informed through these means. They all understood the value of embeds and links to draw people to live performances. All interviewees reported using email distribution lists and announcements on sites advertise performances. All noted the work of this promotional activity, and requested better tools for integrated distribution.

Broadly distributed announcements are obviously a central aspect of creating a presence around which community can grow; so are reliability and regularity. The DJs understood the importance of honoring announced performances and having a regular presence when it comes to scheduling their performances—online here echoed offline. The DJs all said they would try to select a somewhat regular time to broadcast their sets, although their commitment and follow-through varied. Time slots were key. At the time of our interview, Sly was targeting the "afternoon office crowd", broadcasting weekdays from 12 pm to 5 pm; at other times, Sly would blank the video with a photo and play music to ensure his presence, even if by proxy, was persistent. Start times were more crucial for signaling reliability than ending times; DooLow scheduled a two-hour show once a week, often playing till 10 pm.

*DooLow: I had a show from like 6 to 8 that was the time on Thursday. But then depending on what how I felt, I would just run, I'd just go. If people were involved, feeling it, I'd keep going.*

BackSide had a time she would "usually" go online with sets. However, while acknowledging the importance of presence, she was non-committal; notably, Backside was the most active in terms of in-person performances. For her online broadcasting was an adjunct to her in-person career.

*BackSide: I try to do it once a week, but that's one thing that I know I didn't want to commit...I just wanted it to help what I was already doing.*

Similarly, BuzzKill chose not to stay on a strict time slot. For him, he enjoyed practicing his sets online but feared if he made it more of an obligation, it might deter his motivation to practice.

#### 4.2.3 Connecting through performance

In addition to growing the community through social networking sites, distribution lists and word of mouth recommendations, the DJs obviously connect with their listeners and fan during their

performances. These moments of synchronous connection are the most important way to fuel dedication among fans.

We observed three notable aspects of this connection creation and maintenance: the importance of activity logging mechanisms such as view counts for reading the crowd; the role and management of seeing audience members, creating eye-contact and chatting for maintaining a connection and crowd management; and the benefits and barriers of technology management. We address each of these in turn.

#### 4.2.3.1 Reading the crowd

Of the club performing DJs, they all reported their job is to bring a crowd into a bar and get people dancing. This energizes the audience, draws a buzz for the club, and drives people to the bar for drinks. This requires an artful connection with the audience and requires some awareness of the venue and its people.

*DooLow: If I'm doing a club scene, it's basically reading the crowd. Basically I'll start off playing some music and while I'm doing my thing I'm looking and I'm try to see who's giving me feedback by a head nod/foot tap. So I'll just keep going in that direction whatever style of music I'm playing then eventually if I get them to the floor, then I'll just stay with that style and I'll usually keep them there until either they get tired...*

When asked how do they accomplish this feat online, without the dance floor to see people engaging with the music, all the DJs said they used the view count meter as their dance floor.

*DooLow: Well (laughs) now that's a good one, because I look at the view meter. Because it's just like radio. It's like 'Ok' if I have 7 people and I'm trying to get say maybe 20. I'll just keep fishing around, fishing around until my hits go up. And once my hits go up and they are steady. I just stay with that.*

The view count is the sum of all the chatters in the room and any other stream watching from their videocast channel, MySpace bulletin, or blog embeds, all of which have no chat component. Notably, the number of chatters had less influence on the DJs.

With regard to seeing audience members and engaging with them through eye gaze, Y!Live was designed to actively encourage engagement between members of the audience community, as well as between the performer and the audience. This design focus is unique to Y!Live.. The broadcasters and the viewers mutually view each other in the room. It allows the DJs to see up to 4 members of their audience at a time where they can look and see if someone hand is tapping or head is nodding. All the DJs talked about peripheral monitoring of activity in this 4-image cam tray. During his how, Sly tries to elicit participation from his viewers who have their webcams turned on by inviting or goading them into playing along with various skits he runs.

*Sly: I did a bit on the show, I called it The Sly National Convention....I basically put on some glasses and I put on a suit and I acted like I was running for president. Everybody in the chat room reacted to it really well. Basically I was just acting funny, acting crazy; you know people were on the cam tray and they had little signs like it was a convention. [Holding hands in the air as if he were*

*holding a banner] They were saying 'Sly for Change'!...*

Sly commented he is planning on rallying more webcam engagement based on his past successes.

#### 4.2.3.2 Connection and crowd management through chat

All the DJs recognized the importance of the chat as a valuable mechanism to connect with their audience. However, all were clear about the delicate balance between focusing on selecting, cuing and playing music and being distracted by a chat conversation. Aside from requests, BuzzKill and DooLow said they would routinely turn off the chat so they can focus on themselves and the music. DooLow uses the chat to take requests or catch up with his audience only between songs:

*DooLow: Yeah, because you figure I got a couple of minutes before songs, so I'll do it, I'll take a question or two or whatever.*

In addition to the distraction chat causes when requests are being posted, BackSide, DooLow, and Sly all cited problems with the chat being filled by spam and offensive content. While in physical clubs DJs need not be concerned with policing offensive behavior that can spoil the experience of the whole audience, online live performances require the careful management of 'crowd' behavior as well as the performing of the set. BackSide commented the problem is so severe that it would hinder her ability to continue to use Y!Live:

*BackSide: They'll go and they'll be racist and all sorts of stuff and just spam the room over and over again. And like, by the time you see it and you go, you know say I'm DJing say I'm mixing a record and I go back into the chat room to say hi and and I see all this spam and all this lame stuff and I see who wrote it and I go over to the names to ban 'em or kick 'em or whatever and they might already be gone...I cant necessarily be looking at the chat screen 24/7 and DJing. I just can't do it.*

While DJing, often she may not be looking at the channel window for several minutes while she's mixing tracks. This is just long enough for an abuser to enter the channel, do damage, and leave before she can see the chat window. To combat this problem, she engaged a moderator to watch the chat and take action as needed. In discussing the features of Y!Live with us, she suggested a technical solution that would help her create the 'right' atmosphere in the chat: allowing her to grant special access to selected and enabling them to ban offensive chatters.

DooLow said he enjoys having friends and fans in the chat room, and again, he talked of banning offensive chatters from his room:

*DooLow: You know you got those flakes out there that wanna come and make the fat jokes and the racist comments and you know I just hit the kick and ban and keep on going.*

Clearly illustrating that different communities have different norms and forms of governance, Sly had a different perspective that reflected the nature of his show. Given his format of 'hip hop + shock jock', he realizes part of what he will attract is offensive people. While he does not agree with racist or vulgar comments, he does let them slide as he feels it is part of the act:

*Sly: It's a show, you know it's like going to a comedy show. You go to any type of comedy show...you have hecklers...I say things and I do things to get to people for them to heckle. It interacts people. I don't wanna be up there it's just not my style, I like to get people going.*

Typically, Sly will talk about controversial news and events and invite people to leave chat comments to start conversations in the channel.

#### 4.2.3.3 Technology as performance facilitator and connection barrier

With regard to technology management, DJs are comfortable mixing multiple audio and video sources; all saw this as a central part of their craft. However, to use webstreaming software, DJs have to make a choice to either run a direct line with their mixed audio performance or use a microphone to pick up the audio over the air. All of our interviewees preferred to run a direct line from their laptop to the web application; we were told that this guarantees the highest audio quality possible, and that playing into an external microphone produced very poor quality audio. However, running a direct line means not having a microphone, which effectively bars being able to speak to the audience. Therefore, sometimes the DJs would unplug the line in from the mixing deck and speak into the laptop's microphone (over the playing audio, reducing the music audio quality but allowing for direct, synchronous communication. As a result, most of the DJs ended up resorting to running a microphone into their board and mixing its volume over the music. We note that the process for diverting a laptop's built in microphone to line in is not trivial, yet none of the DJs reported any issues regarding routing the audio. It does however mean careful mixing is part of the ongoing practice of performance production; multitasking can mean disengagement from the audience, so DJs are constantly managing where their focus should be placed.

All of the participants positioned the webcam on themselves or the record decks. A clear aesthetic was expressed: an ideal framing of the video would show part of the decks and part of them. We note most webcams do not have the angle or mobility for such an arrangement, especially the cams built into laptop screens. Using an external webcam, BuzzKill arranges his lighting and camera angle to create the optimal picture for his viewers.

Two DJs would use special software and filters to overlay other videos, graphics, or text onto their video screen. DooLow switches his video stream to show audio visualizations or music videos from his computer while he plays the web-cam in a picture-in-picture format. He reports this drives his view count up, which he attributes to the content of the music videos.

*DooLow: What I wanted to do I wanted to show the video aspects of the song so I had like video in the box and I was showing the video and there was like some scantily clad, they weren't nude, just scantily clad women...and in that 3 minutes I went from like 5 people to like 20. I mean the room just. And it was just all guys.*

Sly almost always has a text banner overlaid on his video and often adds other graphics and icons (Figure 5). He says "Consistency is the core key to success," so he tries to incorporate his video into a more 'professional' style with logo overlays as seen on broadcast TV. He believes the combination of show



**Figure 5. On The Sly Show, Sly often overlays text banners, a station bug (logo in the lower right side), and event graphics (the USA flag in this example).**

production and community growth will lead to his show's eventual mass appeal and to successful revenue generation through advertising deals.

#### 4.2.4 The DJ channel as a place

Following from the idea that DJs create ambiance by managing audience actions and interactions, we got a strong sense of connection to the Y!Live channel. The DJs considered Y!Live to be part of their DJ presence in the world, and their channel to be their home 'venue'.

Three had active MySpace pages (Backside, Doolow, Sly); three had websites (Backside, Buzzkill, Sly). However, all described online channel as something they own, a 'place' where they can invite people, where they can dictate behavioral norms and where they can set the tone for the music and conversation. Audience members are seen as guests; this introduces a different dynamic than that offered when inviting someone to see an in-person, physical show. DJs determined what to play and how interactive to be, and contrasted this to a club where they play to the format specified by the venue. BuzzKill in particular noted as sense of freedom to experiment:

*BuzzKill: but with Live I just play whatever I want to play and that's where I get a lot of the inspiration like "Oh that was amazing." And I'll write it down, I have a book, and I'll write it down and then I know these two tracks go really well together.*

BackSide also enjoyed the ability to do whatever she wanted to in her channel.

*Backside: Well on Live I can do whatever I want. Cuz I do have an audience to cater to but I really don't. It like all of the people that are watching me they are coming into my room. This is my domicile. I'm gonna play what I want right now; what I'm feeling. If you're not feeling it, get out of the chat room. That's how I feel about it. I'm bringing you the show. I'm bringing you the situation.*

By contrast, DooLow did feel somewhat obligated to keep his view count up, and sometimes he selected music to play that was not his primary choice:

*DooLow: I guess they don't think black guys do house music. (laughs) I dunno. But I'll have a low count. But if I switch to Hip Hop or some real rough hip hop or some reggae, it will go up. Because I don't think there's a lot of DJs that do Reggae. But I try to touch them all.*

The freedom of experimentation also matched what the design usage of Y!Live. Prior to the sites launch, the designers interviewed six DJs and found the DJs interested in using a webcasting environment for practicing their sets as it gives them an interactive audience. A DJ rehearsing is generally a solo act, opposed to a band that rehearses as a group. The concept of having an audience during rehearsal was appealing to the DJs. From these interviews, the designers developed an understanding of the tool's relationship to the DJ subpopulation. The practice of DJs represents much of what the site's designers were trying to address.

Sly's preference for keeping music running all the time, even when he is not in the room also reflected a notion on personal place.

*Sly: It acts as the Sly Show channel. That's where The Sly Show channel comes into play. Because people are coming, were not on live, but it's a place for people to gather and for people to meet. Ok, it's like 'he has good music, he's not on live, but this is a place that people could come too.'*

People congregate in places even if there is no "host" or focal activity. Sly expressed that he felt "responsible" for providing entertainment for people visiting his channel, even if he was not there; this continuity was seen as essential for promotion of his personal 'brand', and perhaps also derives from his radio-inspired model of web streaming.

As part of their sense of ownership of the channel, the DJs had clear ideas about redesigns that would enable different kinds of connection between audience members, and between them and their audience. DooLow said many of his viewers use his channel as a voice chat room. Since a viewer can pick who is in their cam tray and mix the audio levels, many viewers will join in and add the audio from their friends and talk. He recognized the value of this for his channel and would like to see the ability to broadcast audio without a video camera (currently Y!Live requires a video source be present)—to essentially create an "audio space".

Sly commented about needing more flexibility in the page layout and the cam tray. One example was that he would like the ability to put someone else's video in his viewers' cam tray; while running his Sly National Campaign, he wanted to showcase his viewers with "Sly For President" banners. All commented that more flexibility with the current audience views (the 4 images in the cam tray) would also allow for greater connection, and more flexibility for social interaction design. Finally, while much discussion centered around recording of Y!Live performances, which Y!Live did not support, the main motivation for this was to keep content streaming on the channel when it is not live, *not* to record sessions for later review or to share in other venues/settings. However, all the DJs interviewed believed that recorded shows available on a channel page would make for a greater sense of place—recorded shows would act as social proxies—stand-ins, around which fans could chat until the DJs were again available to perform live.

## 5. DISCUSSION

Our results show that a webstreaming site like Y!Live can act as a central place within the ecology of Internet resources that are used by DJs, a crossroads, where performances take place and where DJs can create a persistent presence. Because DJs can connect live, in real time with audience members, with friends, peers and mentees and with people from the music business, the site offers a vibrant alternative to classic social networking sites that support asynchronous interactions and promotional material distribution. Thus, this technology plays a role in the creation and maintenance of communities around the character of the DJ, and, in turn, those connections help DJs hone their craft.

In terms of the performances themselves, DJs artfully use feedback to drive their performances; they use the features that are available in the interface in order to gauge how people are reacting to their performances. They use music, the chat facilities and the potential for eye-gaze with audience members to engage the crowd further. More specifically, view counts, number and activity of the chatters, visible actions of viewers with cameras all work to give the DJs feedback about their performance and feed into what they do next. The role of chat in supporting social connection and relationship building has been studied for some time [6]. We observed how small cues offer a connection between the DJ and their audience; these cues correspond to elements of what Erickson and Kellogg call "socially translucent systems":

"socially translucent systems"...have three characteristics—visibility, awareness, and accountability—which enable people to draw upon their social experience and expertise to structure their interactions with one another. [8]

In accord with this analogy between the physical world and the web-mediated world, all of the DJs believed their current view count to be analogous to the dance floor at a club; that is, more viewers equated to more attention/engagement.

While DJs work to achieve a connection using these "minimalist visualizations", we also observed that there are opportunities to design features that allow a deeper sense of co-presence between audience members. While all of the DJs predicted live broadcasting is something they should address as they advanced their DJ careers, they sought to connect with their audience in ways the Y!Live and other webcasting sites did not support.

The channels became something they all took pride in, and the DJs were concerned about the experience design issues related to their new broadcasting medium. All noted issues with multitasking - managing the technology while also maintaining connection with the audience. Further, there was discussion of redundant, "distracting" information on screen, a call for more screen real estate for the camera views. It was clear that audience management tools were also needed - having the ability to assign channel moderators (who can ban people from the room) would police activities during performances, and send clear messages about sanctioned behaviors and community norms.

The DJs felt ownership of their channels, describing channels as places; this kind of ascription of place to a web location has been noted elsewhere and is intimately linked to the sociality people experience there [11]. The DJs felt they had the right to use the features in their own ways to create their own brand of intimacy and connection with the crowd in their places. This was contrasted with performing in a live venue; DJs reported feeling more

constrained in live venues by the crowd, the venue management and style, and the time.

In addition to the maintenance of a sense of engagement online and at live events, the route to being a successful or cult DJ involves self-promotion between live events. Rising DJs and their agents spend considerable time on seeding, growing and maintaining an active community of fans. Activities include the production and dissemination of a calendar of upcoming events, advertising of branded merchandise and the grooming of relationships with key, influential individuals at clubs and in social circles [5]. All 4 interviewed DJs carefully examine their traffic and fans' movement between Y!Live channels or from MySpace to their Y!Live channel. All 4 also complained about the lack of facilities for social networking, emailing and time/calendar management that the site offered.

We quickly discovered three communities that are important to the DJs, with whom they want to maintain reliable and consistent connection: the audience/fan community, their peers, and sources for new music and related content (which overlaps significantly with the peer community but includes friends and people in the music business). Each community has its own place in the DJs' activities and has particular flavour of interactions. The DJ's peer group provides inspiration, connections and information; DJs talk to other performers to find gigs, discover music, and trouble shoot equipment. They seek out peers to discuss experiences and to create shared experiences. DJs seek out people who are good sources of new music and fresh content, including connections at music labels and live venue agents. Audience connection requires sensing what an audience responds to, ensuring a regular and reliable calendar of activities and promoting offline performances; they also work to let audience members know that they understand what they want to see or hear and that their requests are going to be fulfilled. The DJs knew the competition for attracting viewers is difficult. They were also very much aware of catching attention of people passing by either the Y!Live's 'featured channels' on the home page or their MySpace page's or blog's embedded videocast. It was clear that there is much space for better audience management tools, better communication and address book tools, better calendaring facilities and some facility for recording and creating content to enable social presence beyond synchronous connection.

Much of what the online DJs discussed in our study is congruent with prior field research on DJ practices. Gates, Subramanian, and Gutwin [9] conducted a study of DJs in urban centers in Canada. Their DJs commented about watching the dance floor but playing to the entire club. Our findings were somewhat similar. While the DJs would play to the activity of their room (viewers and chats) the overall view count (a.k.a. the club or channel) remained of the most importance. Gates et al.'s DJs also remarked about a club dynamic of people cycling through the club's closed ecosystem: dance floor to bar to bathroom and back to dance floor. Online cycling differs from this. People may leave the browser window open but to the side or minimize it as they surf the web or walk away from the computer. Note as long as the Y!Live page is open, the viewer can still hear the music. Digital cycling through webpages and applications tends not to affect the view count and hence has a different effect on the DJ and their performance.

The motivations of the DJ's performance were tightly aligned with the DJ's ownership of his or her channel. This ownership and sense of "home place" made most broadcasts feel more like practice with an audience as opposed to being hired to play a

venue. This affords the DJ room to express themselves and not feel as if they are tied to a specific venue or crowd. As a result, unlike the DJs in Gates et al.'s study, none of the pure music DJs we interviewed spent much time on preparation work before a show. Gates et al.'s study concludes with several design implications. One of the implications is as follows:

[DJs] are already very busy, so new technologies must allow them to spend more time on the creative tasks associating with DJing rather than using complicated new equipment. [9] (p78)

Our findings suggest technological tasks are commensurate with the practice of DJing will not be disruptive to their performance. Audio mixing, music selection and talking to the audience are manageable. This is because the DJs familiarity with to mixing audio (and video) provides an entry point for the introduction of adding another element in the chain of devices that sits between the vinyl records and the audience. By contrast, managing abuse in a chat stream is not manageable. We note that this was not technical difficulty, but social difficulty, for which technical design solutions can be implemented.

## 6. SUMMARY AND CONCLUSIONS

In this paper we have addressed the ways in which DJs have adopted one webcasting technology, Yahoo! Live, and how this technology fits into the ecosystem of their online presence. We discussed how the technology is used to create and maintain connections with three overlapping communities: with peers, with mentees, friends and sources of materials, and with audience members or 'fans'. We discussed details of how the DJs are adapting their practices around planning and performance of gigs for remote audience members.

Although prior studies of DJs in clubs have found technology to be problematic to integrate into physical performances, we have found that that webcasting technology appears to fit closely within existing DJ practices, drawing on an established skill set of mixing audio and video streams. We believe this lies behind the apparent easy adoption of the technology by DJs and their stated beliefs that live Internet broadcasting is a natural extension of their ability to express themselves and comfortably reach a broader audience.

However, we also found that the creation of a connection between DJs and their communities during and between performances could be far better served. Therefore, we have outlined and illustrated a number possibilities and opportunities for future technological development—both at the application feature level and at the infrastructure level for webcasting technologies to make them more effective performance production, audience construction and community building tools.

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## 8. REFERENCES

- [1] Andrews, R. 2006. Second Life Rocks (Literally). *Wired News*. <http://www.wired.com/techbiz/it/news/2006/08/71593>

- [2] Barkhuus, L. and Jørgensen, T. 2008. Engaging the crowd: studies of audience-performer interaction. *CHI '08 Extended Abstracts on Human Factors in Computing Systems*. ACM, New York, NY, 2925–2930.
- [3] Beamish, T., Maclean, K., and Fels, S. 2004. Manipulating music: multimodal interaction for DJs. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '04. ACM, New York, NY, 327–334.
- [4] Bly, S., Harrison, S., and Irwin, S. Media spaces: Bringing people together in a video, audio, and computing environment. *Communications of the ACM*, 36 (1), 28–47, 1993.
- [5] Brewster, B. and Broughton, F. *Last Night a DJ Save My Life: The History of the Disc Jockey*. New York: Grove Press. 1999.
- [6] Churchill, E. F. and Bly, S. A. It's All in the Words: Supporting Work Activities with Lightweight Tools. SIGGROUP Conference on Supporting Group Work 1999 New York: ACM. pp. 40-49.
- [7] Curtis, P., Dixon, M., Frederick, R., and Nichols, D. A. 1995. The Jupiter audio/video architecture: secure multimedia in network places. In *Proceedings of the Third ACM international Conference on Multimedia*. MULTIMEDIA '95. ACM, New York, NY, 79-90.
- [8] Erickson, T. and Kellogg, W. A. 2000. Social translucence: an approach to designing systems that support social processes. *ACM Trans. Computer-Human Interaction* 7, 1 (Mar. 2000), 59–83.
- [9] Gates, C., Subramanian, S., and Gutwin, C. 2006. DJs' perspectives on interaction and awareness in nightclubs. In *Proceedings of the 6th Conference on Designing Interactive Systems*. DIS '06. ACM, New York, NY, 70–79.
- [10] Gaver, W., Moran, T., MacLean, A., Lovstrand, L., Dourish, P., Carter, K., and Buxton, W. Realizing a Video Environment: EuroPARC's RAVE System. *Proceedings of ACM CHI'92 Conference on Human Factors in Computing Systems*, pp.27–35, May 3–7, 1992.
- [11] Jones, R. and Ortlieb, M. 2006. Online Place and Person-Making: Matters of the Heart and Self-Expression. *Proceedings of Ethnographic Praxis in Corporations*, 2006: 214–228
- [12] Kirk, D., Sellen, A., Harper, R., and Wood, K. 2007. Understanding Videowork. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '07. ACM, New York, NY, 61–70.
- [13] O'Hara, K., Glancy, M., and Robertshaw, S. 2008. Understanding collective play in an urban screen game. In *Proceedings of the ACM 2008 Conference on Computer Supported Cooperative Work*. CSCW '08. ACM, New York, NY, 67–76.
- [14] Harrison, S. (Ed) 2009. *Media Spaces: 20+ Years of Mediated Life*. London, UK: Springer-Verlag.
- [15] Rutter, J. 1997. 'Stand-up as Interaction: Performance and Audience in Comedy Venues' PhD Thesis, University of Salford.
- [16] Serato Scratch LIVE by RANE <http://www.scratchlive.net/>
- [17] Shamma, D. A., Bastea-Forte, M., Joubert, N., and Liu, Y. 2008. Enhancing online personal connections through the synchronized sharing of online video. In *CHI '08 Extended Abstracts on Human Factors in Computing Systems*. CHI '08. ACM, New York, NY, 2931–2936.
- [18] Shamma, D. A., Liu, Y. 2009. “Zync with Me: Synchronized Sharing of Video through Instant Messaging,” *Social Interactive Television: Immersive Shared Experiences and Perspectives* Ed. Pablo Cesar, David Geerts, Konstantinos Chorianopoulos, Social, Information Science Reference, IGI Global, 2009
- [19] Slayden, A., Spasojevic, M., Hans, M., and Smith, M. 2005. The DJammer: "air-scratching" and freeing the DJ to join the party. In *CHI '05 Extended Abstracts on Human Factors in Computing Systems*. CHI '05. ACM, New York, NY, 1789–1792.
- [20] Stults, R. 1986. Media space. Xerox PARC technical report.
- [21] Tang, J. C., Isaacs, E. A., and Rua, M. 1994. Supporting distributed groups with a Montage of lightweight interactions. In *Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work*. CSCW '94. ACM, New York, NY, 23–34.
- [22] Virtual DJ <http://www.virtualdj.com/>
- [23] Weisz, J. D., Kiesler, S., Zhang, H., Ren, Y., Kraut, R. E., and Konstan, J. A. 2007. Watching together: integrating text chat with video. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '07. ACM, New York, NY, 877–886