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TuneTracker: Tensions in the Surveillance of Traditional Music

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ABSTRACT

We describe the design and deployment of the first system ever to dynamically track and publish records of folk music playing. TuneTracker is a software system that has been, at time of writing, deployed at a pub in Dublin, Ireland for five months. It captures, stores, and posts the names of tunes played in Irish traditional music sessions on a public website. This paper makes two contributions: (1) drawing from a two year ethnographic study of trad musicians, it details the design and development of a system to track and publish traditional musicians' practices while respecting the ethos of tradition, and (2) it presents a discussion of professional musicians' reactions to having their music practices surveilled. This latter fieldwork revealed divergent viewpoints on the effect that TuneTracker would have on local sessions and the process of tradition.

Author Keywords

Folk music; Irish traditional music; ubiquitous computing; surveillance; ethics; ethnomusicology

ACM Classification Keywords

H.5.5 Information Interfaces and Presentation (e.g., HCI): Sound and Music Computing

INTRODUCTION

Though labeled “Irish”, Irish traditional (trad) music is a global phenomenon [19]. In pubs, houses, and festivals around the world, musicians meet to play traditional tunes together in sessions. Outwardly, these gatherings look like egalitarian jam sessions where musicians from all walks of life gather to improvise and—as if by magic—create music together. In fact, as past work attests, music playing in an Irish session is tightly structured and follows a strict moral order [6, 2]. In the past, sessions were a rich training ground for budding musicians to learn the tradition—the practice of listening, playing, and sharing tunes with each other [21]. Seasoned traditional musicians regard sessions not only as places for performance, but as loci for active practice. Active practice reinforces the *trad ethos* of tunes as flexible, ambiguous,

and social [21]. Tunes aren't just about the notes but about one's relationship with people, places, and events.

When first encountering the session, the most daunting task for beginner traditional musicians is the sheer number of tunes everyone seems to know by heart (sheet music is frowned upon in sessions). However, modern information technologies have transformed the landscape of traditional music. Those without the luxury of Irish trad musicians, lessons, or sessions nearby can now easily access a myriad of online videos, audio archives, and sheet music repositories. Instead of relying on local musicians handing down traditional music, today's amateur can strategically learn from an assemblage of media sources [23]. Today's trad musician, regardless of his or her locale, now has unprecedented access to information on Irish tunes.

Yet, to many, this “fast-track” is a head-on collision with tradition. This new breed of traditional musician may have a rigid concept of the “notes” of a tune. This new musician may be too focused on technical dexterity. He or she may disregard the social aspects of tunes that make the session a joy for many. The mystery and unpredictability of trad music is lost when every performance may become digitized, recorded, and publicly available.

On one hand, there is no doubt that information technologies have made trad music more popular and accessible for amateurs. On the other hand, such artifacts may threaten the ethos of traditional music. In this paper, drawing from a two-year ethnography in Ireland [21], we describe our attempt to balance these two concerns in creating and deploying a system called TuneTracker.

This paper makes two contributions:

1. We describe the motivation and design of TuneTracker for the *surveillance* of tradition. TuneTracker continuously and automatically recognizes the tunes' names played in a session and posts them publicly to a website. It makes visible a historical and precise record (e.g., longitudinal statistics) of tune playing practices, the changing repertoire of a session. At the same time, TuneTracker seeks to respect the privacy of musicians by not recording or streaming any actual audio.
2. Based on a deployment for five months in Dublin, Ireland at The Cobblestone pub, we describe how professional players regard TuneTracker as controversial. The musicians' responses reveal a divergence of opinion: on one

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hand, TuneTracker powerfully undermines the process and ethos of tradition by presenting false “facts” about Irish music; on the other hand, TuneTracker provides an unprecedented, dynamic representation of current tune playing practices, facilitating the process of tradition for all groups of players.

TuneTracker was designed to benefit both amateur and seasoned trad musicians. Amateurs can intelligently practice certain (e.g., most popular) tunes in a session. Professionals will be able to reflect on the repertoire of their sessions. Yet, TuneTracker is also an academic exercise in intervention—an artifact meant to probe and elicit design problems in a new domain: surveillance of tradition. Here, our use of the word surveillance is deliberate. We emphasize that our deployment of TuneTracker is precisely to examine whether instrumentation of traditional and folk arts is and should be possible.

PRIMER ON IRISH TRADITIONAL MUSIC

To set the stage, we describe an Irish traditional music *session*. A session is a gathering of musicians in a public space to play Irish music together. Musicians play sets of tunes in a session. A set is two or three tunes played in succession without a pause. Tunes in a set usually have the same meter/rhythm (e.g., jig, barndance, hornpipe, polka, slide, or reel). Each tune in a set is repeated three times in a row. In turn, most tunes have an A and B part, both of which are repeated twice. The musician who starts a tune is usually expected to lead by choosing what tunes follow one after another (thus forming a set). Tunes are played in unison with limited melodic variation. Melody is prioritized but harmonic or percussive backing by guitar/bouzouki or bodhrán (an Irish drum) is also found. In Dublin, Ireland (and in the site of TuneTracker’s deployment, The Cobblestone pub), a common practice is to have sessions lead by paid *anchor musicians* (professional musicians) to ensure that there is (1) always music playing during the allotted time and (2) a minimum standard of playing. Sessions in Dublin do not use sheet music. For more details, Foy [10] provides a good introduction to trad session etiquette. Both authors play Irish traditional music and regularly participate in sessions—one is a beginner and the other is an advanced player of the Irish flute.

TUNETRACKER

TuneTracker is motivated by a two year ethnography of trad musicians in Ireland examining the role of technology in learning the tradition [21]. That field work showed that a common barrier today’s amateur musician faces is a misunderstanding of how one ought to properly find and integrate various *representations* of a tune [17]. A useful perspective into the process of making music in the Irish tradition was found through a theory of literary criticism called the aesthetics of reception [13, 12]. It argues that a *literary work*, a work of value to the written canon, is only brought into existence in a virtual space where the reader’s horizon (meaning “background” in the Heideggerian sense) and the horizon within which the text appears merge. In other words, the act of reading involves considerable effort between the reader and text to successfully create art. For example, a trad musician that

blindly reads sheet music without seeing the text’s possibilities for improvisation would create boring art. Proficient trad musicians know that tunes are not simply notes on a piece of sheet music but rather a process in tradition that is social, collaborative, and collocated. To form a tune that is aesthetically worthwhile, they must intelligently amalgamate various representations (e.g., audio recordings, YouTube clips, and transcriptions) together in the context of the history of tune playing in a locally situated session. Beginners, however, may face difficulty reconciling representations and finding proper representations (e.g., a good version of a tune to learn from).

Drawing from these findings, we developed TuneTracker to create a more nuanced *representation of tradition* for musicians of all skill levels. While one can find audio/video clips of players and sheet music for tunes, there is no central resource for dynamically capturing the playing practices of musicians in a local session. TuneTracker surveils tradition, providing a real-time view of the history of playing in a session. TuneTracker is a step towards supporting the aesthetics of reception while attempting to respect the ethos of traditional music. TuneTracker has been deployed for five months in what is arguably the most popular pub for traditional music in Dublin, Ireland, The Cobblestone. From the onset, our intention was to both provide a tool, not a replacement for the tradition, to allow traditional music to be more inclusive. Yet, we acknowledge that the degree of data collection made possible by TuneTracker is unprecedented in the history of folk music. For some, TuneTracker may not merely track but surveil music practices. We will now describe the design and features of TuneTracker.

Respecting Privacy

Traditional music is a collaborative affair. Yet, musicians are very cognizant of the disruptive nature of technology. Fieldwork showed that many musicians were weary of “tapestorms” who did excessive recording of sessions, especially if they did so without asking for permission. Musicians were afraid of where the resultant recording would end up (e.g., YouTube). However, most musicians were happy to allow recordings for the sake of private pedagogy when asked—one might record a tune in a session to later learn at home. This was a common practice of sessions in Dublin and considered an essential part of the training needed to become a trad musician. TuneTracker was designed to respect the privacy of the musicians in a session.

First, TuneTracker is physically situated in a visually unobtrusive space. Figure 1 shows the system’s placement. TuneTracker is installed on a notebook computer. A mixer board is placed on top with a flexible microphone stand drooped towards the musicians’ area. While we have instrumented a pub, the system itself is not in the usual public’s line of vision.

Second, we have designed TuneTracker to only run when necessary. Since the Cobblestone has prefixed times for when its sessions run, TuneTracker “sleeps” when there is no music scheduled. However, even in sessions, music is not played continuously—musicians take breaks between sets to chat, or someone may sing an Irish air. Thus, TuneTracker also



Figure 1. Left: The musicians' area, Right: TuneTracker is deployed near the ceiling with its microphone directed towards the musicians.

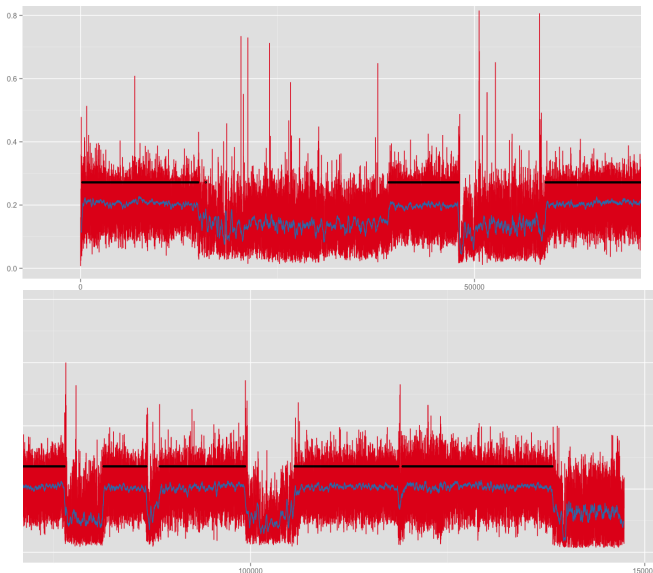


Figure 2. Discriminating between music (black lines) and chatter.

tries its best to automatically discern whether people are playing music in a session. While there is no research focusing on our particular domain of trad music, Panagiotakis and Tziritas [16] have surveyed the speech and music discrimination problem. We took advantage of the fact that music and speech have very different pitch patterns. In particular, the rate at which pitch changes in traditional music is considerably faster than in speech or general chatter (i.e., white noise). The rate of change can be measured via the spectral flux (also called the spectral difference) which measures the Euclidean distance between the power spectrum of the current frame with the previous frame [1]. Based on the field testing in sessions around Dublin, TuneTracker is configured to record audio with 44100Hz sample rate, 1 channel, 16 bits per sample, and calculates the power spectrum via FFT with a window size of 2048 samples. The magnitude of spectral fluxes becomes easier to discriminate if we calculate a moving average of approximately 86 spectral fluxes (approximately two seconds worth of data). We use expectation-maximization to classify audio as either being music or not (a 80% probability threshold). Because every pub has different

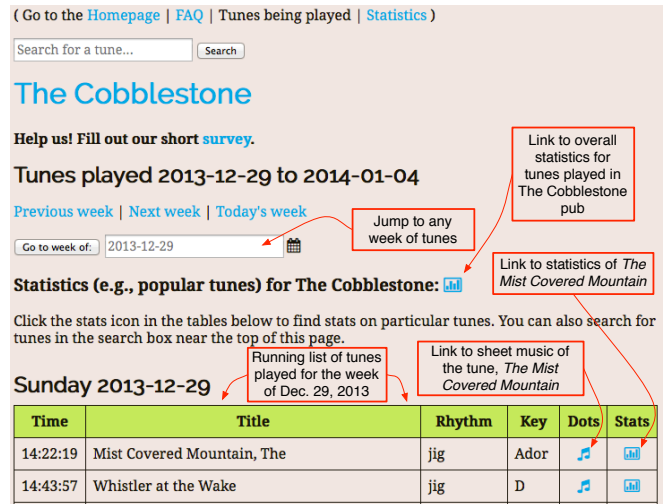


Figure 3. Web interface for browsing tunes.

acoustic properties, TuneTracker needs to be calibrated at the site of interest with audio that contains both music and other noise. The scope of the paper does not allow a full length description of our algorithm, but, to illustrate, Figure 2 shows a rolling average (blue) of spectral fluxes (red) for a 1 hr 45 min recording of a session in a pub. As the graph depicts, there is a clear distinction between music (higher fluxes, less variability) and chatter. The black bars indicate when the algorithm believes there is music playing. Based on 5 hours of recorded session data, TuneTracker was able to consistently discern when music is being played.

Finally, TuneTracker only stores the tunes' names. Once an attempt to recognize the tune's name is made, any audio in volatile memory is discarded. We make this clear in a FAQ page of the TuneTracker website.

Seeing the History of Tune Practices

TuneTracker's main feature is to create an online archive of tune playing practices. TuneTracker's tune recognition algorithm is based on Tunepal's, the most popular mobile app for Irish traditional musicians [7]. TuneTracker runs the Tunepal algorithm three times (sampling 12 seconds of audio each time), and if there is majority vote for a particular tune name, it will save the tune playing record in its database and post it on the website. It is difficult to predict the overall accuracy of tune recognition with TuneTracker because music and noise levels depend heavily on the number of musicians and pub patrons. The first author sat in two sessions and manually notated each tune played and compared it with the TuneTracker record. The first session had 3 tunes misidentified, 31 tunes correctly recognized, and 40 tunes missed. The second session had 2 tunes misidentified, 22 tunes correctly recognized, and 37 tunes missed. The causes for missed tunes are noise levels (loud conversations and laughing) and the tune corpus was lacking the tunes which TuneTracker uses to compare its transcription with (the tune corpus we used had a lack of certain kinds of tunes—slides, polkas, barndances, and horn-pipes). Misidentification occurs when TuneTracker happens to match the tune with another tune that has a phrase with

Mist Covered Mountain, The Search by title

Transcription: id:hn-jig-42
Discography: De Dannan: Mist Covered Mountain
Martin Hayes

Figure 4. Transcription (via Tunepal’s webpage) of a tune.

Lilting Banshee, The	jig	Ador		38
Mist Covered Mountain, The	jig	Ador		32
Connaughtman's Rambles, The	jig	Bm		32
Miss Monaghan	reel	D		27
Father Kelly's	reel	G		25

Figure 5. The top tunes played on the Monday night sessions.

high similarity (some Irish tunes have phrases or parts that sound similar to each other).

Figure 3 shows the web interface for browsing the tunes found with TuneTracker. Users can browse any weeks’ tunes and also view the sheet music (Figure 4) from the tune corpus that most closely matched a detected tune.

Tune Practice Trends

While the above feature gives a raw, running list of tune playing, what we believe makes TuneTracker particularly valuable is that its database can be statistically mined for musical trends. A representation of such trends, we argue, allows trad musicians to adapt and build upon their own playing with the playing patterns found in local sessions.

TuneTracker provides a summarization of the changing repertoire of a session by listing the most popular tunes for each night. In The Cobblestone pub, different anchor musicians lead different session shifts. Figure 5 shows the most popular tunes on the Monday night session lead by Mary Begley and Marion McEvoy. The last two columns depict how many times the tunes have been played and what percentage of tunes played are made up of this particular tune. Thus, an amateur musician may intelligently decide to practice some of the more popular tunes like *The Lilting Banshee* and *Father Kelly's*.

In addition to listing the top tunes, TuneTracker gives summary statistics of sessions. For example, Figure 6 shows that on Monday night sessions, the average number of tunes

Summary statistics across all Monday sessions

All days | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday

average # of tunes/session	33.26	standard deviation	13.36
# of unique tunes detected	232	total # of tunes played	632
% of tunes that are unique	36.71%		

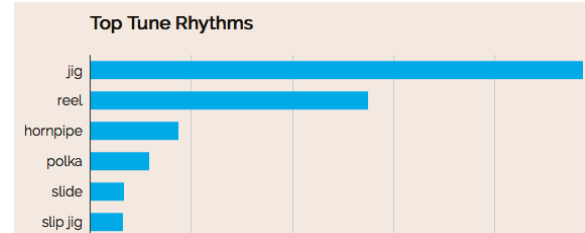


Figure 6. Summary stats for Monday night sessions.

Tunes occurring within 5 minutes before:

Title	Rhythm	Key	Count	Dots	Stats
Lads of Laois, The	reel	Edor	2		
Dan Breen's	reel	Ador	2		
Maid behind the Bar, The	reel	D	2		

Tunes occurring within 5 minutes after:

Title	Rhythm	Key	Count	Dots	Stats
Lady's Pantalettes, The	reel	G	5		
Redhaired Lass, The	reel	G	3		

Figure 7. Discerning sets with *The Crooked Road* reel.

played is about 33. More interesting is the “% of tunes that are unique” metric. The percentage in the table roughly indicates a session’s *tune diversity*. A weekly session with a low percent (low diversity) suggests that each time you go to that session, you can expect the same tunes to come up again. A weekly session with a high percentage (high diversity) suggests that you will frequently encounter new tunes when you attend that session. Monday sessions in The Cobblestone with a diversity score of 37%, for example, tend to have more beginners than other nights. In contrast, Wednesday night sessions at The Cobblestone has 55% diversity. TuneTracker (bottom of Figure 6) also tells the user what kind of tune rhythms dominate in a session (here, jigs dominate Monday sessions).

Besides playing tunes, part of the creative joy in playing trad music is imaginatively deciding what tunes to play together in a set. TuneTracker gives the user the opportunity to see what tunes tend to precede or proceed a particular tune. We can take advantage of the knowledge that, on average, tunes that are repeated three times last no longer than 4 minutes. TuneTracker will examine its records for tunes that occurred within 5 minutes of a particular tune. Figure 7 illustrates part of the webpage displayed for the tune *The Crooked Road*. The musician can discern here that a possible set to try may

be *Dan Breen's–The Crooked Road–The Lady's Pantalettes*. *The Lady's Pantalettes* especially seems to commonly follow *The Crooked Road* reel.

INTERVENTION AND PROFESSIONAL REACTION

Having discussed TuneTracker's main features, we now turn to its deployment. TuneTracker's deployment in The Cobblestone pub was announced locally by distributing flyers, the pub's Facebook page, speaking with the anchor musicians (the musicians who are paid to attend and play in a session) of the nightly sessions, and emailing musicians in Dublin. We also made a more general announcement online via the largest discussion forum for traditional music, thesession.org. TuneTracker's website also encourages users to fill out an online survey. The system also gained some local publicity: an article on the system was posted on *The Journal of Music*, a bi-monthly magazine on Irish music.

After 1.5 weeks of deployment, we immediately had reactions from the trad community. Some of the anchor musicians of a particular night requested that we turn off TuneTracker during their session time. Given our own intimate experience as trad musicians and the care we took to respect musicians' privacy, we were frankly surprised by the swift and negative reactions to TuneTracker. We complied with the anchors' request, and this spurred us to first focus our investigation on the reaction of the session anchors.

In the next sections, we will describe views that vacillate between two extremes—one that sees TuneTracker as a useful tool that facilitates entry into the tradition and another that takes a view that TuneTracker represents the ultimate intrusion and destruction of tradition. As of this writing, TuneTracker has been running for five months. During TuneTracker's deployment, we conducted in-depth fieldwork by sitting in at least one session per week at The Cobblestone, spoke with local musicians, and observed the behavior of musicians in The Cobblestone. After three months of deployment, we held semi-structured [24] interviews (N=7) and less formal interviews during session observations (N=4) with anchor musicians. Our interviews covered anchor musicians from each of the daily sessions in The Cobblestone. In these interviews, we demoed and displayed screenshots of the TuneTracker website to elicit richer responses. All quotes below have been anonymized.

TuneTracker's Omnipresence

TuneTracker's initial presence generated reactions due to its novelty. The mixer on top of the laptop in which TuneTracker is installed emits a blue light when the power is on. Over the course of its deployment, we heard many musicians give it the nickname "The Blue Light." Some anchors felt intimidated by the machine with its microphone because it seemed to be "judging" the quality of their playing. When a tune was correctly recognized on the website, musicians joked that they must've played the tune mostly correctly. On the other hand, we observed how musicians were happy to have "beaten" TuneTracker with an obscure tune it couldn't recognize.

Once the novelty wore off (about a month), most musicians soon became "unconscious" of its presence. Professional

recordings happen often in The Cobblestone; hanging wires and leads afterwards are a common sight, and the presence of TuneTracker seemed "normal" [2]. One anchor noted that "if I'm in there and I'm playing, I've forgotten that the thing's there." None of our interviewees thought the system effected the way they played, nor did they think it had changed the nature of their sessions. Anchors had divergent views on how other musicians viewed TuneTracker. Opinions ranged from "I don't think it's been an issue for anyone from what I hear" to "Nobody is happy with it. We've been looking for the plug, literally."

Representing and Reflecting on Tradition

For some of the professional musicians, TuneTracker filled a gap in current trad musicians' resources by *actually* showing what tune playing practices are in The Cobblestone. Whereas books and audio recordings are set in a very specific time, TuneTracker gave what informants called a "snapshot" or "picture" of local sessions. It demystified and quantified session playing: "It puts words to something that's out there. We're in a dream and we're in a trance playing away. We don't have any plan or anything. It's nice to see what actually we're doing."

Furthermore, the fact that TuneTracker was installed in a pub respected for trad music (as opposed to trad music played in Temple Bar—an area in Dublin some regard as catering mostly to tourists) made such representations of sessions even more valuable and venerated: "I think it gives people a picture of what's actually played. Like, at the end of the day, you're not going after some pub in Temple Bar. You're going after where there's authentic Irish music being played. It's the real deal with good players. And you'll get the picture." Indeed, The Cobblestone is perhaps unusual in Dublin because it has traditional music every night, has classes in trad music and set dancing in its backroom, and regularly holds gigs sponsored by the Pipers club (a leading organization for Irish traditional music).

How is such a representation useful? The real-time nature of TuneTracker was seen as useful for filling in incomplete representations of tunes and thus helping professionals find new tunes to add to their repertoire. One player said, "I don't have a huge repertoire....If I heard the lads playing the tune here before [my shift]...I can look it up and then I can actually try and source the music for it. It's a very good thing." We also spoke with local musicians who would make a note during a session (marking down the time of day) to learn a tune later when they got home by going to TuneTracker. This was useful because sometimes, as the sessions can be quite noisy and crowded, musicians had trouble asking the person who started the set about a particular tune.

The descriptive statistics of sessions also elicited reflection for the anchors on the direction their sessions were going. Reel and jig tunes often dominate sessions. Some musicians reflected on the lack of tune rhythm diversity. When seeing the low percent of polkas (3%) in her session, an anchor told us, "Now, we'll have to do something about that! Hopefully when we see this research, we'll go and press on in a different direction...put some more polkas and slides and we have to

have more and more of them...Well I would feel like having maybe 20% polkas (laughs)...There are so many lovely ones."

Yet, some musicians reacted negatively towards The Cobblestone's sessions being posted publicly. While the eventual plan is to have several pubs tracked by TuneTracker, The Cobblestone is the pilot test. As such, musicians were worried that people would see The Cobblestone as the "reference point" whereas sessions all over Dublin can be very different. Having more sessions being tracked would help *diminish* The Cobblestone's influence as *the* pub for "session" (standard) tunes. One player noted that when she leads sessions in The Cobblestone, she plays very differently than in the sessions over at Hughes (a pub 10 minutes walk away). Many musicians remarked that The Cobblestone is a place for them to relax from a long day: *"We're all chillin' out, playing a few tunes, having a pint, a bit of craic [fun], you know."* Thus, musicians may play tunes *"out of habit"* rather than trying out unusual or unique tunes. The opposite was also true—a group of musicians told us the tunes they played in The Cobblestone would not necessarily be the ones they would teach to students (i.e., good tunes for pedagogical reasons). The worry here is that users misunderstand that The Cobblestone is not a complete picture of anchor musicians', Dublin's, and the whole of Ireland's repertoire. It may also not be a proper source for good tunes to help a beginner improve.

One anchor commented on TuneTracker's reliance on particular tune transcriptions (c.f. section on TuneTracker): *"If the tunes don't make it out to TuneTracker, are they going to be forgotten altogether? There's no Kerry music on that [database], so if you end up not having Kerry music, does that mean that nobody's going to be playing Kerry music? It's kind of straitjacketing."* The tune databases that TuneTracker relies on have a field for a "main title" with another field for alternative titles. The public website will only show the main title (though the user is able to download the raw transcription with alternative titles). This is another sort of misrepresentation, a loss of regional labels for a tune: *"Locally a tune might be called John Egan's reel because it was always associated with him, and you can tell the story [behind the tune name]. But if it becomes, I don't know, The Merry Stone in the Wall, the official name out of the book, then there's the end of the story. They'll [musicians] take that as the official [name]. I don't have to think anymore because the machine tells me."*

Nonetheless, a bigger issue for some musicians than misrepresentation is that TuneTracker's representation of sessions threatens to destroy creativity itself in sessions.

Creating the Non-traditional Traditional Musician

Perhaps the most passionate responses came from musicians who believed that TuneTracker would engender a new kind of amateur player, one who disregards the *process* of traditional music [21]. Without generalizing, professionals expected that amateurs would not see TuneTracker as a tool, but as a substitute or shortcut to becoming a traditional musician. Here, an anchor laments about the kind of musician he knows will result because of TuneTracker:

You're just in a computer, churning out the tunes. It's the lowest denominator. I'm just waiting for someone to walk in and say, "I have my list of tunes from last week and I've learned them so let's play them." And then we play, and then we play, and then we play...I'm only waiting for it to happen...I'm going to [refuse]...and play a completely different set of tunes.

This musician recalled that he met an American who had bought his CD and had asked him to play a set from the CD. He replied, *"I don't play sets, I play tunes...[In the CD] I might have just put two or three tunes together for a recording, but they wouldn't necessarily be the ones I'd play the next time."* The anchor feared that TuneTracker would encourage this scenario. In other words, TuneTracker is imprinting on amateurs a deterministic image of what a session is—that it follows a formula. For some anchors, they fear this means that amateurs will *expect* and perhaps demand anchors and other session musicians to follow such a script.

TuneTracker may also give learner musicians undue confidence about joining in a session. An anchor asked, *"Do you always want the learner player to be able to follow you in absolutely everything in the tune you play? I actually don't think you would maybe want that all the time."* Without sitting in the session, amateurs may now think they *know* the tune and are able to join in the session. Professional trad musicians *"want to create a certain sound"* in the session by maintaining a certain standard of playing that, for them, is only attainable by having a history of playing with the people in a session.

This "instant fix" for trad music bypasses the experiences of many professionals:

I mean, when I was starting, part of the enjoyment and the learning process of traditional music was going into a session and actually sitting down and listening to the people in the session playing and learning from that and then going home and digesting and then maybe trying out the tunes—it's a whole process. Whereas, what is happening here, technology is doing the process for you, you know. Technology is great but you cannot jump the stages. There's no shortcuts.

Those who miss out on these experiences become oblivious amateurs; they can "spoil" a session: *"When they come to a tune they don't know, they either get up to the toilet or they start talking to the person next to them and they chat and they chat...until another tune that they know comes up."*

One has to put in their time into the learning process. Tradition is handed down from people. One anchor described a session as a place for *conversation*: *"Not just the talking, I'm talking about the tunes. The tunes that you choose to play with people is part of your conversation...your relationship with these people. Tunes that you feel comfortable playing with these people."* One can't simply join a conversation without being part of the history of that session. Anchors worry that amateurs will choose tunes simply to join an anonymous session, rather than because the tune has *meaning* for them. TuneTracker essentially ends all conversations in a

confident manner because it is interpreted as the *truth*; players will no longer ask about a tune's name, the story behind a tune, and where the tune was learnt from. In a statement remarkably echoing theories of situated learning [14], one informant noted that *"if you...turn it into something that you can have in your pocket instead of having it in your head—well then...the tradition loses."*

Of course, not all musicians shared the viewpoint that TuneTracker would directly cause the downfall of conversation. One professional thought TuneTracker might engender richer discussions in sessions: *"You could have someone that might look up something on TuneTracker and...they might come in and say, 'Oh I've seen you play this tune in TuneTracker...Do you know where it came from?'"*

Creativity and Homogenization

For some, TuneTracker and other technology represents the impending homogenization of Irish traditional music. With Irish government sponsored classes and competitions [8], TuneTracker represents the encroachment of standardization in the one relatively untouched arena of trad music, informal sessions.

In this dystopian future, sessions are robbed of their spontaneity and local tune variants. Everyone is playing the same tunes week after week. For anchors, *"the whole pleasure of playing is, for me, to go to a different crowd of people and hear tunes I've never heard before and be completely unaware of them."* Another described this surprise as the *"beauty"* of sessions. While informants acknowledged that personal recordings of sessions and CDs have always been a part of the trad music scene, one professional considered TuneTracker's collection to be unprecedented: *"To take it to another level where you're going into an establishment, where there's an actual session, and you have the tunes documented and everybody and anybody who comes in knows exactly what's going to play...it's [at] a different scale."* There is a power asymmetry here: musicians merely take and learn tunes rather than bring in their *own* tunes to a local session.

Some anchors scoffed at the benefit that TuneTracker offered in unprecedented accuracy of tune trends. The ambiguity with which humans remember tunes was seen as a benefit: *"That's where the variations happen. That's where the growth of the music happens, not when it's been made down and set in stone."* Even tune books only provide a skeleton for how a tune might turn out when it is interpreted [21]. Yet, with TuneTracker, the ability to forget [3] is nullified and the opportunity to make the representation of tunes hazy is gone.

Session: Local vs Public

Interestingly, while there is general consensus regarding the necessity of the oral process of tradition, there is a wide divergence amongst the musicians as to what a session is and hence its relation to TuneTracker. On one hand, musicians see sessions as a public space for musicians of all skill levels (as long as etiquette is followed). On the other hand, some musicians see sessions as a private space that is highly localized.

Part of TuneTracker's perceived benefit was to support travelling musicians. Ireland is the obvious mecca for Irish traditional music and The Cobblestone gets many visitors. Some anchors welcomed having any technology that might facilitate the participation of visiting trad musicians: *"Say somebody's in California and they're learning the fiddle and they want to know, geez, I'd love to go to The Cobblestone and they have a fair idea who plays there. The chances are, if I learn these tunes, I get to play them...That's only beneficial."* TuneTracker would provide an opportunity for those taking the effort to travel for music to make the most of their experience. Moreover, for the local musicians, TuneTracker would give them the opportunity to see a record of tunes perhaps introduced by visitors: *"Sometimes there's some very good musicians passing through Dublin who come in here. There could be some really...famous...piper playing the tunes...I could go home and see what he played."* For such musicians, *"The Cobblestone is a session pub where anybody can walk in off the street and sit down and play if they so wish."* One anchor made pains to explain that sessions are not gigs, nor performances. While playing tunes with everyone is not everything, being able to do so certainly helps.

In contrast, there are anchors that believe sessions are spaces with activities that are private to locally situated musicians. One anchor told us, *"[I want it to be private] among the people who are playing to ourselves and to the people who have come in to listen to us. It's not necessarily for mass consumption."* Here, the musicians feel that there is no need to make playing practices public. With regard to travelling musicians, the point should not be to "prepare" so that you are able to play tunes together: *"It's not a playing competition. It's a listening and learning and enjoying [activity]. And let them [travelling musicians] bring a tune in with them. That's the whole point of it. It's not about sitting in and playing all the tunes. That was never the idea of a good session."* This also ties back to the issue of preserving the spontaneity of a session. Another anchor concurred, believing that *"they [visiting musicians] should just come in"* and listen. The difference here is that committing tunes to an anonymous list for a public goes against a session as an intimate place for sharing amongst local people you have a relationship with. Tunes are very personal.

Ownership of and Identity with Tunes

Our past ethnography [21] showed that sessions can be conceptualized as sites of active practice. Musicians iteratively introduce new/forgotten tunes, create sets, swap tunes in and out of sets, etc. Some anchors expressed concern that all their research and practice of tunes might get appropriated by a TuneTracker user: *"All of a sudden these tunes are out there while you're looking to rehearse them, to record them or something like that"*. In the worst case scenario, someone may use these sets in a new album. There was no clear consensus to this issue—on one hand, musicians acknowledge that tunes are never owned by anyone and sharing tunes with others is beneficial; on the other hand, there are some *"musicians who might be a little bit more covetous."* In some sense, the musicians recognize that by playing tunes in a public session, they have already *"offered"* them to others. How-

ever, TuneTracker offers these tunes to a much larger audience than before imagined. There was also some concern that the Irish Music Rights Organisation (<http://www.imro.ie>) would scan the list of tunes, look for copyrighted tunes, and seek to collect royalties on modern composed tunes. All musicians we talked to abhorred such practices.

When we demoed TuneTracker, we showed the anchor musicians tune records from their own sessions. The anchor musicians enjoyed and were remarkably adept at recalling their “conversations” about the tunes:

Karl Gallagher was in that night cause I remember him playing a couple of tunes that I hadn't played in a while actually. So that's how I'd remember that. *Tom Ward's Downfall*—now I wouldn't have played in a while, you know. *Pipe in the Hob*—I wouldn't have played in a while. And I remember remarking on it.

Musicians were also able to pick out tunes on TuneTracker that they would *never* play: “*Although...I would have never played that [laughs]...It's played out like [laughs] [i.e., the tune is overplayed].*” However, what troubled some musicians was that others familiar with their repertoire were able to identify their *presence* through TuneTracker. One anchor told us he received a text from a friend saying “I see you're in The Cobblestone tonight from the tunes that are being played.” Through the tunes, the musicians were being tracked. Several musicians called this “*Big Brotherish*” and a violation of their privacy. In this sense, sets of tunes are like a personal stamp of identification for professional musicians: “*Any musician worth his or her salt has their favorite tunes, and everybody knows what their tunes are. And people associate tunes with particular people.*” Although musicians may emphasize the cavalier nature with which they choose tunes in sessions, the fact remains that patterns *do* exist (whether subconscious or not) in their selection. TuneTracker brought these patterns to the forefront.

SUMMARY: TOOL OR SUBSTITUTE FOR TRADITION?

As not only researchers but Irish traditional musicians, we designed TuneTracker to be respectful to the ethos of tradition. It was certainly not our intent to have TuneTracker *replace* tradition or even provide *shortcuts* to tradition. We reasoned that people would use TuneTracker as people have used recordings and sheet music sensibly as a part of the learning process that includes “time” in the session. Yet, because our surveillance into tradition was unprecedented, we knew we could not confidently predict its adoption by musicians. As our intervention demonstrated, the range of reactions to TuneTracker revealed that seasoned musicians have very different ideas of what tradition is and the role of technology in the traditional arts. This is perhaps best summarized by the following two quotes:

1. I don't think technology should be pushing the music. I think the musicians should be pushing the music...It's a bit [like] a genie out of the bottle though.
2. You're providing people with a tool, not a substitute. And, at the end of the day, it's not the tool's problem, it's the person that uses it. It's like alcohol. Alcohol's not the prob-

lem; it's the person that drinks too much alcohol that's the problem. Paper doesn't refuse ink.

In the first quote, TuneTracker has agency [5]—it deliberately introduces a power asymmetry [4] by wresting control of sessions away from the musicians and into a technological artifact. TuneTracker will be prescriptive: spelling out what tunes people should demand in sessions. Because TuneTracker is authoritatively clothed in digital garb, it asserts itself as the final truth—whether it be regarding tune names, tune notes, the order of tunes in a set, etc. Thus, TuneTracker threatens to destroy tradition by marginalizing the human element in the traditional process. This (fallible) human element contributes to the flexibility, ambiguity, surprise, and variation of tunes in sessions that rigid representations such as those ostensibly offered by TuneTracker circumvent. Also implicit in this assertion is that amateur players are somewhat like what Garfinkel [11] called “cultural dopes.” The worst of the learner musicians will blindly follow the notes and lists of tunes without taking the local context into account and seek to find shortcuts to the traditional process. Here, sessions are conceived as deeply personal and private (but public to the local area) affairs amongst close associates to produce high quality music (or conversations).

In the second quote, the musicians see TuneTracker as a tool, not a substitute for the tradition. For them, any artifact that can encourage more people to play and reflect on traditional music, thereby preserving the tradition, is beneficial. TuneTracker will encourage visiting musicians to join in sessions. Just like any resource (e.g., sheet music), it can be misused. Yet, these musicians may give learner musicians more credit—TuneTracker will be but one part of an assemblage of resources to facilitate them in the process of learning tunes. Here, sessions are conceived as egalitarian spaces where anyone who can reasonably play and has common sense can join in.

RELATED WORK

To the best of our knowledge, our work is the first to instrument a space for the purposes of surveilling folk music. Certainly, there have been studies examining the effects of “older” technologies such as tune collections and commercial recordings of folk music [6, 15, 22, 19]. For example, the expatriate fiddler Michael Coleman's commercial recordings proved immensely influential back in Ireland, and his sets of tunes are now considered standards in sessions. Chief Francis O'Neill (a police officer in Chicago) published a transcription of tunes from local musicians in 1903 that have become a standard reference for Irish trad musicians. While TuneTracker is like tunebooks and audio recordings in that it is a record of tune playing, it is different in that it does not store audio nor outputs actual transcriptions of performances.

The topic of standardization in tradition has been covered in ethnomusicology. Fleming [8] examines the controversy over the institution of government-supported organizations and competitions in Irish trad music. However, she concludes that despite the threat of standardization, regional styles still persist and musicians are able to grow beyond the government's curricula. Forsyth [9] discusses the pedagogical practices at

a fiddle camp for adult students and provides an overview of debates in using sheet music vs. learning by ear. Veblen [22] provides a “snapshot” of stability and change with respect to the oral transmission of Irish trad music. Waldron & Veblen [23] describe an ontology of online sources for trad musicians but do not discuss how such sources in practice are used, nor the controversies surrounding such technologies. We build upon these works by directly examining whether in-situ pervasive technologies have a role in tradition.

The ethical concerns echoed by our trad musicians regarding TuneTracker build upon Benford et al.’s insightful research on the “moral order” of Irish sessions [2]. They explain how sessions often have an implied hierarchy (an anchor who starts many of the tune sets), discourage overt learning aides such as sheet music, and have a shared repertoire. They also propose designing for “situated discretion,” creating technologies that assist musicians in a session while being discrete enough to not disrupt the moral order. TuneTracker does incorporate some of the tenets of situated discretion—as we mentioned in the sections regarding respecting privacy and omnipresence, currently TuneTracker is generally forgotten, does not effect playing, and has become part of the background fixtures in The Cobblestone pub. Our research shows that whether this is beneficial or not to tradition is controversial amongst professional players.

LIMITATIONS & FUTURE WORK

I would say you’d need to keep that going for 12 months...to get a really good picture of what trends are there.

—Anchor musician on TuneTracker’s deployment duration

We believe TuneTracker’s eventual benefit or detriment to tradition will only be apparent with a longitudinal study requiring a length longer than five months. For trends in music practice to be apparent, TuneTracker will need to collect enough instances of tune playing in the sessions at The Cobblestone. Moreover, we plan to deploy TuneTracker in sessions located in the United States. This will help deemphasize the influence of The Cobblestone as representative of tune playing practices.

The findings of our study only reveal the opinions of professional musicians. However, TuneTracker was also developed to help both local and remote novice musicians. This population is perhaps less visible (e.g., Internet users and musicians from afar) and vocal. Our plans are to conduct in-depth interviews with learner traditional musicians. To recruit local musicians, we will contact musicians taking classes in The Cobblestone. To capture remote users’ perspectives, we will be contacting those who filled out our online survey and snowball sample from that population. We also plan to solicit potential interviewees from the thesession.org website.

Finally, while our intent was not to build a full proof system that tracks tunes with perfect accuracy in The Cobblestone, we plan to continue working to improve TuneTracker’s accuracy. For instance, TuneTracker’s detection of music vs. speech requires a separate training phase, but a later version will dynamically re-train the music classifier to adapt to different noise levels (e.g., later in the night tends to get ex-

tremely noisy in pubs). Our motivation to increase accuracy is not only to improve the utility of TuneTracker, but to discern the reaction of musicians as TuneTracker’s claim to truth becomes stronger.

CONCLUSION

Drawing from previous fieldwork, we have designed and deployed one of the first systems to track the practices of artists in a public space. Our deployment for five months points out that TuneTracker faces the difficult task of trying to balance between two extreme notions of tradition. This task is made even more difficult because sessions are, by their very nature, diverse. TuneTracker necessarily cannot satisfy everyone’s preferences. This raises some interesting questions. Should the professional’s viewpoint on traditional music usurp the learner musician’s preferences? Who speaks for the session?

While we have no simple answers, we believe we have shown that TuneTracker has been a powerful artifact to elicit questions about new technologies that now have the ability to dynamically represent, preserve, and present cultural practices to a new scale. Rosner et al. [18] suggest that we need to recognize that digital preservation needs to account for the “dynamic nature of cultural forms.” Sessions are, by definition, a dynamic cultural process. We admit that TuneTracker is seeking to disrupt tradition, in a hopefully beneficial way. Ultimately, our intention is to have TuneTracker empower traditional musicians, to allow them to become better participants in Irish traditional music. As our field work reveals, the trends and data collected by TuneTracker provide important clues to the history of tune making practices (“rhythms of interaction” [18]) to an unheard detail.

We have also demonstrated that TuneTracker itself is comprehensive, detailed, and generally accurate in its tune recognition. TuneTracker successfully captures the names of tunes and the sets being played in sessions. Musicians were able to reflect on and recall their own playing practices through TuneTracker.

Our discussions with professional traditional musicians show that the surveillance of tradition is a double-edged sword. For some, TuneTracker represents an intrusion of tradition and threatens to encourage a new breed of amateurs without the proper traditional mindset. TuneTracker may homogenize music by causing local versions and settings of tunes to disappear. For others, TuneTracker represents a new resource that helps to unveil the mystery behind tune playing in sessions.

Our own opinion is that the full significance of TuneTracker will only be realized after some time and by speaking with the diverse participants of the sessions in The Cobblestone (c.f. future work). While we expected that some musicians would feel skeptical about TuneTracker, we were genuinely taken aback by the more strongly worded opinions of TuneTracker. Furthermore, the divergence of viewpoints amongst professionals demonstrates the tensions already inherent amongst members in the trad music community (e.g., “pure drop” traditionalists vs. more progressive trad musicians). Certainly, in any community surrounding a particular skill [20] there will inevitably be professionals who seek to remain indis-

pensable to amateurs, and there will be amateurs who seek alternative routes to learning. Our anchor musicians may feel that their professionalism is threatened by TuneTracker.

Undoubtedly, there will always be people behaving at odds with tradition in sessions. The question is whether TuneTracker encourages such behavior and whether TuneTracker will irrevocably change the very nature of tradition. We will continue to monitor TuneTracker's progress in The Cobblestone. It may very well be that tradition is best left a mysterious process that is incompletely passed on from generation to generation. If that is the case, then we will dismantle TuneTracker. However, our intuition is that conflicting opinions in the role of any technology in cultural practice is unavoidable. For now, we will take a cautiously optimistic viewpoint that like recordings, sheet music, YouTube clips, and websites, people will find ways to intelligently utilize technologies in service to creating magical music in the tradition.

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