TakeoverTV: Facilitating the social negotiation of television content in public spaces

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Abstract—Social television, in essence, is a way to share and experience media with others. Rather than attempt to bridge physical distance by creating new social experiences, we have built a system called TakeoverTV that augments canonical social interactions by addressing three key questions:

1. How can we better support social gatherings around media in public and private places?
2. How can we enable conversation across our devices rather than forcing us to communicate through them?
3. How can we help people come to agreements about what media they want to watch together?

Primarily aimed at public spaces like bars, TakeoverTV is a system that lets local users influence and interact with the movies and television programs shown on public displays. Our system collects the media preferences of all people physically present at a given location, lets users start a vote among all members of the space, and allows everyone to participate using tangible physical objects like tables in addition to smart devices. Over time, public establishments can evolve complex identities based on the preferences and votes of their patrons while generating valuable analytic data for patrons, establishment owners, content-providers, and advertisers alike.

Index Terms—Augmented public space, Multimedia social negotiation, Smartphone, Social TV

I. INTRODUCTION

TAKEOVERTV is a platform that allows public displays to become aware of the content preferences of nearby users, allows these users to visualize the collective preferences of those present, and to start and participate in votes that determine what is shown on the display (Fig 1). When a user arrives at a location, their likes and dislikes automatically influence what can be shown on local displays (Fig 2). Those that want more control can start a vote to choose a new show using their beer glass or phone. The system supports a continuum of lean-forward and lean-backward interaction strategies, allowing public displays to scale from passive broadcasting (current model) all the way up to full social negotiation where all users vote and interact via mobile phones and augmented tables to decide what should be shown and when.

Specifically, our system supports these key features:
1. Exposing common interests among co-located users
2. Allowing users to collectively decide between a simplified set of common interests (to prevent information overload) using both lean-back and lean-forward interactions
3. Evolving media identities for physical locations: e.g. bar X becomes a place to watch “Lost” [1] and bar Y becomes a place for fans of the show “24,” [2] creating unique opportunities like allowing owners to co-create and evolve their establishment along with their clientele.

II. SCENARIOS

A. Phase I – One TakeoverTV location

John and his friends head out on a Wednesday evening for a casual night out. After grabbing a seat, they notice that the TV’s in the bar are airing an episode of American Idol. They dislike the show and decide to change it by starting a vote with TakeoverTV. Next, they slam their drinks down on the table to begin a vote, and all patrons are encouraged to choose what they would like to watch. TakeoverTV has been silently collecting the preferences of all current patrons, so when a vote is started the system uses a heuristic to narrow down voting options to the top three common interests among the crowd. People vote by knocking their beers on the table or by mobile phone, and as the timer counts down to zero, the crowd gets rowdy as patrons try to coerce others to change their votes. The vote ends, a show is chosen and begins to play. Patrons turn their local table volume up or down, depending on the outcome of the vote.
B. Phase II – Many TakeoverTV Locations

Now that TakeoverTV is installed in multiple bars and restaurants throughout their town, John and his friends have begun to identify with specific establishments. They know that Jackie’s diner tends to attract fans of trashy dramas and that The River Lounge pulls in a college crowd that prefers animated comedies in the evening like Futurama [2]. TakeoverTV has aggregated the preferences of patrons, allowing John and his friends to check the TakeoverTV analytics on their phone as they search for a bar. Since they’re in a mood for The Simpsons [2], they decide that The River Lounge is a good spot. After arriving at The River Lounge, they see that another animated show, King of the Hill, is playing. John’s group begins talking to others at the bar and find that they seem to have a lot in common, due to the bar having an identity that helps like-minded individuals find each other.

C. Phase III – TakeoverTV locations in multiple states

Content-providers and advertisers use TakeoverTV as a way to introduce new content to proper demographics. Companies that create new shows can sponsor pilot show nights where they pay bar owners to place a new pilot show as a voting option. If patrons vote to see the pilot, the bar buys a round of drinks. Establishments that tend to prefer stand-up comedy routines get hand-selected for private shows from the comedian most popular at that location, and only the loyal attendees get tickets. Bar owners use anonymized TakeoverTV metrics and analytics to better understand their customers and have drink special nights for the most influential voters. The identities of locations are complex, time-based entities that grow and change as the patrons change, and users, owners, and content-providers all benefit from the feedback loop provided by TakeoverTV.

A. Exposing common interests

TakeoverTV collects the interests of all users present at a location, and uses a heuristic to determine which shows should be included as options in a vote. The system narrows down the options to prevent obvious information overload, and we offload this work onto the system. First, the heuristic filters out noise by ignoring transient patrons that come and go quickly. Second, the algorithm orders each user’s preferences by the last time that show was played while the user was present. Finally, it finds the most common elements of the top choices of each user and presents the top three choices for all users to vote on.

Furthermore, the preferences, locations and votes cast by users create valuable data that can be used for metrics and analytics. For instance, TakeoverTV can begin to disentangle who is voting for which shows at which times in which locations, as well as how the voting is occurring. Are shows interrupted? Is there a high rate of churn? What patterns in the data expose user preferences and tastes? Our metrics will allow us to answer these questions. Additionally, we maintain privacy of the system by anonymizing data and presenting metrics only in aggregate.

Group decision-making is a rich field of exploration all to itself [3]-[5] and we have built an architecture that supports multiple decision-making processes. We chose to start with voting as a first-order decision to provide legible feedback from the system, allowing users to understand and unravel how the system might work simply by using it. More advanced techniques likely will provide better results, though they risk losing transparency. We plan to explore additional techniques in the future, and we encourage others to explore novel techniques to apply to the platform.

B. Collective decisions

At any time, users can attempt to change the movie or show being played by starting a vote. They do this by either tapping their glass on the table corner that starts a vote (lean-back) or by using the TakeoverTV application on their phone (lean-forward). The tables at a TakeoverTV location are able to detect tapping in distinct regions, allowing users to interact with the system using only their hands or a glass.

Once a vote is started, a two-minute countdown begins and all displays switch to voting mode (Fig. 1) that is visible to all users in the location. Users then vote for their favorite option by tapping their glass on the table corner that corresponds with that option, or by selecting the option on their phone. When the countdown ends, the winning show begins playing. For now, we allow voting at any time, though we may decide to limit it to start only at the end of a show.

It is important to note that the system scales easily to support several interaction styles in order not to disrupt patrons’ experiences. We define and support multiple interaction strategies: passive, semi-passive, semi-active and active. Passive users do not pay attention to the displays in public locations and thus TakeoverTV has no effect on their expected experience because it does not subsume their experience. Semi-passive users might cast a vote by tapping their glass on a corner, but won’t start a vote. Semi-passive users’ preferences are still included in the vote, and can interact if they wish. Semi-active users start votes by phone or

III. KEY FEATURES OF THE SYSTEM

In order to answer the original questions postulated in the abstract, we will first discuss the key features of the system and then follow with a section that addresses the questions.
by tapping on the table, and will try to convince their friends to vote for their choice. Active users will not only attempt to convince friends, but also will attempt to convince strangers in the area by shouting to strangers.

By design, if no one starts a vote, TakeoverTV completely fades into the background.

C. Public location identities

TakeoverTV becomes significantly more valuable over time - locations gain an additional dimension of identity from the history of its patrons’ preferences and votes. Currently, a person may characterize a public location by the decor, the dress of the patrons, the music choices, etc. TakeoverTV adds an additional dimension that moves beyond the superficial by providing metrics and analytics on the movie and show interests of guests. A lounge may attract sports fans in the afternoon, while it attracts a college crowd interested in animated comedies at night. Our system exposes these trends.

This has implications on how users might interact. In the way that dating websites often rely on questions about the types of music or television shows a person likes as a way to extrapolate taste [6]-[8], we believe these tastes can be useful in choosing a location for a night out. Users may choose one bar over another if the inhabitants of that bar tend to like the shows and movies that they like, as these preferences indicate taste in humor, style, and attitude [6]-[8]. If users can expect similarities in taste, they may be more willing to strike up conversations with strangers. We plan to test the system in key locations around Cambridge, MA, in hopes of supporting these claims.

Fig. 3. The TakeoverTV table equipped with Mac Mini, tap sensors, integrated audio transducer, RFID readers (final version should have readers mounted in establishment not at table), and offset display to mimic ambient placement in public spaces.

Furthermore, the metrics provided by TakeoverTV can help establishment owners co-create and co-evolve their location with their clientele. Currently, owners can only guess at the preferences of guests, but our system can provide actual evidence for media preferences. Not only can they better understand their target audience, but also they can explore niche groups that are perhaps poorly supported.

Finally, content-providers are able to screen pilot shows to appropriate demographics and gauge reception by audience response. A content-provider pays a bar owner a set amount to have their pilot show appear as a vote option for a limited time, and if that pilot is voted for and watched, patrons get a free drink or some other incentive. We can then offer interactions like voting off the pilot if it is reprehensible, and pass that information on to the content-provider. Similarly, advertisers can better understand when their targets are visiting locations and how to better appeal to them. By analyzing the metrics provided by TakeoverTV, advertisers can learn from real-time preferences and trends in a currently unrepresented market.

IV. HOW TAKEOVERTV ADDRESSES KEY QUESTIONS PROPOSED

In the abstract, we introduced three primary questions that transform everyday situations into beneficial social television scenarios. We now discuss how our system addresses these questions:

A. Encouraging social gatherings around media

TakeoverTV helps people collectively vote on what to watch both at home and at public locations like bars. It aggregates their preferences and simplifies the choices to reduce strain, allowing people to focus on each other and the social gathering instead of the technology. Using a well-known design style that we refer to as “Just-in-Time Interface Design,” the technology only becomes visible when it is needed, and when it appears, it is clearly identifiable as technology. The system encourages discussion about show preferences, instigates negotiation of decisions in a controlled, simplified way, and creates common ground among local users. This provides unique opportunities for conversations between strangers and public groups. Over time, we expect the identities that locations develop will create a desire to choose one location over another, and motivate people to explore the social circles around them.

B. Conversation across devices, not through them

We could have designed the system to only support mobile phones, so that interaction with the system required users to stare at a small screen and disconnect themselves from their immediate social environment. Instead, we provide multiple access points - the table and the phone - that allows interaction to become part of the social setting and even enhance it. Convincing friends to vote for shows can cause users to physically grab another’s glass and tap it, or to encroach on their space and tap the table. We purposefully designed the system to not only enact playful behavior that breaks people away from the myopic interactions associated with mobile phones.

Lastly, we designed the tables to look ordinary to avoid detracting and disrupting the local ambience [9]. The technology that underlies the table could be added to any standard bar table and users would not know that anything had changed. This is critical to meshing with the existing social norms at public places like bars.

C. Coming to agreements about what to watch

As noted earlier, group decision making is an extensive field, and our architecture supports a wide variety of decision
making styles. By first narrowing the choices to a good fit for local users, then offering ways to change what is shown through social negotiation, we reduce the complexity of the choice while increasing the social engagement required to get others to vote for your choice. This first-order scaffolding for group decision-making is introduced into an area that currently has no support for decision making (rarely do patrons have any influence over what is shown), and we plan to apply more advanced techniques in future work.

V. IMPLEMENTATION

A. Software

Our prototype system is powered by an Apple Mac Mini connected to a 37” display mounted at the MIT Media Lab (Fig. 3). The server-side consists of a Tornado python server (running Nginx) with a MySQL database. The front-end display is a Cocoa/Objective-C application that renders video files natively and displays voting content via a WebKit object that fetches content to display from the server. This python server determines which users are present, reads their preferences, and determines voting choices, rendering all this data to the WebKit object. The use of a web-based front and back-end system allows for cross platform deployment. The Mac Mini provides a nice wrapper for media playback, but it is not critical and could be replaced by other options.

Currently, each user manually specifies show preferences on their iPhone; however, in the future we plan to use the Netflix API to read in user’s preferences automatically.

The iPhone application is written in Objective-C and communicates with the server via the same RESTful interface that the displays use. It allows users to log in via Foursquare or a custom RFID number, to start a vote for the location they are at, and to cast and change their vote.

User detection is done by both RFID and via the Foursquare API. Users can “check in” to the TakeoverTV location at the Media Lab, and their picture is automatically shown on the displays. While this is a more realistic interface for current scenarios, we also built a passive login system using RFID. We use ThingMagic [10] Vega readers - operating at an EPC GEN2 compliant UHF (850-950 mHz) - and Alien Technology’s ALN-9640 Squiggle(R) inlays, encoded and individualized using a Zebra model R100Xi label printer. The tags users look like normal name tags, and we also support credit-card-sized battery-powered RFID cards that can be read through a wallet in pocket. This allows anyone with a name tag or card to simply be near the system and have their preferences included in the set and start and cast votes.

We chose to use Foursquare (1 million users) because location-based “check in” services like Foursquare, Gowalla, Brightkite, Yelp, etc. are growing at exponential rates, allowing people to “check in” at locations they visit as a way to find other friends, coordinate gatherings, or simply gloat about the places they go. Additionally, Google’s Latitude (3 million users) is another service that lets users find each other based on their location and is said to be moving toward “check in” behavior [11].

B. Hardware

The TakeoverTV table hardware is tasked with delivering the television audio experience to each table, and also providing a means to for patrons to vote without using the phone interface. It was also important that the hardware feel natural in a bar setting. The audio had to be delivered in a clearly audible fashion at each table, but not too intrusive enough to overpower normal bar conversation. It was also desired that the voting mechanism be invisible when not wanted, and not feel “electronic” even when in use. Lastly, it had to be resistant to spilled drinks and rough handling by bar patrons.

The prototype audio system receives wireless audio over a Bluetooth link and delivers the audio signal to a vibration transducer mounted on the underside of the table. Using a wireless protocol allows the table to move around the bar freely and eliminates any visible wires. The audio transducer actually radiates sound through the wooden table surface itself. This creates sound field that is clear within a two to three foot radius, but rapidly dissipates outside that distance. The transducer is completely shielded by the tabletop and dispatches the need for any grills or exposed electronics.

Continuing in the theme of the audio system, the voting hardware is also hidden completely on the lower table surface. It consists of four bi-morph piezoelectric sensors located near the table corners [12], an AVR series microcontroller for signal processing, and a Bluetooth serial link to the TakeoverTV control system. During a vote, the three show choices are mapped to three of the table corners. By tapping (or slamming) a drink near one of these corners, a patron can vote for the corresponding show. The fourth table corner is reserved for other functions (such as initiating a vote). The outputs of each piezoelectric sensor are un-amplified but are biased to approximately mid-scale on the microcontroller analog-to-digital converter. The microcontroller samples all four sensors at approximately 35KHz to detect the rising (or falling) edge of the drink impact waveform. The first corner sensor to receive this signal is the closest to the impact site, and this selected corner is transmitted back to the Takeover TV system.

We chose to hide the electronic underpinnings to encourage patrons to emphatically slam their drinks down when voting for their favorite show to fit with bar culture. In our limited experience with approximately 40 visitors, this voting mechanism is durable, accurate, and generates positive user interactions.

While the hardware system outlined above works well, there are several opportunities for improvement. Firstly, our testing has shown that Bluetooth is a suboptimal communication mechanism in this application. It is not robust in challenging RF environments, requires stateful connections, has relatively high power consumption, and is expensive compared to other low data rate radio technologies. More promising candidates are low power, stateless technologies like those employed in low cost data chipsets by Texas Instruments (formerly Chipcon) and Nordic Semiconductor. On the audio delivery front, low power analog FM radio links seem to be a viable alternative. While somewhat dated, this
technology is extremely robust, offers a handful of audio channels, low power consumption, and low cost.

Another shortcoming of the current system is that each table contains a battery that must be periodically charged or replaced. With a bit of labor one could simply replace low battery packs after closing or before opening each day. Alternatively, table power consumption could be greatly reduced by moving to an overhead fixed audio system. This potentially limits table positions and/or mandates more intrusive audio, but could extend battery replacement interval to months or years. Lastly, a wireless power distribution system could be employed. Traditionally these systems have had limited range because of the size limits imposed by portable devices, but a table sized power reception antenna might be able greatly improve their performance [13].

VI. FUTURE WORK

Despite our in-depth implementation, the system is not yet ready for deployment. We must further refine the implementation and improve the implementation so that it is more robust before we can test the system in locations around Cambridge, MA. We plan to compare the system to other media voting mechanisms such as iTunes DJ, and how the social connections and demographic analysis of TakeoverTV benefit or hurt the experience. We also hope to an internet-enabled DirecTV DVR box to provide a wider array of fresh content and present different ways to slice group preferences. Additionally, we hope to learn how to improve user acceptance of the system and combat privacy issues by focusing on opt-in features.

VII. CONCLUSION

TakeoverTV replaces the typical one-way television experience in public spaces like bars and gyms with a conversation about other’s interests and identities. These conversations take place at several levels. First, as people begin to choose locations based on others media preferences, they are implicitly negotiating territory with friends and strangers. Second, within a given location, TakeoverTV creates an electronically mediated conversation about show preferences. Third, and mostly importantly, the system encourages and instigates direct person-to-person interactions at a given table and the immediate space around it.

This last point is significant because TakeoverTV avoids funneling all interaction through the system and instead attempts to encourage interaction through increases direct human side-channels. In the near future, we plan to deploy this system and study how these emerging conversations and identities affect the locations people choose, how they characterize themselves, and how they blend their personality with the personality of the space.

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REFERENCES