iEPG: An Ego-Centric Electronic Program Guide and Recommendation Interface

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ABSTRACT
Conventional program guides present television shows in a list view, with metadata displayed in a separate window. However, this linear presentation style prevents users from fully exploring and utilizing the diverse, descriptive, and highly connected data associated with television programming. Additionally, despite the fact that program guides are the primary selection interface for television shows, few include integrated recommendation data to help users decide what to watch. iEPG presents a novel interface concept for navigating the multidimensional information space associated with television programming, as well as an effective visualization for displaying complex ratings data. Results from a user study indicate people appreciate the ability to search for content in non-linear ways and are receptive to recommendation systems and unconventional EPG visualizations.

Categories and Subject Descriptors
H.5.2 [**Information interfaces and presentation**]: User Interfaces - Graphical user interfaces.

General Terms
Human Factors.

Keywords
Electronic program guide, EPG, social television, collaborative rating, show recommendation, remote control navigation.

1. INTRODUCTION
Television programs have a rich set of metadata associated with them, including, but not limited to, actors, writers, directors, guest stars, airdates and genres. Equally diverse are the relationships between these entities. For example, series and their episodes are strictly hierarchical, while a person can cross series, being a guest star on one show and an actor on another. Research has shown that users appreciate being able to navigate television data in non-linear ways [5]. However, making this inherently multi-dimensional data understandable and navigable for users poses a significant challenge.

Television shows are static, thus providing a common experience for all viewers. This allows television to be a conversation item for groups of people that are remote, such as friends, coworkers, and extended family (collectively referred to as friends henceforth). Even in single households, upwards of half of television viewing time is done alone [11]. Indeed, friends often watch the same shows and talk about them after they have aired - the so-called "water cooler effect" [11]. The value of this shared experience increases as more people participate.

Groups can establish common shows to watch by discussing an upcoming series or television event, or via a recommendation. Unfortunately, recommendations may not be suitable for the entire group. In addition, as the group grows, it becomes harder to manage which shows have been recommended and for what reasons. This social data, in its most general form, consists of which individuals watch a particular show and their opinions of that show's quality. If this data were available when users were selecting what to watch, they would not only be more likely to make an informed decision about what shows may be of interest to them, but also increase their potential to reinforce social connections with their friends by watching shared content.

We address these deficiencies with a novel electronic program guide (EPG). After considerable exploration and prototyping, we selected a graph-like visualization as the preferred method for navigating the multidimensional information space associated with television programming. In order to make social ratings data accessible and useful, a special visualization was included in the interface to help users find shows that were highly rated among their group as well as inline with their viewing interests.

Digital Video Recorders (DVRs) are becoming increasingly prevalent and the adoption of video-on-demand (VoD) services looks set to accelerate [1,7]. Anecdotal evidence from test users with DVRs suggests that people rarely channel surf to find shows to record. Instead, users typically know what they are looking for (e.g., from discussion on the radio, tip from a friend) and setup their DVR to record a show for future viewing (or to download in the case of VoD systems). Thus, helping users select *what to record* is not as interesting as helping them select *what to watch* among their recorded content. iEPG focuses on the latter.

2. RELATED WORK
A plethora of EPGs are currently available, with comparable offerings from almost all content providers (e.g., DirecTV, Dish Network, Time Warner Cable). The standard format for presenting television programming is a matrix organized by time and channel. The origins of this straightforward visualization can trace its history to the printed TV guide, first produced in 1945 [13]. Despite advances in set-top boxes and displays, this format persists – the primary selection method in these interactive systems is essentially navigation of a list (e.g., Tivo, MythTV, [4, 10]). Some systems allow users to organize their content into trees, for example genre > series > episode (e.g., Crime Dramas > Law and Order > The Blue Wall). However, only a single level is displayed at any given time and there is no way to jump between sub-trees, other than recursing back to a common parent node. Other systems offer the ability to search for particular entities. For example, a user could search for "Harrison Ford" to find programming in which the actor stars. However, no EPGs allow seamless navigation of multiple entity types in a unified interface.

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Some attention has been given to incorporating social rating data into EPGs to aid users in program selection. ChaTV proposed using real-time popularity graphs and chat [6]. Other systems rely on viewing data, generating recommendations using collaborative filtering or clustering methods (e.g., [4,12]). It is also possible to make recommendations without social data, for example, as [9] does with natural language processing on program descriptions. Lastly, web-based TV recommendation systems have been shown to be successful [2], although these information- and interaction-rich interfaces may prove challenging to integrate into remote controlled TV-based EPGs.

3. SYSTEM DESCRIPTION

3.1 Data

iEPG fetches metadata about recorded content from Zap2It (http://zap2it.com). This data is provided in a linear list; each show has a unique record that contains information such as channel, airdate, title, and actors. This information is processed and converted into a cyclic, undirected graph. Edges in the graph have varying relationships. For example, "Lisa Gets an A" is an *episode* of "The Simpsons" and "Dick Wolf" is the *executive producer* of "Law & Order." A special "me" node is also inserted into the graph to which all recorded series are connected (Figure 1, top). This ego-centric view provides rapid access to all of the user's recorded content.

3.2 Visualization

Television displays have different viewing characteristics than computer monitors. Typically, they are viewed at greater distances and have substantially lower resolutions. Fortunately, HD television is gaining traction, with current market penetration in the United States around 17% [8]. The superior resolution of these displays offers new possibilities for richer EPG interfaces. Additionally, television is considered a leisure activity [11]. Thus, TV-based interfaces should be especially simple to navigate and understand [5]. Information density in traditional television GUIs is relatively low, a design mantra that iEPG reflects.

As mentioned previously, television metadata is transformed into a graph. The volume of data is too large to be visualized at once. Instead, a single node is centered on the screen and associated entities radiate out from it. This is conceptually logical: the item of interest is centered, and the item's metadata is presented in the periphery. A fan-like layout is used to render the nodes. Each entity type is color-coded to facilitate recognition (varying shapes received negative feedback early in the design process). Although implicit in the interface (in order for two items to appear on the same screen, there must be a relationship), entity connections are visualized with a grayed line. The relationship type is denoted along the edge with a small textual description. The currently selected item and its associated edge are highlighted in red. (Figure 1)

3.3 Navigation

Keyboards and mice are obtrusive and unwieldy in the context of a typical living room. In response, our interface does not rely on these input devices. Instead, the system can be entirely controlled by a conventional TV remote control. The radial layout lends well to the use of just two buttons, which provide clockwise and counter clockwise selection. An action button causes the currently selected entity to become the centered item. If a user wishes to go back, they can simply traverse along the edge on which they came (all relationships are bidirectional). The home screen is the egocentric view, with the "me" node in the center. The user can jump to this home screen at any time by pressing a special button on the remote. If a keyboard is present, users can optionally enter a search string,

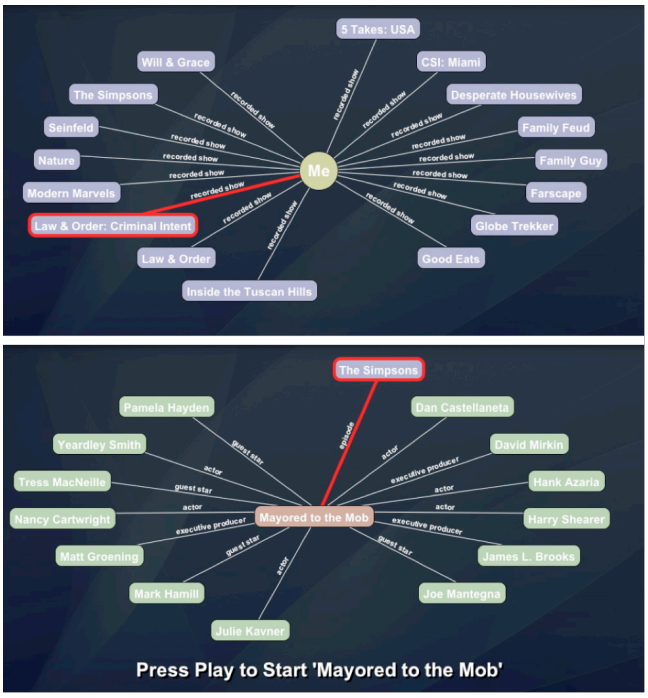

Figure 1. The ego-centric home screen showing all recorded series (top). iEPG centered on an episode of The Simpsons (bottom).

which disables all non-matching entities (down to a single entry if desired, in which case the user can simply hit the action button or return to center on that entity). If a show (an entity of type episode) is selected or centered, the user can press the play button to begin the show. It is not possible for an episode to be both centered and selected, as the two items cannot be directly related.

By traversing along various relationships, users can quickly explore the graph, locating items of interest. This navigation style, in concert with the visualization, not only provides metadata about items, but also allows the metadata itself to be used to search for other content. For example, it is possible to navigate in the following manner: Me > Seinfeld > Sitcoms > Fresh Prince of Bel-Air > Will Smith > Men in Black > Action > 24.

3.4 Ratings Visualization

In a typical program guide, shows are pigeonholed into a single, broad genre. Since many shows have complex, multi-faceted plots, a ratings scheme that allows people to rate multiple attribute dimensions is valuable. Numerous mechanisms for collecting show ratings data are possible. For testing purposes, a custom interface was created to collect attribute data at the conclusion of a program (Figure 2). In particular, people can rate shows on five criteria: action/adventure, comedy, drama, suspense/mystery/ horror, and educational/documentary. An overall rating was also collected. The values could be set from 1 to 5, or "NA" if not applicable, using four arrow keys on TV remote. This data was collected group wide and was displayed for all recorded series.

The data is presented in a compact mosaic plot. Each column represents a television series, with the width representing the overall show rating. These columns are also segmented horizontally, forming bands that represent particular attributes of the show (e.g., drama or comedy). The height of the band represents its relative rating to the other attributes. These bands are color-coded to ease recognition, and to facilitate comparison between shows. (Figure 3)

Figure 2. The show rating input dialog.

This has several interesting properties in addition to providing a unified rating display. Foremost, the combination of width for overall rating and height for attribute rating, causes dominant attributes in highly rated shows to become prominent. For example, the best comedy shows in Figure 3, as rated by the user's social group, are Family Guy and Seinfeld. The best educational show would be Globe Trekker. In this way, area essentially becomes analogous to the quality of a particular attribute. Secondly, this visualization allows all of a show's qualities to be displayed, along with their relative proportions.

4. HYPOTHESIS

Foremost, users will appreciate being able to navigate based on any entity type, and not being constrained by lists of a single type. Secondly, if given a choice, users will prefer using iEPG to a conventional EPG interface. Finally, users will find the show ratings visualization useful in selecting what to watch.

5. EXPERIMENTAL SETUP

A user study was conducted to qualitatively evaluate the iEPG system. In particular, the study investigated the ease-of-use and utility of the graph-based visualization and navigation, as well as the ratings visualization. As a baseline for comparison, we used the EPG included with the open source DVR application MythTV (Figure 4).

In this study, users were seated in a presentation room with a large rear-projection screen. A wireless television remote control was provided for all navigation functionality. A labeled color printout of the remote control was provided for reference. Twenty-three television shows of varying content and genre were included. This simulated a DVR with approximately two-weeks of recorded content [3]. Advertisements were removed, and clips shortened to approximately seven minutes in length. Initial ratings data were seeded through a series of pilot tests and additional data was collected throughout the study.

6. PARTICIPANTS

Thirty-two participants (24 male, with a mean age of approximately 42) volunteered for a small food reward. Participants were recruited using an email campaign at a large corporate research lab. All but one person watched TV on a regular basis.

7. PROCEDURE

Before seeing the system, users were shown a short video that provided an overview of iEPG. This was followed by a hands-on walkthrough, which familiarized participants with both the MythTV EPG and iEPG. Users were then asked to select and start a show of their choosing. Based on the participant's experimental condition, either iEPG or the MythTV EPG was presented (randomized to compensate for order effects, but balanced across participants). Users were encouraged to explore the guide before making a selection. After finishing the first show, participants were again asked to select a show of their choice. However, this time the alternative guide was used. For the third and final clip, users were allowed to choose which EPG they wanted to use. At the conclusion of each clip, the ratings dialog would automatically appear. Users could enter ratings for the show they had just watched or, if they desired, simply escape from the dialog. Following the final show, users were provided a desktop computer to fill out a questionnaire, which employed a five-point Likert scale with the following options: strongly disagree (1), disagree (2), neither agree or disagree (3), agree (4), strongly agree (5). Following the survey, users were interviewed to gather further comments on the system.

8. RESULTS

iEPG received an overwhelmingly positive response from users. When asked if iEPG was easier to navigate than the traditional guide interface (MythTV), almost two thirds agreed or strongly agreed (m=3.625, sd=0.66). There was a similarly favorable distribution with questions inquiring about the intuitiveness of the navigation and the presentation of information (m=3.56, sd=0.84 and m=3.84, sd=0.63, respectively). Users were also asked whether they thought the ability to navigate in a non-linear, web-like visualization was more useful than a conventional list-based view. Two thirds of the participants agreed or strongly agreed, and the remaining third had no preference (m=3.875, sd=0.71).

The ratings visualization also enjoyed a positive response. When users were asked if they felt the mosaic plot was intuitive, about a fifth of the respondents disagreed, with one person strongly disagreeing. This result was somewhat expected - despite efforts to simplify its appearance, the mosaic plot remains quite a sophisticated visualization technique, and one that most users will have never encountered. Regardless, just under half agreed or

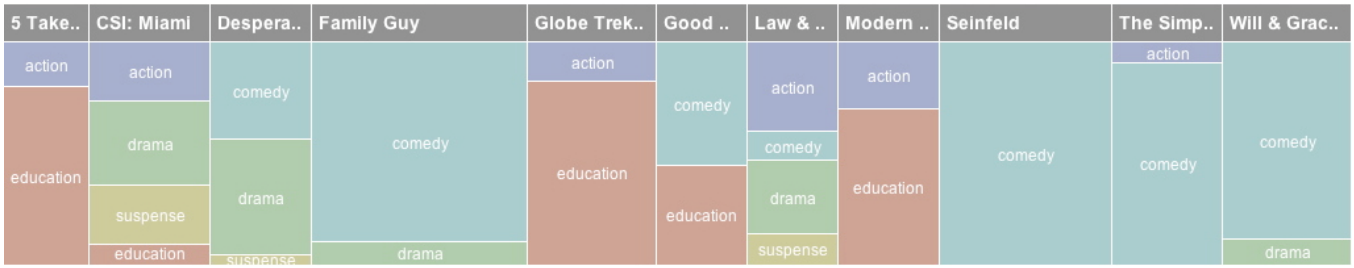

Figure 3. Show ratings visualization.

Figure 4. The MythTV EPG for recorded programming. This interface was included in the study so that participants could compare iEPG with a conventional list-based EPG.

strongly agreed that it was intuitive (m=3.43, sd=1.11). From comments made during the study, it was clear that most participants saw its value, but that it would take time for them to fully understand and utilize what it was showing. This anecdotal evidence is supported by results from a subsequent question, asking users if they believed the ratings visualization was useful, in which people who disagreed or strongly disagreed dropped to about one-eighth of the participants, creating a more positive distribution (m=3.47, sd=0.95).

Interestingly, the visualization of attribute distribution (e.g., action, comedy) proved popular. About 40% agreed it was useful, with an additional 33% strongly agreeing (m=4.06, sd=0.80). Of course, this data is only available if users are willing to contribute it. The data collection interface, even in its present, primitive form, saw 75% of respondents agreeing or strongly agreeing they would be likely to input attribute and ratings data (m=4.00, sd=0.88). Equally encouraging is that 82% of respondents indicated they would be likely or very likely to watch new shows that were highly rated by their group (m=4.06, sd=0.80).

9. FUTURE WORK

Although the results suggest that iEPG's visualization and rating scheme would be appropriate and welcomed in a television-viewing context, it is important to acknowledge that novelty effects undoubtedly played some role. A study that investigated extended use in a more realistic setting (e.g., the home environment) would be a logical next step. Additionally, users from different demographics, including heavy TV users such as children, would be invaluable.

A plethora of new features are currently being considered for the next version. For example, new entity types could be supported, including, airtime (e.g., 9pm), channel (e.g., NBC), duration (e.g., half an hour), characters (e.g., Al Bundy) and other items of interest. It is hoped this will not only enrich the metadata for existing content, but also provide new and powerful ways for people to locate new content (e.g., a highly rated show that is rated TV14 and is 30 minutes in length). Furthermore, the graph could be infused with more social data. For instance, friends could be injected into the graph, offering the ability to center on a friend and see all of the programming they have recorded. Additionally, friends could also connect to entities they have explicitly noted as favorites, for example, their favorite actor or genre. A secondary effort is focused on refining the visualization engine to be easier and more informative. Finally, we will be exploring new input modalities, including speech, gesture and vision.

10. CONCLUSION

iEPG provides a powerful way for people to navigate and choose television programming. Results from the user study clearly indicate users are open to new interface and visualization paradigms, and enjoy the flexibility that list-based systems cannot offer. The results also support that social data can be both effectively integrated into EPGs and immensely valuable; users seem willing to utilize and provide complex rating data to a system that can help them find new shows to watch.

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