Social TV and the Social Soundtrack: Significance of Second Screen Interaction during Television Viewing

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Abstract. The presence of social networks and mobile technology in form of secondary screens used in conjunction with television plays a significant role in the shift from traditional television to social television (TV). In this research, we investigate user interactions with secondary screens during live and non-live transmission of TV programs. We further explore the role of handheld devices in this second screen interaction. We perform statistical tests on more than 418,000 tweets from second screens for three popular TV shows. The results identify significant differences in the social element of second screen usage whilst the show is on air versus after the live broadcast, with the usage of handheld devices differing significantly in terms of the number of tweets during live telecast of TV shows. Desktop devices as second screens are also significant mediums for communication. This research identifies the change in users' interaction habits in terms of information sharing and interaction for TV broadcasts via the presence of a computing device as a second screen.

Keywords: second screen, multiple screen interaction, social television, social sound track, social media.

1 Introduction

With the advent of Internet technology and the emergence of online social networking, the social possibility of TV has greatly expanded, as the merging of technologies now allow a number of social activities and conversation concerning TV content via social networks (e.g., Facebook, Twitter, Weibo etc.). This combination of TV and online social networks has forged a social TV that imparts feelings of togetherness and communication among people in dispersed locations. The social network has embedded itself within the modern TV culture and it acts as a social soundtrack for TV content.

The social soundtrack is an interesting communication interactivity that can be both real time (i.e., during the live broadcast) and non-real time (i.e., not during the live broadcast) based around TV shows. This social commentary happens on social networks, especially on Twitter. The integration of Twitter (or other online social

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network) as the interactive medium with televised broadcasts marks the emergence of a new phenomenon augmenting the prior social aspect of TV. This new usage phenomenon is referred to as second screen (TV and computing device), although there may be multiple screens involved (TV and several computing devices). With the second screen phenomenon, the TV is the base device while the secondary screen is the computer (desktop or laptop), tablet, or smartphone. The secondary screen allows the social soundtrack, the conversation with others, regarding the particular TV program.

In this research, we investigate the use of the secondary screen during the telecast of three popular TV programs, specifically examining if viewer interactions differ during and after the live broadcast. We also examine the extent to which handheld devices play significant roles during second screen interaction. This research is important as the degree of usage of secondary screens can facilitate the personalization of TV content and advertising with the design of mobile apps. Findings can also assist both the channel owners and advertisers to formulate new strategies for TV airing, launching apps for product ads to engage more viewers, promote sales, and earn revenues.

2 Related Work

2.1 Social TV (sTV)

There is existing literature concerning socializing aspect of TV. Since the emerging social TV (sTV) relates to interaction among people associated with program watching, sTV highlights a special form of socialization, where the TV content is accompanied by social interaction. sTV is an emerging communication technology and practice in the fields of interactivity, mass media, computing, and entertainment.

sTV refers to a broad spectrum of systems that support and investigate the social experiences of TV viewers. Researchers have developed a series of sTV prototypes. Abreu, Almeida and Branco [1] developed the 2BeOn sTV system with the goal of making the users go online to ensure interpersonal communication. Coppens, Trappeneirs and Gordon [2] introduced the AmigoTV prototype, which brings personal content, voice communication, and community support by offering real time interaction among a group of friends around a TV show. Regan and Todd developed Media Center Buddies [3] that permits multiple users to engage in instant messaging while watching TV together.

Though the proposed sTV systems enrich TV based socialization, their design goal was to allow a small group to share a feeling of sociability or togetherness. The degree of sociability increased significantly via the integration of online social networks services with TV viewing. The conversation interactions in the social soundtrack can be considered as a form of end-user enrichment of the TV content [4]. Such end user enrichment enhances the sTV socialization via the user generated content and converts sTV into a community [5].

2.2 Integration of Prior Work

Despite the prior literature in sTV, there has been limited research on second screen interactions. Leroy, Rocca, Mancus and Gosselin [6] analyzed users' second screen behavior concerning where and when people look at their TV. Zhao, Zhong, Wickramasuriya and Vasudevan [7] extracted viewers' sentiments about US National Football League teams by analyzing real time tweets. Lochrie and Coulton [8] showed that Twitter is increasingly used as real time audience communication channel for sharing TV experiences.

Though the aforementioned research speaks to the usage of social networks to make TV more social via viewer interactions with the technology, the studies regarding significance of social interaction using secondary screen is scarce. As such, there are several unanswered questions concerning the second screen phenomenon. How is social media used during live TV broadcasts? How is social media used after the live broadcasts? What is the effect of mobile devices on the social soundtrack? What are the discussion patterns of second screen usage? What are the interaction points between TV and social media? These are some of the questions that motivate our research.

3 Research Question

Social networks allow for TV programs to be accessed and shared by viewers in a variety of ways. The audience can join in discussion while watching the show and have their interactions be viewed and responded by other members. Such interaction may or may not be active in terms of real time discussion during live telecast of the programs. The second screen technologies, such as smartphones, tablets and laptops / desktops, facilitate these interactions to occur anytime, anywhere irrespective of airing times of the TV shows. Commercial and other organizations are increasingly keen to capitalize on this second screen technology interaction to measure the viewing habits and reactions of the audience. Participating in active discussion using second screens while experiencing live TV shows may lead to an index regarding change in user's TV viewing habit. This issue formulates our first research question: -

1. *Is the usage of secondary screen significant for social interactions during live transmission of TV shows?*

There are two perspectives that are highlighted by the aforementioned research question. First, the significance of a secondary screen during live broadcast of TV shows identifies the adaptation of social network sites as the driver of real time conversation from the perspective of the audience whilst the program is on air. We refer to this as real time interaction (i.e., during the live broadcast). Second, the active interaction via social networks might create commercial opportunities by the advertising agents at the intersection of the social networks, the TV, and the second screen. So, the first research question regarding social significance of secondary screens during live show time begets the following research hypothesis.

Hypothesis 01: There is a significant difference between real time and non-real time social interaction based on a TV show w.r.t usage of secondary screen.

We further explore the presence of second screen technology during such sTV phenomenon in terms of handheld device usage. The ease of portability, mobility, and usage has triggered the widespread use of mobile devices, particularly the "always on", "always there" and "always connected" attributes. Thus, place and time independence play pivotal roles in promoting the touchscreen devices such as smartphones (e.g., iPhones, Android, Blackberry etc.) or tablets (iPad, Booklet, GriDpad etc.) for interactions in social networks. The intuition that tactile experience provides more interaction during live telecast refers to the second research question:

2. *Is the usage of mobile devices as secondary screen significant for interaction during live transmission of TV shows?*

Investigation of this question is important as the growing focus of production and consumption of interactions in the form of micro-blogs, texts, and symbolic messages helps to make mobile devices unique platforms for the development of personalized apps for social commerce. The apps can better exploit mobile devices' native capabilities for a more responsive and seamless experience. Based on the second research question, hypothesis 2 is formed.

Hypothesis 02: There is a significant difference between real and non-real time social interactions among viewers during the course of a TV show w.r.t use of mobile devices.

Hypothesis 02 indirectly leads us to one more hypotheses. Hypothesis 03 refers to the comparison between mobile and non-mobile devices (e.g., laptop, desktop etc.) to be used as the second screen medium for interaction during a live TV program.

Hypothesis 03: There is a significant difference in usage of mobile and non-mobile devices as secondary screen for interactions among viewers during live telecast of a TV show.

4 Data Collection

We selected three popular TV shows and collected users' interactions in form of tweets from Twitter. The TV shows selected for this research are: 1) *Dancing with the Stars,* 2) *Mad Men*, and 3) *True Blood*. The shows belong to three different genres and the reason for considering a spectrum of genres is to deal with the generalizability issue for the significance of second screen in social interaction during and after live broadcast of the TV shows. The tweets for *Dancing with the Stars* were collected for two consecutive weeks starting from 13th May 2013 to 25th May 2013. These two weeks account for selection of finalists and champion for season six respectively. Regarding *Mad Men* and *True Blood*, we collected tweets for three successive weeks in the month of June. For both shows, it spans from 9th June to 29th June 2013. As 23rd June was the date for the season finale for *Mad Men,* we stopped collecting tweets for both *Mad Men* and *True Blood* the following week. For each show, the tweets posted in English texts were collected. The number of tweets for *Dancing with the Stars,*

Mad Men and *True Blood* are 46269, 152259 and 220390 respectively. Here the queries are the TV show names. The number of tweets for *Dancing with the stars* is less than that for other two TV shows as the version of Twitter API for *Dancing with the Stars* tweets was older (API 1.0) compared to that used (API 1.1) in tweet collection for other two shows.

For identification of the use of mobile technology for viewer communication, we leveraged the *"Source"* field of the tweets in Javascript Object Notation (JSON) format. We classified mobile tweets based on the existence of keywords within *"Source*" attribute. The keywords we used were *"iPhone", "iPad", "Android", "iOS", "Blackberry"* and *"Mobile Web"*. *"Mobile Web*" refers to access browser based internet services from handheld mobile devices. If the *"Source"* of a tweet contains any of these keywords, we classified it as a mobile tweet. Otherwise, we classified it as a non-mobile tweet. The keyword list seems to be exhaustive to classify mobile tweets from *"Source"* attribute.

We first focused on those tweets collected on the days of live telecast of the TV programs to measure the second screen effect on user interaction during the live broadcast. We segregated the count of tweets collected in 24x7 hours across the weeks for all three TV shows into fifteen minutes intervals and stored the time versus count data in three spreadsheets, each for one televised program. We also stored the numbers of mobile and non-mobile tweets with the intervals of fifteen minutes for each show in the time vs. count format. We annotated the timings of the tweets generated and categorize them as "real time second screen" (rtSS) and "non-real time second screen" (nrtSS) tweets w.r.t Eastern Daylight Time (EDT). The rtSS tweets indicate that the tweets are posted during live broadcasts. The nrtSS counterparts are the ones posted by the users while the TV shows are not on air. We need to focus on the tweets as rtSS tweets collected in hours shown in Table 1 combining the show timings of all six different US time zones (i.e., Eastern, Pacific, Central, Mountain, Alaska and Hawaii) considering the time differences w.r.t EDT. The airing time for all three TV shows is about 60 minutes each day except the week for champion selection for *Dancing with the Stars*. The airing time of *Dancing with the Stars* in final week is about two hours each day.

Table 1. Time in hour w.r.t EDT focusing collection of rtSS tweets for three TV shows

	Sun	Mon	Tue	Wed
Dancing with the Stars		8 PM, 9 PM,11 PM	9 PM, 10 PM	12 AM
Mad Men	10 PM	1 AM		
True Blood	9 PM	12 AM		

5 Result

We transformed the data via the Box-Cox transformation using log transformation function *log(variable + 1.0)* as the data is not normal. Using the log transformation,

the data is successfully normalized, though a bit of skewness exists on the left (i.e., the histogram of transformed data nearly follows normal distribution). The Box-Cox transformation of the non-normalized data increases the efficiency of univariate t-tests [9]. In SPSS, we ran three separate t tests between relevant combinations of (rtSS, nrtSS) and (mobile, non-mobile) pairs to evaluate the hypotheses. Two tailed statistical t-tests were carried out at 95% confidence interval where t-statistic for each test is 1.96 at significance level $\alpha = 0.05$ for large degrees of freedom. $\alpha = 0.05$ is feasible standard to catch effects, large enough to be of scientific interest.

For hypothesis 01, the two-tailed t test result indicates that there is a significant difference between the rtSS and nrtSS categories of tweets for all three TV shows as observed in Table 2. So, hypothesis 01 is fully supported. The statistical significance of hypothesis 01 led us to explore the direction of the second screen effect. For one tailed two sample t test we have $t_{critical} = 1.645$ at $\alpha = 0.05$. From Table 2, it is evident that t-values of all three shows are significantly greater than $t_{critical.}$ So, we conclude that social interactions in terms of number of postings during the live telecast of the shows are greater than the postings when the shows are not aired.

Table 2. T-statistic with p-values obtained from two-tailed t test between rtSS & nrtSS tweets for the TV shows

	T-value	p-value
Dancing with the Stars	11.152	0.00 < 0.05
Mad Men	8.017	0.00 < 0.05
True Blood	5.060	0.00 < 0.05

For Hypothesis 02, we perform t test between two independent samples: 1) tweets posted from handheld devices during live broadcast of the shows (rtSS) and 2) tweets posted from handheld devices when the shows are not live (nrtSS). The results in Table 3 show that there are significant differences of means of mobile tweets between rtSS and nrtSS categories of postings for all three TV shows. The result fully supports hypothesis 02. We carried out one tailed two sample t test to investigate the direction of second screen effect on mobile interactions. From Table 3, it is evident that t-values of all three shows are significantly greater than $t_{critical}$ (1.645). This infers that the mean of usage of mobile devices for real time sharing of TV experiences is greater than that for sharing of views when the programs are not being televised real time.

Table 3. T-statistic and p-values obtained from two tailed t test for rtSS & nrtSS mobile tweets

	T-value	p-value
Dancing with the stars	13.173	0.00 < 0.05
Mad Men	8.140	0.00 < 0.05
True Blood	4.956	0.00 < 0.05

For hypothesis 03, the result of the two tailed t-test, displayed in Table 4, does not infer that there is statistical significance between the usage of mobile and desktop devices for interaction when a TV show is airing.

Table 4. T-statistic with p-values obtained from two tailed t test for rtSS tweets posted by mobile & non-mobile devices

	T-value	p-value
Dancing with the Stars	1.465	0.145 > 0.05
Mad Men	1.887	0.064 > 0.05
True Blood	0.797	0.429 > 0.05

6 Discussion

In this research, we investigated two main research questions pertaining to second screen interaction highlighting the use of social networks in sharing conversations about TV shows. Both of these questions are examined from perspective of human information processing in terms of the volume of tweets posted about the TV media content. Intuitively, the proximity of second screens will increase the social interaction among the viewers about the TV shows. Our results show that the use of second screen during live transmission of TV occurs based on the rise in real time social communication. The findings are important as they indicate the changed of TV viewing habit of the users in terms of information sharing behavior and social interactivity. During live transmission of the TV programs, the presence of a second screen generates significantly more tweets than when the program is not live. It is noteworthy that usage of mobile devices gains considerable momentum during such second screen interaction when the TV show is on the air. Though there is rise in usage of mobile phones for sharing communication during live transmission of a TV show, the use of desktop devices for posting of tweets is still strong for second screen usage. It is interesting, from Table 4, that neither mobile nor desktop devices claims clear majority as a medium of second screen technology. Our assumption is that viewers may be watching the shows or reviewing the social soundtrack on their desktop computers. Thus, it is easier for them to share social media content via that hardware platform.

Regarding practical implication retailers can advertise their brands or services during a live TV show, targeting the users on social media as potential consumers. The growth of social interaction via second screen during live transmission of TV shows increases the possibility of purchase intent among the potential consumers of the brand. On the other hand this will help broadcasters to generate increased revenue from retailers by allowing them to air personalized ads during the TV shows.

7 Conclusion

Though our data set spans for two/three weeks for each TV show, the results regarding evaluating the interaction effect of the second screen phenomenon in this research indicates that the adjacency of second screen during live transmission of TV shows generates higher social interaction relative to that when the show is not airing live. In addition, higher engagement of mobile users is observed when the show is live. We believe that our research provides valuable novel contribution concerning user's

behavior and interaction while viewing of mass media in a relatively new but emerging avenue of user behavior research and personalization of ad and TV content.

For future work, we will test the effect of the second screen phenomenon mechanism over a number of TV shows from different genres across several subcontinents to find whether the results translate to a spectrum of genres and non-US TV shows with large data set. We will further conduct content analysis of the social soundtrack to determine the content of the conversation occurring via user interactions with the second screen.

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