Understanding Mass Interactions in Online Sports Viewing: Chatting Motives and Usage Patterns

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This article aims to deepen understanding of these mass interactions in online sports viewing through studying Naver Sports, the largest online sports viewing service in Korea. We examined the diverse aspects of mass interactions, including interactive experiences, usage motives, and relationships between usage patterns and motives, through analysis of almost 6 million chats from Naver Sports and from self-reporting survey data from 1,123 users. First, we found that online sports viewing provides unique interactive experiences when compared to other settings such as offline sports viewing and social TV viewing with friends. Second, we found the key motives inspiring online sports viewing include the following: sharing feelings/thoughts, wanting to be entertained, sharing information, and wanting to feel membership in a group. Third, these motives were significantly related to specific usage patterns. Finally, we explored how the study's key findings can offer practical design implications to enhance online sports viewing services, and to show system designers how to support particular usage patterns to better accommodate specific user motives.

CCS Concepts: • **Information systems** → *Chat*; *Web log analysis*; • **Human-centered computing** → *Collaborative and social computing*

Additional Key Words and Phrases: Online sports viewing, mass interaction, sports fan, social TV

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1. INTRODUCTION

Sports fans enjoy watching sports games at various venues, including in-home and out-of-home locations (e.g., sports bars, workplaces, and sports stadiums). Viewing experiences vary widely depending on where the viewing occurs [Eastman and Land 1997]. In particular, public viewing, which can be defined as watching mediated (or televised) sports in public places such as sports bars, provides strong social experiences because viewers can share and affirm their fanship as though they were spectators at a sports stadium [Gantz 2013].

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This type of public viewing has gone online as a result of recent advances in information technology, for example, high-speed Internet and Web 2.0. Now, sports fans can watch sports from anywhere using social TV services such as YouTube Live, MLB TV, and Naver Sports, interacting with other fans via online chatting and cheering on their favorite teams while at work, on a bus, in a taxi, and so forth. Social TV services provide unique viewing experiences in that viewers have a degree of freedom similar to that of viewing at home, but they can additionally share and affirm their fanship with other online viewers.

Live chatting behavior in social TV is considered a mass interaction because a large number of online viewers utilize a single public space to cheer on their favorite teams, express their feelings, and ask/answer questions. However, our knowledge of the nature of mass interactions in online sports viewing remains limited. Prior studies on mediated sports are limited to social experiences in offline settings such as sports bars [Eastman and Land 1997; Gantz 2013]. Large-scale data analyses have been used primarily to automatically summarize sports games because the chatting content is related to the current game [Melnick 1993], analytic algorithms can pinpoint highlight moments during which viewers actively participated in live chatting [Nichols et al. 2012; Tang and Boring 2012].

This article deepens our understanding of mass interactions in online sports viewing, and explores how the key findings can offer practical ideas for social TV system design. The following research questions were considered:

—RQ1: What are the quantitative and qualitative characteristics of interactive experiences in Naver Sports?
—RQ2: What are the primary motives for engaging in mass interactions while viewing online sports?
—RQ3: How are these motives related to usage characteristics (physical/social context and chatting patterns)?

We began by investigating interactive experiences in Naver Sports (RQ1). We explored both the quantitative and qualitative aspects of interactive experiences, and characterized them by comparing them to other settings such as offline sports viewing and social TV viewing with friends. Then, based on a uses and gratifications approach [Blumler and Katz 1974], we tried to understand the motives for chatting in online sports viewing (RQ2) and to relate them to diverse usage patterns (RQ3). These analyses helped us to provide practical design suggestions that can be used to support user interactions with the goal of increasing specific user motives.

The research questions were answered by analyzing almost 6 million chat messages from Naver Sports, the most popular live streaming service for sports in Korea. Furthermore, we supplemented the large-scale data analysis with a self-reporting survey of 1,123 Naver Sports users. To date, this study is the first large-scale study reported for real-world mass interactions in social TV. The key findings of this study are summarized as follows.

First, we investigated interactive experiences in Naver Sports and compared them with those of other services, such as offline sports viewing and social TV viewing with friends (RQ1). In essence, the number of co-viewers was far greater than that of other services, and the chat speed was also faster than that of other services (e.g., offline sports viewing [Eastman and Land 1997] and Internet relay chatting [Jones et al. 2008]). Qualitative analyses also revealed that the topics of chats were coherent and mostly contextually relevant to the current video content. Unlike offline sports viewing, conversation among co-viewers rarely developed from sports into personal matters. Finally, we found several unique functions of chat interactions that have not

been reported in study of general social TV viewing [Weisz et al. 2007]: commentating, emotional release, cheering/jeering, and questioning/answering.

Second, the key motives for participating in mass interactions in social TV were identified as follows (RQ2): *sharing feelings and thoughts*, *fun and entertainment*, *information seeking*, *information offering*, *emotional release*, *intra-membership*, and *inter-membership*. Interestingly, we found that the survey participants (17.1%; 13/76 responses) mentioned fan membership as their main motive, while no one participant described building interpersonal relationships. This finding is unlike existing studies that evaluate user experiences in small-scale social TV environments (e.g., a group of friends) [Weisz et al. 2007]. Because personal conversation in Naver Sports is limited (considering the high speed of chat postings and strong topical coherence, observed in our quantitative and qualitative analysis), Naver Sports users seem to rarely expect interpersonal relationships with other co-viewers. Instead, they tend to enjoy a feeling of fan membership by co-viewing and chatting with a massive number of others who share similar interests.

Third, the overall usage behaviors and the unique relationships between usage patterns and motives were identified using regression analyses (RQ3). In particular, it was found that multitasking and smart media users exhibited a stronger motive for sharing feelings and thoughts with chats (e.g., to compensate for the loss of interaction opportunities due to multitasking and the lack of interaction opportunities afforded by their mobile devices). Chat length was negatively correlated with the entertainment and emotional release motives according to the frequent use of emoticons instead of long texts. The number of chats and the number of reporting abusive chats are positively related to information seeking/offering motives. Finally, fan loyalty observed in chatting behavior was clearly reflected in the membership motive. Based on our key findings, we present practical design suggestions.

The remainder of this article is organized as follows. In Section 2, we provide background information about mediated sports viewing and review the related literature. In Section 3, we illustrate user interfaces in Naver Sports and our dataset. Section 4 explains both the quantitative and qualitative analysis results of the chat dataset. Section 5 presents the results of the explorative factor analyses that identified the key usage motives, and Section 6 shows the relationship between those motives and diverse usage patterns. Based on our findings, practical design suggestions are presented in Section 7. Section 8 describes the limitations of this study, and this article concludes in Section 9.

2. BACKGROUND AND RELATED WORK

2.1. Motives for Enjoying Mediated Sports

The popularity of watching mediated sports is largely attributed to several factors, including emotional, cognitive, and behavioral/social motivators [Raney 2006]. The relevance of these factors for understanding mass interactions in social TV will be demonstrated.

First, people watch mediated sports because they expect positive emotional impacts from watching. This is called emotional motivation. Several studies have reported high expectations of being entertained or experiencing enjoyment during games that people can bring to sports programming [Gantz 1981; Gantz and Wenner 1991]. Another emotional motivation is self-esteem. People tend to perceive themselves as attractive, competent, and likable when their favorite team wins [Wann 1995; Wann et al. 1999]. For example, sports fans often identify themselves as winners when their favorite team wins. This is called *basking in the reflected glory* [Cialdini et al. 1976]. These behaviors reflect fan identity—that is, social identity related to a specific sports team

[Jacobson 2003]. According to the social identity theory, such social identity motivates people to behave in ways that maintain and increase their self-esteem. Thus, self-esteem motivation is more influential when people have stronger fan identities. Finally, escaping the stress of daily life motivates people to watch mediated sports [Gantz 1981; Gantz and Wenner 1991]; for example, people want to view mediated sports to take a break from repetitive tasks [Krohn et al. 1998].

Second, cognitive motivation drives people to view sports on television. Viewing sports is a cognitive activity as well as an emotional activity. People are often motivated to learn more about players and teams [Gantz 1981; Gantz and Wenner 1991] because this knowledge can be useful conversational content with friends and strangers [Melnick 1993]. Viewers also have aesthetic motivations that lead them to appreciate the artistic or stylistic beauty found in sports games [Zillmann et al. 1989]. This motivation is stronger in sports that contain more aesthetic elements, such as gymnastics or figure skating.

Third, behavioral and social motivations lead people to enjoy mediated sports. Watching sports provides viewers with an opportunity to release emotions [Gantz 1981; Gantz and Wenner 1991]. Viewers often bring their repressed emotions to their viewing experiences, and these emotions are further enhanced through viewing sports. With respect to social emotions, prior research has reported that a stronger companionship exists between sports viewers than among those who view other types of television content [Wenner and Gantz 1998]. Furthermore, many fans are motivated by group affiliations beyond temporal companionship [Smith 1988].

Existing studies have focused primarily on identifying the motives of offline sports viewers. As a new form of media, social TV systems use chatting functions to provide a high degree of freedom similar to that of home viewing or co-viewing experiences such as stadium/public viewing. The number of online sports viewers who regularly watch sports games, ranging from baseball to e-sports, increases continually. However, there is a lack of research concerning how viewers use social TV systems and how/why they interact with other viewers, particularly in a mass interaction space. We believe that understanding the usage behaviors/motives and the relationships between these usage behaviors and motives will assist in outlining practical design suggestions for online sports viewing systems.

2.2. Online Mass Interactions

The virtual public is a computer-mediated space that enables mass interactions among the public [Jones et al. 2004, 2008]. Example services include Usenet, IRC, social TV (Naver Sports TV, GetGlue, etc.), and Twitter groups. The existing research on mass interactions has focused primarily on information overload, the state at which the communication overheads required to process messages exceeds an individual's information processing limit [Jones et al. 2004, 2008]. In their Usenet studies, Jones et al. [2004] identified several user strategies for managing information overload such as responding to simpler messages, generating simpler responses, and participating less actively. In IRC chatting [Jones et al. 2008], information processing limits impose limits on user participation—that is, the community size is typically less than 300. However, the active posters are limited to 40 users, and the information processing rate is bound by 30 messages per minute.

Group chats in Twitter have appeared as new media for mass interactions. Budak and Agrawal [2013] analyzed 30 educational groups and demonstrated that user contribution followed the power-law distribution (a large number of Twitter users participate in a single chat group, while a small number of users contribute to multiple groups.). The participants were limited to 2,000 individuals, on average. They also found that the factors closely related to continued participation in group chats after the initial

visit included individual initiatives, group characteristics, linguistic affinity, and perceived receptivity. The significant usage motives were to explore due to curiosity; to learn about new information, tools, and methods; to make connections; and to have a sense of belonging. Note that unlike existing virtual public spaces, social TV has two unique characteristics: chat sessions are associated with a corresponding TV program and large numbers of viewers participate in chat sessions simultaneously.

Our study extends understanding of such new media and provides practical suggestions for designing online sports viewing systems by analyzing the relationships between interaction motives and usage patterns.

2.3. User Interactions in Social TV Systems

Social TV is a new breed of video service that integrates other communication services like voice, chat, context awareness, and peer ratings to support shared TV experiences with others [Klym and Montpetit 2008]. It has been reported that social TV services change traditional user interaction in TV viewing and offer better user experiences. For example, various socializing features in social TV systems provide a feeling of sharing the same social events with others [McPherson et al. 2012], making video content more enjoyable [Weisz et al. 2007].

Social TV services support diverse social interactions. Cesar and Geerts [2011] classified social interactions in social TV services into four categories: content selection and sharing, communication, community building, and status updating. First, content selection means that TV viewers share relevant information about programs to help each other make a decision on what to watch (i.e., program recommendations). For example, Facebook Live provides a "like" button on a live video, and Hulu allows users to edit and share video clips with others. NextGuide allows users to create a profile and share their favorite movies or shows with friends, and Grabyo provides an editing tool to share real-time videos via SNS. Second, some social TV services support direct communication with other viewers via chat, audio, or video. CollaboraTV [Nathan et al. 2008] and AmigoTV [Coppens et al. 2004] provide a text-based chatting function for viewers, and Naver Sports, Daum Sports, YouTube Live, and MLB TV support mass interactions among a large number of co-viewers. Additionally, KakaoTV is a mobile social TV service that allows mobile viewers to chat with each other by providing streaming video. Third, a large community of viewers is built when they share their comments about a program. For example, GetGlue (currently closed) and Voice of TV, customized social network services for TV programs, provide an online space for each TV program so that TV viewers can exchange messages about TV programs. Finally, status updating gives viewers social awareness of each other's presence. Naver Sports and TVing show the number of current viewers. Likewise, Viggle shows the number of users who are checked into a program, and users can browse their friends' check-in statuses.

With the advent of smart TV and Internet TV, the concept of social TV covers broader aspects of new media, and social TV can be further classified according to several additional design dimensions. First, social TV systems can be differentiated according to their integration of social interaction with a video. In some social TV systems, the space for social interactions can be co-located on the same screen. With GoogleTV and CommentTV [Hwang et al. 2012], for example, viewers' comments are presented right next to the video screen. Viewers can even use second screens separate from the device on which a video is playing. For example, while watching a video on a TV or PC, viewers can post short messages with Twitter and WhatsApp using their smartphones or tablets. Han et al. [2014] showed that viewers often use mobile messengers to search for relevant information, communicate with others, and work on tasks in opportune moments during perceived lulls in the first screen's content.

Social TV systems can be also differentiated based on the publicness of their interaction groups. Some social TV systems support only private social interaction spaces for small peer groups. For example, CollaboraTV and KakaoTV provide chatting functions for a group of friends who watch a video together online, and TunerFish gives viewers an awareness of what their friends are currently watching. Another type of social TV system provides an interaction space for the public. Such social TV systems usually support mass interactions of numerous co-viewers who share the same interests in a live video (e.g., YouTube Live, TVing, MLB TV, and Naver Sports). In addition, some services support user interactions in both public and private spaces. For example, GetGlue users can share comments in the public space for each program, and at the same time, they can also directly interact with users on a "friend list."

In this article, we analyze Naver Sports, which supports direct communication through text-based chatting. The interaction space of Naver Sports is open to the public, and it can be considered a venue for mass interactions among sports viewers. Therefore, our study investigates text-based mass interaction services typically observed in current social TV systems. While previous studies have focused on the user interactions of a small group of viewers [Geerts et al. 2008; Dezfuli et al. 2011; Weisz et al. 2007; Geerts et al. 2011], we complement these studies by quantitatively analyzing mass interactions with a large-scale dataset.

2.4. Online Sports Viewing by Social TV Systems

Earlier studies have demonstrated that sports are one of the most characterizing genres of TV. First, people are more interactive while watching sports games [Geerts et al. 2008]. The authors demonstrated that communication patterns depend on program genre. Furthermore, a genre's plot structure is an important factor that contributes to determining the level of social interaction while watching TV. Genres with an engaging plot structure, such as drama and movies, may permit fewer opportunities for synchronous social interaction because they require more viewer attention. In contrast, genres with short or negligible plot structures, such as quizzes and sports, offer more opportunities for synchronous interaction.

Second, people feel more comfortable talking with strangers while watching sports games [Dezfuli et al. 2011]. Relatively fewer social interactions occur among strangers in the presence of other genres of television because people prefer to interact with family or close friends. However, sports fans enjoy watching games with strangers due to the group identity associated with teams [Lee 1985]. Furthermore, in sports games, the number of co-viewers is more important for viewer satisfaction than the identity of the co-viewers [Dezfuli et al. 2011].

Prior studies have analyzed the user interactions of small groups. In recent years, social TV services based on mass interactions (e.g., YouTube Live, MLB TV, and Naver Sports) have been grown rapidly, but our knowledge of the nature of such systems remains limited. Our study aims to bridge this gap by deepening understanding of mass interactions in online viewing and identifying practical suggestions for social TV system design.

3. DATASET: NAVER SPORTS

Naver Sports is a convenient online platform for online sports viewing experiences. It delivers live video streams from public broadcasting stations and supports multiple devices, such as PCs and smart devices (phones and tablets). It also covers diverse sports genres including baseball, soccer, basketball, golf, e-sports, and so on. E-sports refers to competitions of video games such as StarCraft and League of Legends, and Korea has professional leagues for e-sports that usually provide live competition broadcasts.

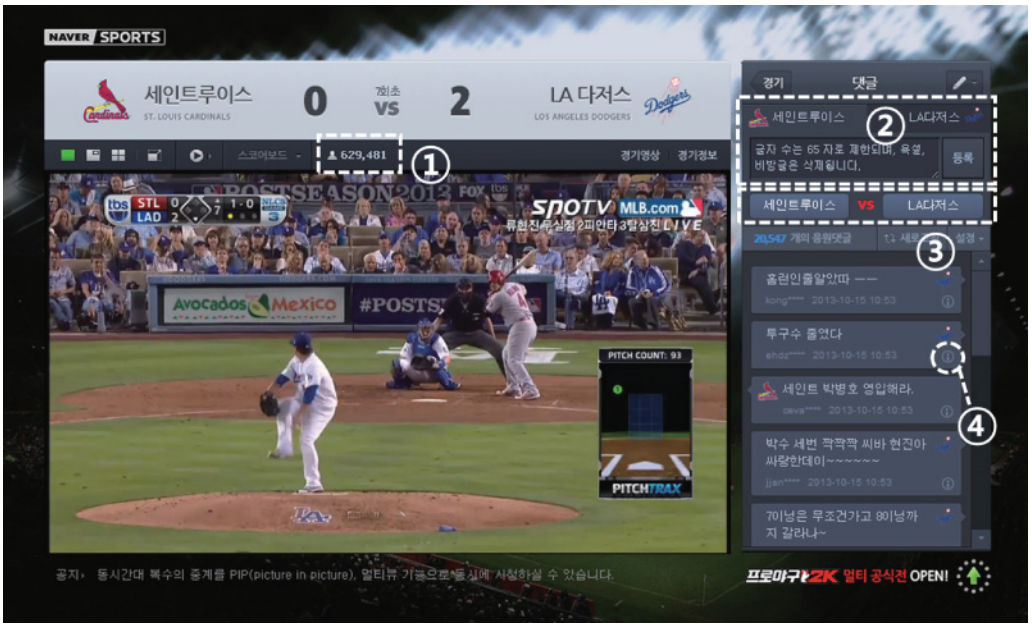
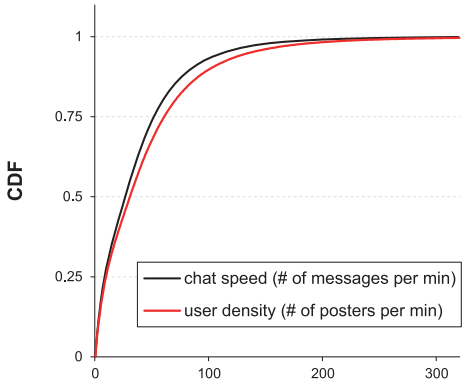


Fig. 1. User interfaces of Naver Sports. (Left: live streaming panel; right: chatting panel; ①: number of viewers; ②: input area for chatting; ③: team selection button to see chats for each team; ④: button for reporting abusive users).

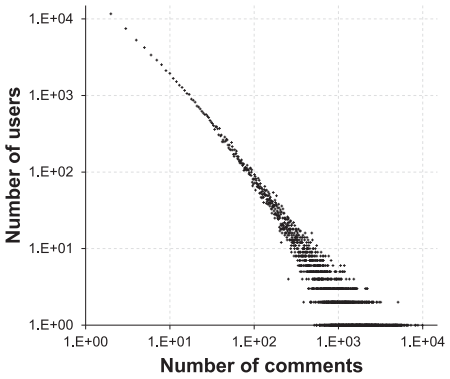
Naver Sports supports real-time messaging features for live chatting that have been widely used in online sports viewing systems. Figure 1 presents the main user interface of Naver Sports. When the user selects a sports game to watch, a pop-up window for the video stream is opened, as shown to the left of Figure 1. The live video is shown on the left panel of the pop-up window, and the live scoreboards of other games in the same genre are also displayed on the right panel. Clicking the scoreboard of another game moves the user to the live streaming page for that game. If the user clicks on the chatting button, it displays the recently posted chats for that game. Because the chats are placed in the right panel, people can watch the live video in the left panel while simultaneously chatting online with other viewers.

To post a chat message, users are required to sign into the website. Then, users are asked to choose a favorite team from among the two in the game, like selecting places from which to cheer in a stadium or wearing a favorite team's uniform, as shown in ② in Figure 1 (note: switching the selected team during a game is allowed.). Next, users can write a chat message, and the inputted message is shown along with the selected team's icon in the list of chat messages. The maximum length for a chat message is limited to 65 characters. Furthermore, user interactions are rate-limited to three messages per minute in order to prevent spamming. All recent chats are displayed by default. A user can filter chats by team by clicking a team's icon, for example, if they want to chat with only the fans of their favorite team (see ③ in Figure 1). There is also a button to report and filter an abusive user (see ④ in Figure 1).

For our analysis, we crawled live chats for four popular sports genres in Naver Sports (baseball, soccer, basketball, and e-sports) from December 2012 to September 2013. The crawled data contained 105,221 unique chatters and 6,475,159 chats. Each crawled chat consisted of a game ID, user ID, chat messages, favorite team (i.e., the team selected when the user posted the chat message), and posted time.



(a) Cumulative Distribution Function (CDF: prob. of $X < x, X \in \{\text{chat speed, user density}\}$).



(b) Message frequency

Fig. 2. Quantitative analysis of chats in Naver Sports.

4. RQ1: INTERACTIVE EXPERIENCES IN NAVER SPORTS

In this section, we investigate interactive experiences in Naver Sports and discuss the similarities with and differences from experiences in related areas, such as social TV and offline sports viewing. Our analysis was conducted both quantitatively and qualitatively. We first analyzed the quantified interactivity of Naver Sports users (e.g., chat speeds), then conducted content analysis on chats to explore their topics of discussion and the functions of their interactions.

4.1. Quantitative Analysis

We first conducted an analysis to quantify the level of interactivity of Naver Sports, looked at items like how many viewers watched a game at the same time and how fast chats were posted. In our analysis, we considered the number of viewers/messages per minute, as in prior studies (e.g., IRC [Jones et al. 2008] and social TV [Weisz et al. 2007]), for ease of comparison with other communication environments.

The results showed that a large number of viewers co-watched sports games and that they had a large number of chat interactions. In our dataset, the average number of viewers per minute was 34,331. The number of comments per minute was 47.09, and the number of posters per minute was 41.60. Most of the time, chat users did not hit the rate limit imposed by Naver Sports, which allows a user to post three comments per minute. Figure 2(a) plots the distribution of the chat speed in terms of the number of messages per minute across all sports games. We also calculated the number of words per message, and it was quite small ($M = 4.03$, $SD = 2.05$).

Each sport had relatively distinct statistical characteristics. The chat speeds for soccer games ($M = 9.28$, $SD = 8.99$) and basketball games ($M = 8.78$, $SD = 8.49$) tended to be slower than that of baseball games ($M = 62.72$, $SD = 53.45$) and e-sports games ($M = 25.00$, $SD = 31.44$). Such speed differences in chat interactions across different sports are possibly related to the different gameplay structures of each sport and the varying number of viewers. In particular, we found that the number of viewers varied widely across different sports. Baseball had the largest number of viewers ($M = 39,365$ viewers per minute, $SD = 20,182$), and e-sports ranked second ($M = 24,093$ viewers per minute, $SD = 18,086$). In contrast, soccer ($M = 7,803$ viewers per minute, $SD = 6,874$) and basketball ($M = 15,908$ viewers per minute, $SD = 15,167$) usually had less viewers in Naver Sports.

In addition, further analysis revealed the power-law nature of user participation. Figure 2(b) presents the distribution of each user's chat message frequency, which equals the number of messages per user. A small number of active users posted a large number of messages, and the remainder of users posted only a small number of messages. 58.5% posted fewer than ten messages during the period, and the top 10% of chat participants posted 79.9% of the messages.

4.2. Qualitative Analysis

We conducted content analysis to understand the content of chats in Naver Sports. We first sampled 2,500 chats, and 25 chatting blocks were randomly selected from the dataset. Each block had 100 consecutive chats in order to preserve the chatting context. We then performed affinity diagramming of the chats to identify the topics of chats and the functions of interactions.

4.2.1. Topics of Chats. To investigate the topics of chats, two researchers collaboratively conducted affinity diagramming. The coders individually extracted a topic keyword for each chat, and they grouped the keywords together through discussions. This task was conducted iteratively, and we finally found that a key dimension for distinguishing the topics of chats was whether a chat was related to sports or not. This binary coding scheme was evaluated by two external coders (non-researchers), and the results were reliable (kappa value = 0.87).

Overall, chats in Naver Sports were topically coherent with a broader theme of sports games. Almost all the chats were related to sports (93.5%). The viewers were most likely to chat about live sports events, for example, interpreting and commenting on events and cheering for players and teams. In addition, they occasionally chatted about peripheral matters such as cheerleaders, game commentators, other matches in different stadiums, and different sports genres.

In contrast, non-sports chats were small in volume (6.5%). Most of the chats in this category were related to the advertisements shown during breaks. Viewers talked about celebrities or products in the advertisements on a live video, for example, "I would like to buy this." There were other chats about trending topics (e.g., breaking news) and self-expressions from the viewers (e.g., statuses like "I'm hungry, now"). Interestingly, our manual investigation revealed that most viewers tended to chat about sports events, even during the breaks. They evaluated previous innings and predicted upcoming innings instead of conversing on other topics such as ads, possibly because the same set of ads typically recurred throughout a game.

4.2.2. Functions of Chat Interactions. Next, we classified chats according to their interactional functions. Again, two researchers conducted affinity diagramming, and five categories emerged: commentating, emotional responses, cheering/jeering, and questioning/answering. We tested inter-coder agreement with two external raters, and the result was reliable (kappa value = 0.89).

First, commentating was the most popular function (50.2%). This included interpretation, evaluation, prediction, instruction, and discussion of game events. For example, there were chats objectively explaining events that had just happened through simple descriptions (*"His third pitch was a strike"*) or interpretations (*"That was because of the third pitch out rule"*). We note that the commentating' chats are different from the answering' ones, even though both give useful information for other co-viewers. Our coding analysis classified chats containing objective information into commentating' and question/answering' groups depending on whether they were answers to a previous question or not. Additionally, there were also chats containing subjective opinions. For example, viewers had a discussion about referees' decisions, made predictions about upcoming plays, and gave instructions for game strategy.

Second, a fair number of chats related to emotional responses (31.8%). Most of the chats in this category expressed simple emotions about specific game plays, either positive (e.g., "Good," "nice!," and "Wow") or negative (e.g., "Ah," "T_T," and ":-("). Moreover, viewers often responded to other viewers' chats. For example, viewers who enjoyed others' funny chats and jokes responded with laughing emoticons.

Third, we found a considerable number of chats cheering and jeering (13.4%). Some chats encouraged a team and its players with messages along the lines of "You can do this!" Interestingly, for some popular players, viewers typed their names (or nicknames) and the players' fight songs as encouragement. Furthermore, some of chats in this category, like "Please one more hit!" and "I really want a shot this time," reflected the viewers' desires and wishes. In addition, jeering chats included discouraging expressions toward the opponent's team. Furthermore, we found fights between two groups of fans mocking each other.

Finally, viewers also chatted for questioning/answering purpose. This category comprised 8.7% of the chats, and the fraction of questioning chats (5.9%) was greater than that of answering chats (2.7%). Most seeking chats related to game events. For example, a viewer who had missed an event might ask the others to explain what had happened. Some viewers also actively sought information about current matches and players. For answering, the majority of chats were answers to others' questions. Additionally, viewers often answered questions by citing the latest news on a team or an explanation of the game's rules.

4.3. Discussion

Our quantitative analysis showed unique characteristics of chat interactions in online sports viewing. The number of co-viewers in Naver Sports was large, and the chat speed was fast; for example, in baseball, the number of co-viewers was close to 40,000, and the chat speed was 62.72 per minute. This level of chat speed was also observed in overloaded IRC chat channels (e.g., 30 messages per minute with hundreds of participants) [Jones et al. 2008]. A small number of active users contributed to a large amount of the chat volume. This power-law nature of user participation is commonly observed in other mass interaction media, including Twitter groups [Budak and Agrawal 2013] and Usenet groups [Whittaker et al. 1997].

From our qualitative analysis, we found that there was strong topical coherence. Most of the chats were related to a sports game on a live video. The chats also served many functions closely related to sports: commentating, emotional response, cheering/jeering, and questioning/answering in response to a live sports game. These results are similar to the functions of chats among offline sports viewers [Eastman and Land 1997]. However, while offline viewers often pursue chatting topics ranging from sports to personal matters [Eastman and Land 1997], personal conversations were rarely observed in Naver Sports. In fact, such strong topical coherence is likely to be related to information overload—highly coherent content requires much less processing overhead than diverse content. There seems to be a social norm that sports-related chats are acceptable, whereas other concerns are off-topic and should be limited. Although chat topics could become mixed at some points (e.g., one viewer talking about a pitcher, while others talked about a batter), topical identity remains as long as chats are relevant to the current context of the live videos, or topically coherent with a broader theme, namely sports.

The strong topical coherence of chats in Naver Sports could be also related to weak interpersonal relationships among co-viewers. Naver Sports users rarely know each other personally, so it is likely difficult for them to share their personal matters. The online mass interaction probably makes it yet more difficult for strangers to share diverse, off-topic matters. Offline sports viewers like to have conversations with strangers

on diverse topics from sports to personal matters [Eastman and Land 1997]. For example, while 30–50 viewers watch a sports video at the same place (e.g., a bar), they can still develop conversations with the person next to them (like a sub-group). Namely, offline viewers are given space for two-way communication with a small group members. However, in a mass interaction setting like Naver Sports, it is hard to find a separate space for developing interpersonal relationships due to the large volume of concurrent chats by a large number of co-viewers.

In the next section, we aim to deepen understanding of the mass interactions in online sports viewing by analyzing the relationship between chat usage and motives for mass interactions and drawing practical design suggestions for online sports viewing systems based on our findings.

5. RQ2: MOTIVES FOR MASS INTERACTION IN ONLINE SPORTS VIEWING

The motives of mass interaction in online sports viewing were investigated using the Uses and Gratifications Theory (UGT) approach [Blumler and Katz 1974], a theoretical framework that examines the "how" and "why" of media use. Strengths of this approach include its applicability to a variety of media and its provision of a common framework for understanding usage motives, antecedents, and outcomes. The UGT has been widely used to understand a variety of interactive media including Facebook [Joinson 2008; Spiliotopoulos and Oakley 2013] and blogs [Kaye 2010]. In this study, we adopted the two-stage process of identifying motives typically used in UGT work [Joinson 2008]. In the first stage, we conducted an exploratory study to determine users' motives through soliciting answers in a free-text format. Then, survey items were generated based on the significant motives that emerged from collaborative content analyses of user responses. In the second stage, we performed a large-scale survey and conducted exploratory factor analyses that grouped relevant survey items in order to derive statistically significant motives. In addition, the relationship between usage motives and actual usage behavior was investigated through a series of multiple linear regression analyses.

5.1. Exploratory Study

5.1.1. Participants and Survey Content. This study targeted active users who posted a large number of chat messages in Naver Sports. We invited a total of 1,928 active users chosen from the four sports genres (baseball, soccer, basketball, and e-sports) to participate in an online survey. Sixty participants responded to the invitation (52 men and 8 women). Most participants were in their 20s (10s: 17.24%, 20s: 58.62%, 30s: 15.52%, 40s+: 8.61%). Furthermore, many participants reported that they watched games with Naver Sports 2 or 3 days per week (0–1 day: 6.67%, 2–3: 51.67%, 4–5: 26.67%, 6–7: 15%). The online survey contained basic demographic questions (e.g., age, gender, and frequency of Naver Sports use) as well as open-ended questions that probed usage motives. The participants were asked to respond to the following questions in a free-text format similar to those described in earlier studies [Joinson 2008]. The participants were compensated with a gift voucher worth USD $10.

—What is the first thing that comes to mind when you think about what you enjoy most when using chats (reading/posting messages) in Naver Sports?
—What other words describe what you enjoy about using chats in Naver Sports?
—Using single, easy-to-understand terms, what do you use chats in Naver Sports for?
—What uses of chats in Naver Sports are most important to you?

5.1.2. Analysis Results. Two raters worked collaboratively to perform the affinity diagramming, which extracted keywords from the participants' responses, and grouped them into representative themes. Affinity diagramming was conducted iteratively, and five key motive themes emerged, as outlined in Table I: *sharing feelings and thoughts*,

Table I. Main Motive Themes

Sharing Feelings and Thoughts (41 mentions)
"When I watch a great scene, I would like to see others' responses." *"I feel that I am communicating with other people."* *"I can exchange thoughts and feelings in real-time."*
Membership (13 mentions)
"I can cheer on my favorite teams with other fans." *"When I cheer together, I feel a sense of unity."* *"I can defend our team against critics and insults."*
Information Sharing (6 mentions)
"I can ask questions and receive answers." *"I can learn useful information such as game rules and players' nicknames."*
Fun and Entertainment (5 mentions)
"I chat to pass the time when the current game play is tedious and boring." *"It is really fun to read other people's comments about the events in the game play."*
Emotional Release (4 mentions)
"I can write what is on my mind." *"I can express my emotions."* *"I can shout through chatting."*
Other (7 mentioned)
"I want to feel real experiences through indirect chatting." *"I write my comments hoping that the players will see them."*

membership, *information sharing*, *fun and entertainment*, and *emotional release*. It is interesting to note that no participants mentioned building interpersonal relationships or fostering closeness with others. In earlier research on social TV, building interpersonal relationships was commonly observed in social TV viewing [Weisz et al. 2007]. We posit that this characteristic is attributed to the large number of *"strangers"* that participate in online sports chat sessions, the key factor differentiating this research from earlier research undertaking small group-based user studies. Although users would identify themselves as fans (membership), due to the massive number of participants, the mass chat format may not facilitate interpersonal relationship building.

5.2. Scale Development to Measure Motives for Mass Interaction in Online Sports Viewing

5.2.1. Survey Content. The questionnaire comprised four parts. First, we asked the participants to respond to a motive survey (which included 26 items on a 7-point Likert scale). These items were based on the motives found in the explorative study and were generated following the same procedures used in earlier works [Joinson 2008]. We generated six items for sharing feelings and thoughts, five items for membership, six items for information sharing, five items for fun and entertainment, and four items for emotional release. The words and phrases in the items were drawn primarily from the original responses. Second, we asked detailed questions about the participants' social TV viewing and chatting behaviors (e.g., frequency of Naver Sports use, viewing locations, and frequency of checking chat rooms). Third, we asked the participants to report any difficulties that they had encountered while chatting. Fourth, we asked users to answer demographic questions and other general media usage information.

5.2.2. Participants. We sent email invitations for the online survey to 44,578 Naver Sports users randomly chosen from the chat dataset. In total, 1,406 participants responded to these requests, but only 1,123 completed the survey in full. Considering the low response rate, we tested for non-response bias, which occurs when the answers of the respondents differ from the potential answers of those who did not answer. To

test for the non-response bias [Lindner et al. 2001], we divided the user responses into two groups: responses submitted in 3 days or less and responses submitted after 4 or more days. The group-wise comparisons did not yield any significant differences, which indicates that the survey results were not severely influenced by non-response bias. The gender distribution was similar to the earlier survey result (986 men and 137 women). Most participants were in their 20s (10s: 18.44%, 20s: 57.04%, 30s: 18.80%, 40s+: 5.70%). The mean of computer usage hours (including smart devices) was 5.92 hours per day ($SD = 3.99$). Participants mainly watched Naver Sports more than 2 or 3 days per week (0–1 day: 5.52%, 2–3: 39.92%, 4–5: 29.85%, 6–7: 24.68%). Fifty randomly selected participants were compensated with a gift voucher worth USD $10.

5.2.3. Factor Analysis Results. We conducted exploratory factor analyses on the survey responses with 26 questions about motives. The initial analysis (principal component analysis with varimax rotation) extracted five components with Eigenvalues over 1, which explained 62.7% of the variance. An examination of the scree plot elbow led to the inclusion of two additional components ($Eigenvalues > 0.8$), which resulted in identification of seven factors that explained 69.32% of the variance. To identify the key items for each component, we eliminated items with a lower factor loading value, which did not seriously affect the reliability of the factor. One item related to companionship from co-viewing did not load on any components. Based on the selected items, we named each component as follows: sharing feelings and thoughts (seven items), fun and entertainment (four items), information offering (three items), information seeking (three items), emotional release (three items), intra-membership (three items), and inter-membership (three items). The factors are described in Table II.

Factor 1 contained items related to sharing feelings and thoughts, which was the most frequently mentioned theme in the previous study. Some items in this factor concerned sharing feelings and thoughts about game play, as well as checking others' responses. Furthermore, participants liked to discuss current events in the chat, although the mean rates of these items were relatively lower than those of the other items.

Factor 2, fun and entertainment, was comprised of four items. Three items explained that the chat messages were fun to read or that chatting made watching games more enjoyable. As shown in earlier research, users tended to communicate with others more frequently when they felt bored. In addition, there was an item related to the act of observing others' feelings functioning as a stimulant for feeling like "one of the crowd" (known as social facilitation [Guerin 1993]). In online sports viewing, exposure to co-viewers' responses could facilitate feelings of enjoyment; for example, people might feel that they are having more fun when they see others' laughter.

Factor 3 was composed of items related to information offering, such as "providing useful information to understand game events" and "answering others' questions." According to an offline public sports viewing study [Eastman and Land 1997], teaching about sports has the function of legitimizing and socially rewarding participants. Despite the fact that these opportunities are limited to those who have sufficient knowledge of sports, the participants in this study generally agreed that they could offer information to other viewers.

Factor 4 comprised items related to information seeking, such as "asking questions" and "learning by reading others' messages." This is closely related to conventional studies about motives for (offline) co-viewing because those who want to become fans or learn about the rules or teams could benefit from co-viewing (as opposed to solitary viewing) [Gantz 1981; Wenner and Gantz 1998].

Factor 5 comprised items about emotional release. The items in this factor reflected the users' desire to express their emotional feelings while watching sports. According to the literature, the expectation of releasing one's emotions functions as a key motive for

Table II. Factor Analysis Results

Items	Mean (SD)	F1	F2	F3	F4	F5	F6	F7
Sharing Feelings and Thoughts (7 items, a = 0.871)	**4.59 (1.29)**							
I want to share my own witty interpretation of the game situation to others.	4.67 (1.72)	.692						
I want to know how others respond to my chat messages about feelings and thoughts.	4.43 (1.82)	.670						
I want to confirm whether others have the same feelings and thoughts about the game.	5.09 (1.53)	.636						
I want to engage in the discussion and conversation occurring in the chat room.	4.15 (1.78)	.603						
I want to express my feelings about the game in writing.	4.73 (1.69)	.590						
I want to express agreement or disagreement with others' opinions.	4.15 (1.85)	.580						
I can express my thoughts, interpretations, and predictions about the game situation.	4.88 (1.67)	.533						
Fun and entertainment (4 items, a = 0.788)	**4.64 (1.38)**							
Chatting is fun and enjoyable in itself.	4.36 (1.81)		.726					
I want to see witty, humorous expressions about the game situations.	4.95 (1.71)		.725					
I pass time with chatting particularly when the game is boring.	4.85 (1.75)		.687					
Reading others' expressions of happiness and laughter makes me feel like I'm having more fun.	4.40 (1.82)		.574					
Information Offering (3 items, a = 0.872)	**4.19 (1.56)**							
I can answer others' questions.	4.19 (1.73)			.825				
I can provide useful information to others.	4.25 (1.73)			.801				
I can correct false information stated by others.	4.12 (1.79)			.777				
Information Seeking (3 items, a = 0.874)	**4.61 (1.59)**							
I can ask questions about something I do not know while watching a game.	4.55 (1.82)				.862			
I can see answers to the questions posed by those who have the same information needs.	4.63 (1.75)				.851			
I can learn some useful information about the game rules, team, players, etc.	4.66 (1.75)				.776			
Emotional Release (3 items, a = 0.767),	**4.39 (1.51)**							
I can express my excitement in writing just as if I were shouting in a stadium.	4.66 (1.83)					.748		
Expressing excitement and anger relieves my stress build-up.	3.85 (1.83)					.657		
I can feel more intense excitement as I read others' reactions when there are dramatic and tense moments in the game.	4.65 (1.82)					.633		
Intra-membership (3 items, a = 0.811)	**4.31 (1.56)**							
Fans can be united by cheering on their teams and favorite players together.	4.38 (1.81)						.814	
It makes me feel like I am a fan of our team.	4.63 (1.75)						.748	
Seeing opposing fans' cheering stimulates my sense of rivalry and encourages me to cheer on our team.	3.93 (1.94)						.581	
Inter-membership (3 items, a = 0.716)	**3.56 (1.53)**							
I want to boo the opposing team and its fans.	2.62 (1.76)							.791
I want to defend our team against critics and insults from the opposing team's fans.	4.11 (2.04)							.749
Seeing opposing fans' cheering stimulates my sense of rivalry and encourages me to cheer on our team.	3.93 (1.94)							.549

sports viewing [Gantz 1981; Gantz and Wenner 1991; Krohn et al. 1998; Wenner and Gantz 1998]. Enjoyable sports viewing involves applauding and shouting in pleasure, as well as yelling in displeasure or anger. In online sports viewing, such usage behavior is similarly observed, but in the different format of online chats.

Items related to membership were grouped into Factor 6 and Factor 7. Factor 6 was related to intra-membership, which referred to fanship or group affiliation [Wann 1995]. The items in this factor focused on the use of chats to cheer on their favorite teams and to strengthen group cohesion. Factor 7 was related to inter-membership, reflecting competitive behaviors against other teams. The items included jeering the opposing teams/fans and defending their own team against insults from the opposing team's fans. Interestingly, both factors shared an item about competing for cheering.

5.3. Discussion

We discuss the survey results for each motive. Fun and entertainment was given the highest rating by the participants ($M = 4.64$, $SD = 1.38$); 19.2% of the participants gave their highest rating to this motive. Similarly, the average rating of sharing feelings and thoughts was relatively high ($M = 4.59$, $SD = 1.29$), and 9.4% of the participants most like to share feelings and thoughts motive. Many Naver Sports viewers enjoy chats primarily to deal with boredom from a current video, similar to conventional social TV viewers [Weisz et al. 2007], they also often enjoy sharing feelings and thoughts with other co-viewers, similar to in offline sports viewing settings [Eastman and Land 1997].

Interestingly, many participants gave a relatively high rating to the information seeking motive ($M = 4.61$, $SD = 1.59$); the largest number of the participants (24.2%) rated information seeking as their strongest motive. However, another information-related motive, the information offering, was not that highly rated ($M = 4.19$, $SD = 1.56$). Nevertheless, we found that special user segments enjoy offering information to other viewers; 11.9% of the participants rated this motive most highly. This result could be related to our previous analysis results on interactive experience in Naver Sports. In the quantitative analysis, we found that the number of information offering chats was smaller than that of information seeking chats. Namely, there are a number of information seekers in Naver Sports and they often ask questions, but the number of those who like to answer their questions is relatively smaller.

The emotional release ($M = 4.39$, $SD = 1.51$) and the intra-membership ($M = 4.31$, $SD = 1.56$) motives were rated similarly. Of participants, 14.4% and 15.6% marked emotional release and the intra-membership as their most significant motive, respectively. These motives are related with fanship behaviors such as releasing emotions (e.g., shouting) and actively cheering for a team with others [Gantz 2013]. Namely, those who have strong fanship may experience this motive strongly. However, a relatively small number of participants who rated inter-membership motive highest (5.6%). Inter-membership was also given the lowest rating ($M = 3.56$, $SD = 1.53$). This is probably because inter-membership is based on stronger fanship than intra-membership (its behavior tends to be more active and wild).

In the next section, we investigate how such motives are related with online sports viewing behaviors.

6. RQ3: USAGE PATTERNS AND THEIR RELATIONSHIP WITH MOTIVES

We examined how the usage characteristics of social TV were related to motives using multiple regression analyses. These analyses can provide design suggestions for online sports viewing systems. Online sports viewing systems designers should focus on this to know how to support particular usage patterns and boost specific motives. In the following section, we present the metrics of the usage characteristics and then explain the multiple regression results.

6.1. Variables

The dependent variables were the seven motive scores; that is, each motive's score was the mean of all ratings. The usage characteristics were used as independent variables and were classified into three types: demographics, viewing behavior, and chatting behavior. The values of these variables were measured by analyzing the survey results and chat dataset. The independent variables are described as follows.

—*Demographics:* We used three variables related to demographics: age (Age), gender (Gender), and hours of computer use (ComputerUseHours). Because gender is a categorical variable, we represented it in a regression model using a single dummy variable (men = 0 and women = 1).
—*Viewing behavior:* We introduced the following five variables to represent viewing behavior: frequency of Naver Sports use (ViewingFrequency); viewing places: home, work, and on the move (LocationHome, LocationWork, and LocationMobile); existence of co-viewer (WatchingAlone); use of smart devices for viewing (SmartDeviceUse); and multitasking while watching (Multitasking). The frequency of Naver Sports use was measured with a four-point Likert scale. The remainder of the variables used binary answers (e.g., Are you at home when you watch Naver Sports?), and these variables were also dummy-coded in the regression model.
—*Chatting behavior:* The variables used to describe chatting behavior were extracted from both the survey and chat data analyses. First, we used three variables from the survey: frequency of checking a chat room using a seven-point Likert scale (CheckingChats), frequency of reporting abusive users using a seven-point Likert scale (AbuseReporting), and use of a team-specific chat filter with a binary scale (TeamFiltering). In addition, we used five usage variables from the chat dataset: total number of chats (ChatTotalCnt), mean message length (MsgLength), proportion of positive/negative messages (SentimentPosRate, SentimentNegRate), fanship (FanLoyalty), and proportion of question-type comments (containing a question mark or 5W1H in order to understand its relationship with the information seeking motives; QuestionRate).

Here, we explain in detail how we measured chat sentiment and fanship from chats.

6.1.1. Sentiments of Chats. Analyzing the chat sentiment (e.g., positive, negative, or neutral) provided valuable insight into understanding the characteristics of mass interactions in social TV. Because the message length was short and the vocabulary sets varied widely depending on the TV content, we found that fixed sentiment lexicon-based approaches did not work well in these environments [Pang and Lee 2008]. We devised a simple approach to learning sentiment lexicon, inspired by the fact that emoticons are good sentiment indicators in text messages. Initially, a set of chat messages containing positive emoticons in Korea (e.g., ㅎㅎ, ㅋㅋ) and a set of chat messages containing negative emoticons (e.g., ㅠㅠ, ㅜㅜ) were selected. By treating each chat message as a document, we calculated the term frequency-inverse document frequency (tf-idf) to weight terms in each chat as follows:

$$W_{t,c} = tf(t,c) \cdot idf(t,C), \quad idf(t,C) = \log \frac{|C|}{|\{c \in C : t \in c\}|} \tag{1}$$

where $tf(t,c)$ was the number of times term t occurred in chat c (how important the term was in the chat message) and $idf(t,c)$ was calculated by inversing the number of chats containing term t among the total set of chats C (how much the term could be distinguished the chat). According to tf-idf weight, the terms in a chat were weighted more highly when they occurred many times in the chat and when a small number of documents included the term. Next, we constructed a m-dimensional term vector of

a message where the ith entry was a tf-idf value of the ith term and m was the total number of terms used in all of the messages [Manevitz and Yousef 2001]. By running a feature selection algorithm that reduced the dimension of the vector space (e.g., the gain ratio method in Weka 3.7), we selected the top 300 most often contributed terms to comprise the sentiment lexicon. Some examples of the selected terms with positive sentiment were "간지 (fascinating)," "쩐다 (amazing)," "오호 (oh)," "샷 (shot)," and "굳 (good)," while those with negative sentiment were "ㅂㅅ (jerk)," "개객끼 (Korean curse)," "아제발 (ah, please)," "씁쓸 (bitter)," "실망 (disappointing)," and "짱나 (irritated)."

For sentiment classification, we used the features of positive, negative, and neutral scores. For a given message, the positive/negative scores were calculated by counting the positive/negative terms based on the lexicon, and the neutral score was the absolute difference of positive and negative scores [Pang and Lee 2008]. We generated a training dataset by randomly selecting 2,000 messages and performing manual sentiment classification. Then, we trained a classification model using a Support Vector Machine (SVM). The 10-fold cross validation results exhibited an accuracy of 0.82, which is superior to conventional SVM-based document classification methods [Manevitz and Yousef 2001]. Its accuracy in our dataset is given as 0.70.

6.1.2. Fanship Behavior. Naver Sports asks users to express their fan identity by selecting a favorite team in the game for cheering (refer Section 3). Online sports viewers like to choose a team icon and post chat messages about both teams during a match (e.g., cheering and jeering), similar to how fans wear a team's uniform to cheer in a stadium. We measured fanship based on the consistency of the team selection for chatting. Namely, we assumed that a user had high fanship if they consistently posted for a specific team. Our method did not consider the sentiment of chats, which could be a potential limitation. For example, fan loyalty could be zero if a user posted the same number of chats for each team, but positive ones to a favorite team and negative ones to an opposing team. However, according to our analysis of 22,512 chats of 2,383 sampled users, such cases of missing high fanship were rarely observed. Most users preferred to select a specific team for chatting instead of switching between two teams in a game; 85% of the users posted chat messages to only one team in a game. In addition, the chats of the other users who posted to both teams in a game tended to be highly skewed to a specific team (ratio of the number of chats between two teams in a game = 7.8:1), and this tendency was even stronger for active users who left more than 5 chats (ratio = 8.7:1).

For a given user (u), we calculated the fraction of chats about a team (t) by the user ($= p_{u,t}$), which was computed by dividing the number of user chat messages about a team ($= C_{u,t}$) by the total number of user chat messages ($= \sum_{t \in T_u} C_{u,t}$). Using this team support distribution, we calculated the entropy of the user. Intuitively, the higher the entropy value, the greater the randomness. Entropy was maximized when a user uniformly supported all teams. Then, we normalized the entropy and negated its value, which resulted in the following fan loyalty metric for a user, as follows:

$$FanLoyalty_n = 1 - \left(\frac{-\sum_{t \in T_u} p_{u,t} \cdot \log_2 p_{u,t}}{\log_2 |T|} \right), \quad p_{u,t} = \frac{C_{u,t}}{\sum_{t \in T_u} C_{u,t}} \tag{2}$$

where T_u was the set of teams for which the user posted messages and represented the number of teams participating in the season. The fan loyalty values ranged from 0 to 1. If a user posted chats on a single team, the user's fan loyalty was 1. A user's fan loyalty was zero if equal numbers of chats were posted for every team.

Table III. Multiple Regression Analysis Results

	Statistics		Standardized Beta						
	Mean	SD	Sharing Feelings/ Thoughts	Fun & Ent.	Info. Offering	Info. Seeking	Emotional Release	Intra-Membership	Inter-Membership
Age	21.4	8.31	.073*	.071*	–.035	–.020	.101**	.046	.015
Gender	.121	.327	–.082**	–.079**	–.106***	–.023	–.022	–.009	–.035
ComputerUseHours	5.93	4.00	.006	.005	–.020	.009	.014	–.038	–.017
ViewingFrequency	2.74	0.89	.026	–.073**	.043	–.028	.008	.109***	.093**
LocationHome	.883	.321	.014	.057*	–.002	.025	.025	–.027	.011
LocationWork	.194	.396	–.041	.025	–.038	–.004	–.014	.008	–.023
LocationMobile	.384	.487	.024	.041	–.007	.007	.004	.014	.026
WatchingAlone	.948	.223	–.027	–.008	–.034	–.042	–.028	–.045	–.023
SmartDeviceUse	.616	.487	.074*	.041	–.004	.058†	.056†	.050	.028
Multitasking	.553	.497	.068*	.063*	–.003	.016	.028	–.003	.033
CheckingChats	4.66	1.54	.440***	.529***	.232***	.282***	.404***	.312***	.260***
AbuseReporting	3.67	2.20	–.018	–.043	.137***	.065*	.011	.031	.047
TeamFiltering	.132	.338	.033	.027	.035	.036	–.006	.087**	.047
ChatTotalCnt	114	539	.015	–.043†	.066*	.051†	–.042	.027	.047
FanLoyalty	.747	.280	–.062*	–.057*	–.103**	–.060*	–.029	.066**	.056†
MsgLength	4.00	1.82	.017	–.087**	.021	–.049	–.053†	–.069**	–.022
QuestionRate	.103	.165	–.001	.039	–.030	–.013	.013	.007	.013
SentimentPosRate	.371	.281	.023	.057*	–.018	–.005	.031	.039	.010
SentimentNegRate	.132	.184	.030	-.004	.003	–.008	.010	.020	.020
R^2			.217***	.306***	.130***	.111***	.176***	.136***	.105***

† p < .1, * p < .05, ** p < .01, *** p < .001.

Note: The section 6.1 'Variables' describes how the variables are encoded for the analysis.

6.2. Usage Statistics

Our usage analysis reveals Naver Sports users' viewing and chatting behaviors. Table III shows the descriptive statistics of our survey and log analysis results of viewing and chatting behaviors. First, our survey results show various aspects of their viewing contexts. The survey respondents answered that they usually use Naver Sports to watch sports games about three times per week, and their viewing mostly occurred at home rather than at work places (home: 88.3%, work: 19.4%). Also, most respondents (94.8%) watch sports videos alone rather than watching it with co-located others. Interestingly, a fair number of respondents reported that they like to use mobile devices for their watching (61.6%). Moreover, half of respondents said that they are likely to do other work simultaneously while watching a sports video (55.3%). Their second tasks mostly involved watching another TV program, doing house work, and web browsing.

Second, we quantified diverse chatting behaviors via the survey and chatting log data analysis. Most respondents tend to be active in checking the chat room; 59.6% answered that they (strongly) frequently check others' chats. We also found two different chatting usages related to reporting abusive users: 42.6% of respondents answered they (often) use the reporting function, while others never or rarely use the function. According to our later analysis, this function usage is mostly employed by those with information seeking/offering motives. In addition, similar to our quantitative analysis in Section 4, we found high fan loyalty in users tending to focus chat messages on one or two teams (fan loyalty based on Equation (2) was 0.747), and their chat messages tended to be short. Finally, the proportions of positive and negative chats were also observed similarly to our previous observations in Section 4 (positive: 37.1%, negative 13.2%).

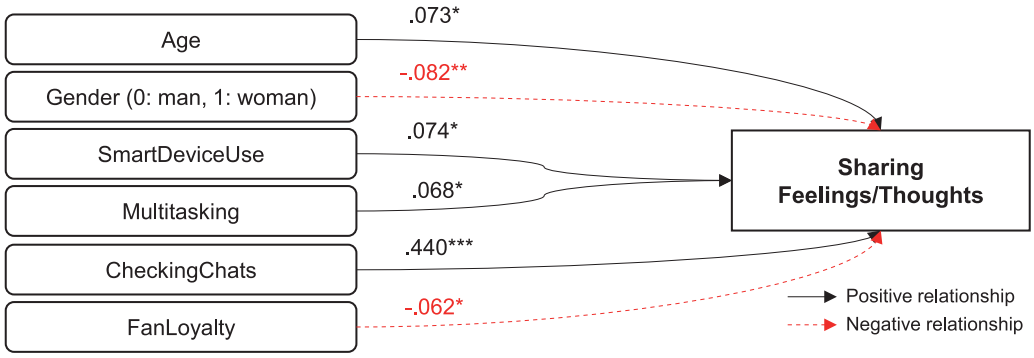


Fig. 3. Variables significantly related to the sharing feelings and thoughts motive.

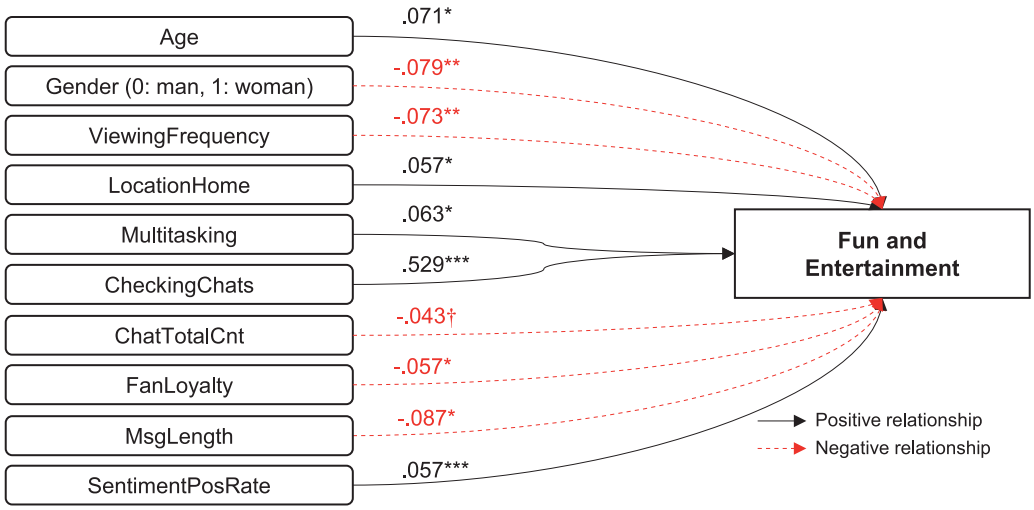


Fig. 4. Variables significantly related to the fun and entertainment motive.

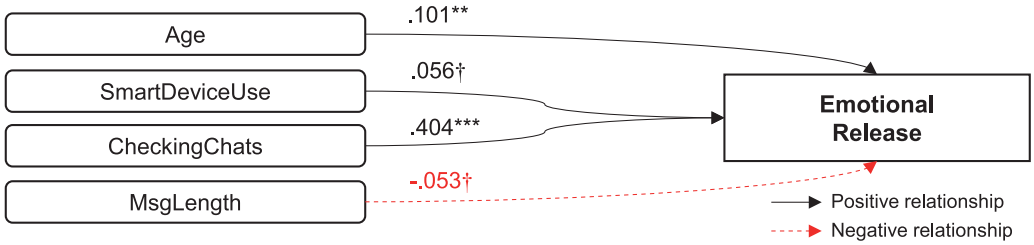


Fig. 5. Variables significantly related to the emotional release motive.

6.3. Regression Analysis Results

A series of multiple linear regressions were conducted. Table III shows the analysis results, and Figure 3, 4, 5, 6, 7, 8, and 9 are its graphical representations. All regression models were significant, and their R-squared values were comparable to those of earlier UGT research [Joinson 2008; Spiliotopoulos and Oakley 2013] (see Table III). Furthermore, we note that our regressions models did not suffer from multicollinearity,

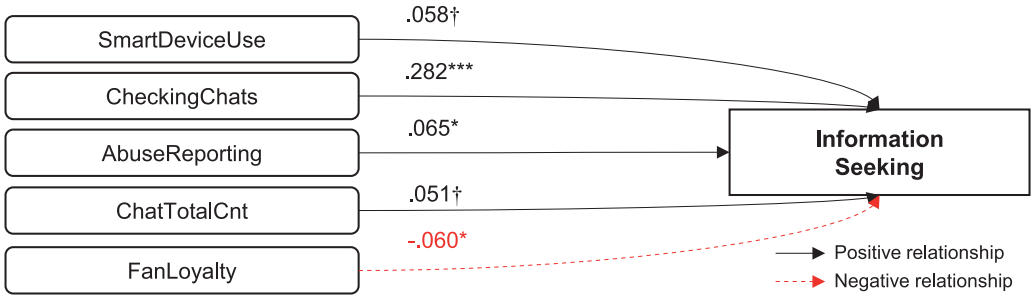


Fig. 6. Variables significantly related to the information seeking motive.

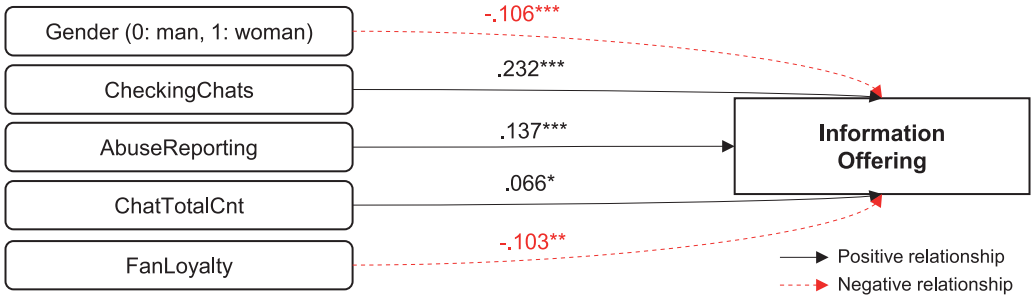


Fig. 7. Variables significantly related to the information offering motive.

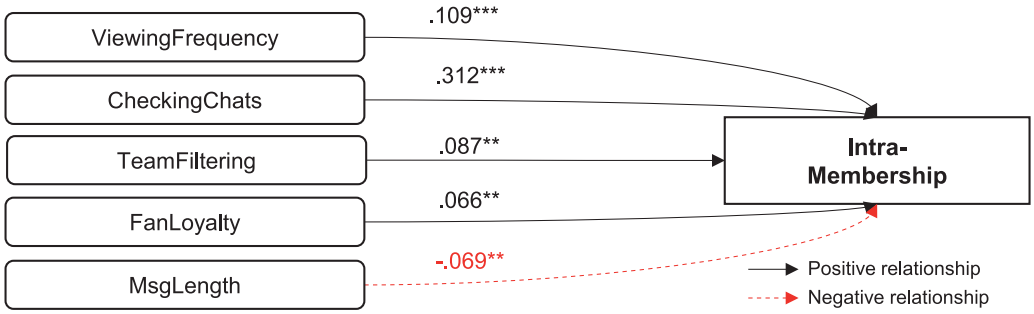


Fig. 8. Variables significantly related to the intra-membership motive.

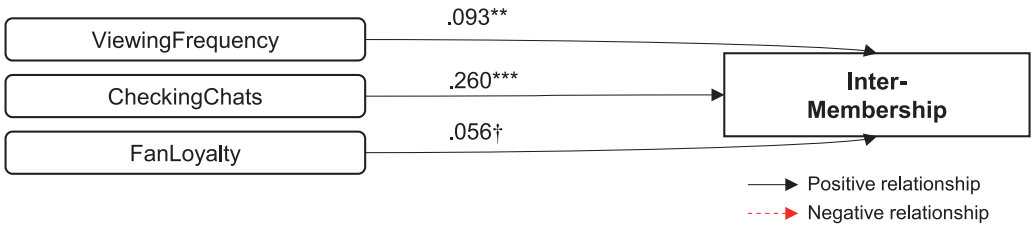


Fig. 9. Variables significantly related to the inter-membership motive.

which can mislead interpretation of the true nature of the responses. We calculated the correlation values for the independent variables to examine potential multicollinearity. While several independent variables were correlated, they were below the critical value of multicollinearity (threshold = 0.8). The strongest correlation was observed between SmartDeviceUse and LocationMobile ($r = 0.468$, $p < 0.001$). The variance inflation factor (VIF) for each independent variable was lower than the critical value of multicollinearity (threshold = 10). The highest value was 1.356 for the SmartDeviceUse variable.

6.4. Discussion

Among the demographic variables, Age and Gender exhibited a significant relationship with some of the motives. Sharing feelings/thoughts, entertainment, and emotional release motives were positively correlated with Age; however, sharing feelings/thoughts and entertainment motives were negatively correlated with Gender, which indicates that men might be more motivated by these than women. Also, Gender was negatively correlated with information offering. This indicates that men like to offer information to others more than do women. These results may result from the different levels of participation in sports between the two groups. According to the demographics of sports fans [Tang and Cooper 2012], men tend to enjoy sports more actively (e.g., viewing and playing) than do women. Therefore, such experiences might empower them to feel more competent in offering information to others.

Several usage patterns—that is, viewing and chatting behaviors—significantly reflected the users' motives for enjoying mass online interactions. Checking chats (CheckingChats) emerged as the strongest predictor of all motives. Intuitively, frequently viewing the chat screen represents a strong motive for enjoying chats with others.

Sharing feelings/thoughts was positively associated with multitasking (Multitasking) and the use of smart devices for viewing (SmartDeviceUse). This indicates that users with this motive desired to check others' responses occasionally while simultaneously doing other tasks, or that they were compensating for the lack of interaction opportunities afforded by the chatting functions of smartphones. Fanship (FanLoyalty) was also negatively correlated with the sharing feelings/thoughts motive, which indicates that those users who liked to share feelings/thoughts tended to chat while watching games among numerous teams.

The entertainment motive was positively correlated with multitasking (Multitasking), as well as negatively correlated with fanship (FanLoyalty), frequency of online sports viewing (ViewingFrequency), and total number of chats (ChatTotalCnt). This indicates that users with a high entertainment motive may have spent their extra time not only watching games featuring their favorite teams, but also those featuring other teams as well. Indeed, our data demonstrate that they tended to post short positive messages and to respond frequently to amusing chat messages using simple emotional expressions such as emoticons.

The predictors of the emotional release motive were similar to those of the sharing feelings/thoughts and entertainment motives. As with the entertainment motive, the emotional release motive was negatively associated with the length of chat messages (MsgLength), which was perhaps related to frequent use of simple interjections and emoticons. In addition, similar to the sharing feelings/thoughts motive, the use of smart devices for viewing (SmartDeviceUse) was positively correlated with the emotional release motive. This may have resulted from the fact that smart devices provide a convenient method for releasing emotions at any time and place.

The information offering/seeking motives were positively associated with number of chat messages (ChatTotalCnt). Users who frequently participated in message

exchanges with others were more likely to perceive chats as useful sources of information. In addition, reporting abusive users (AbuseReporting) was positively correlated with both motives, which represented the users' efforts to develop a better communication environment for information sharing. Furthermore, information offering/seeking were negatively correlated with fanship (FanLoyalty), which implies that informative users tended to watch the sports games of numerous teams rather than focus on favorite teams (and possibly acquired more knowledge about baseball games as a consequence).

There were additional significant variables for predicting the information offering/seeking motives. Information seeking was positively correlated with the use of smart devices for viewing. Due to the limited interaction possibilities while watching sports games on smart devices (SmartDeviceUse), the chat room could be the most convenient source of information; thus, smart device viewers would value the usefulness of chats for information seeking purpose. Interestingly, the rate of questions posted (QuestionRate) was not a significant predictor of information seeking. It appears that users' information needs could often be satisfied through reading the questions and answers posed and received by others with the same informational needs.

The membership related motives were significantly related to behaviors reflecting fanship and group affiliation [Wann 1995]. Those with these motives tended to use online sports viewing more frequently. Furthermore, they exhibited a distinguished chatting behavior of concentrating on a few teams (i.e., high fanship). The intra-membership motive had a significant relationship with the use of team-specific chat filtering (TeamFiltering). This suggests that those who had a high fan-membership wanted to communicate with other members. Chat length (MsgLength) was also negatively correlated with intra-membership, partly because they frequently used simple cheering expressions.

7. DESIGN IMPLICATIONS FOR ONLINE SPORTS VIEWING SYSTEMS

In this section, we summarize our analysis results and present practical design implications based on the key findings.

7.1. Dealing with Information Overload

Our study results in Section 3 show that numerous chats were posted every minute (47.09 new chat messages per minute). This could distract viewers in their chatting and watching of sports games, as in prior studies [Weisz et al. 2007; Geerts et al. 2008]. However, our content analysis of chats reveals that the chats tend to be topically cohesive, and this enables viewers to exchange basic conversations. Furthermore, our follow-up survey also supports this (n = 1,123; for the same survey respondents described in Section 4).

We first asked the participants using a 7-point Likert scale, whether it is difficult to enjoy both watching sports games and chatting in Naver Sports. Interestingly, a majority answered that they do not have difficulty both watching sports games and enjoying chats (56.8%, >= 5 out of 7 points). We next asked the reason for the answer using an open-ended question. The most prevalent answer was that they are mostly satisfied with basic conversations such as sharing feelings and thoughts despite frequent chat messages. One participant mentioned, *"I feel that chats in Naver Sports are usually about a current game or player, not about serious topics. So, [I don't feel any difficulty in both watching a game and enjoying chats because] just checking other co-viewers' overall mood is enough for me."*

However, a considerable fraction of viewers reported difficulties in enjoying both sports video and chats (33.1%, <= 3 out of 7 points). In response to the subsequent open-ended question, they mostly mentioned the information overload problem. It mostly occurred with multiple chat topics in a single chat room. For example, some viewers want

to have a discussion about a particular player or to conduct questioning/answering, but these types of chats are often overwhelmed by other chats expressing feelings and thoughts. Another representative case was related to multitasking. A fair number of respondents reported that they have difficulty in following the accumulated messages, particularly when they returned after doing another thing. Considering that a considerable percentage of online sports viewers perform multitasking according to our survey (55.29%) and this behavior is correlated with one of the key motives (i.e., sharing thoughts and feelings), it could be important to help multitasking users deal with the problem of information overload.

One potential method of mitigating such problems is to implement a computational mechanism for summarizing the trending topics over time while the TV program is in progress. For example, it is possible to automatically detect trending topics and display related keywords [Pan et al. 2013] or to present graphical representations of the message posters' sentiments over a period of time [Marcus et al. 2011]. Furthermore, a chat navigation tool could be introduced supporting a time-based slider annotated with chat density (and associated sentiment) to enable quick review of the public responses.

7.2. Fostering Information Sharing Environments

According to our study, a number of the Naver Sports users showed information seeking and offering motives, and 8.7% of the chats concerned questioning/answering. Interestingly, these motives were significantly and positively correlated with frequency of reporting abusive users. These results could be interpreted as viewers making significant efforts to foster a better communication environment for information sharing. In the following, we discuss practical design implications for moderating abusive users and supporting information seeking.

Our follow-up survey results showed that many respondents (40.2%) were unsatisfied with the current function of manually filtering abusive users in Naver Sports (i.e., a user-based message filtering approach in which a viewer can filter messages from blocked users). Most respondents mentioned difficulty in managing a long list of abusive users. Due to the immense number of concurrent viewers and aggressive language usage commonly observed in sports spectating [Russell 2008], the current Naver Sports' manual moderation techniques would not scale well. Therefore, to support viewers with information seeking or offering motives, social TV designers should carefully consider functions for abuse reporting. Introducing tools that leverage the collective intelligence of viewers would assist in reducing the manual intervention cost, and also assist users with personalizing their message filtering. For example, abusive words or insults collaboratively chosen could be used as filters.

We found that the chat room could be helpful for information seekers who use smart devices for viewing due to the limited interaction possibilities (the information seeking motive is positively related to smart device use). However, information seeking could be still challenging in a single public space with a large number of users because this leads to high chat speeds. For example, some useful information can be often hindered by a large volume of interfering messages like interjections and cheers/jeers. Designating a separate space for information sharing (such as a Social Q&A) could be an intuitive solution. Alternatively, structured tags could be introduced, allowing filtering of messages based on tags. Enabling automatic identification of question/answer pairs in a chat would help users quickly meet their information needs.

7.3. Leveraging Membership Motives

Our analysis results showed that one of the representative motives for chatting in online sports viewing was related to membership. Viewers in Naver Sports like to have a feeling of watching and cheering together with other fans, and considered these their

representative motives (i.e., sharing feelings and thoughts, membership motives). For example, one participant in our motive study commented concerning the membership, *"I can cheer on my favorite teams with other fans,"* and another said, *"When I cheer together, I feel a sense of unity."* Awareness of the presence of co-viewers can help gratify the membership motive. Naver Sports basically supports presence awareness by displaying the total number of chats and the total number of current co-viewers. Considering membership motives, presence awareness of co-viewers could be increased by displaying team-level statistics of user activities.

Further, the membership motive was significantly associated with behaviors that expressed fanship, for example, skewed team selection and team filtering use. Therefore, to increase the membership motive, expression of fan identity should be supported, and better group companionship among viewers cheering for the same team should be established. Possible methods for encouraging fan identity could include showing the number of fans viewing the game online (e.g., enabling fan check-ins) and adopting social reinforcement mechanisms such as badges for fan loyalty [Kraut and Resnick 2012] (note that Naver Sports currently does not adopt any social reinforcement mechanisms except for choosing a team page for chatting). Supporting structured mechanisms for interactive cheering (e.g., voting for the best players and cheering for current players) could be also incorporated to facilitate fan collaboration.

In addition, mining online viewing activities in social TV enables deeper understanding of user behavior, such as fan loyalty, and content characteristics such as scenes of interest. For example, we measured user fanship by adopting the scale from Wann and Branscombe [1993] and conducting multiple regression analyses to predict fanship using the same independent variables used in Section 6, confirming that fanship was significantly correlated with viewing and chatting behavior ($R^2 = 0.203$, $p < 0.001$). Mining such information could be useful for boosting membership motives and to enable a range of new applications for personalized sports marketing and advertising, as well as more personalized content recommendation services for video highlights and relevant news articles about teams and players of interest.

8. LIMITATIONS

As with most single-site work, the generalizability of this work is limited, and additional research using other online sports viewing sites, for example, YouTube Live and MLB.TV, is necessary. Furthermore, it would be beneficial to analyze the mass interactions in second-screen social TV services such as Twitter and GetGlue which provide a public space for mass interactions among TV viewers where live video streaming is not included. Another aspect worth exploring is analysis of mass interactions in different TV genres such as drama, comedy, and movies. In this work, we focused on the sports genre, which usually encourages active viewer participation in social TV services [Geerts et al. 2008]. We believe that more in-depth understanding of general online viewing behaviors could be gained through comparison of diverse genres (e.g., by examining GetGlue data). Finally, while the general behaviors of sports fans are universal, the participants of this study were limited to Koreans. Identifying key differences between different cultures will assist in generalizing the results presented here.

9. CONCLUSION

Our work aimed to deepen our understanding of mass interaction in online sports viewing by analyzing chat interaction data in Naver Sports, the largest online sports viewing service in Korea and conducting a large-scale survey study.

Specifically, our study first revealed several characteristics of mass interactions in online sports viewing. There were a number of co-viewers in Naver Sports, and the

chat speed was fairly fast. We also found that most of the chats were related to a sports game on a live video, and the chats also served many functions closely related to sports: commentating, emotional responding, cheering/jeering, and information seeking/offering. In addition, we identified seven key motives for mass interaction: *sharing feelings and thoughts*, *fun and entertainment*, *information seeking*, *information offering*, *emotional release*, *intra-membership*, and *inter-membership*. These motives were significantly related to specific usage patterns: multitasking and smart device use with motive for sharing feelings and thoughts, short chat length with motives for entertainment/emotional release, chat frequency and abuse reporting with motives for information seeking/sharing, and fan loyalty in chat behavior with the motive for membership.

Our study results provide useful implications for designing online sports viewing systems. First, we observed that information overload problems often occur due high chat speed and frequent multitasking behaviors in online sports viewing. Therefore, providing a summary of trending topics or chat navigation tools can help viewers to deal with information overload and better enjoy mass interaction with others. Second, we found a lot of chat messages related to information sharing behaviors. These chat messages are valuable sources for satisfying viewers' concurrent information needs. However, according to our study, these motives are hindered by limited interaction spaces such as mobile viewing and irrelevant chat messages. Better filtering functions, such as keyword-based filters or collaborative social filters, should be considered to foster information sharing behaviors. Also, designating a separate space for information sharing (such as a Social Q&A) could be helpful. Finally, the membership motive is considered a key motive in online sports viewing. Presence awareness of co-viewers can be helpful in gratifying the membership motive, for example, by displaying team-level statistics of user activities.

Sports have been popular among many people, and sports fan interactions have evolved with the advent of new online media such as SNS and online sports viewing systems. We made the first step toward understanding such fan interactions in a new media. Our results provide valuable insights for designing better interaction spaces through which sports fans cannot only have enjoyable spectating experiences, but also communicate with each other to share information and build membership.

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