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Watching a Movie Alone yet Together: Understanding Reasons for Watching Danmaku Videos

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ABSTRACT

By overlaying timeline-synchronized user comments on videos, Danmaku commenting creates a unique co-viewing experience of online videos. This study aims to understand the reasons for watching or not watching Danmaku videos. From a review of the literature and a pilot study, an initial pool of motivations and hindrances to Danmaku video viewing was gathered. Then, a survey involving 248 participants to identify the underlying factor structures of motivations and hindrances was conducted. Their influences on users' attitude and behaviors with Danmaku videos were also examined. The results showed that people viewed Danmaku videos to obtain information, entertainment, and social connectedness. Introverted young men with high openness to new experience are more likely to view Danmaku videos. Infrequent viewers refused to watch Danmaku videos mainly because of the visual clutter that resulted from Danmaku comments.

1. Introduction

Traditionally, co-viewing with others, e.g., families, friends, or fans of the same sport team, is an important part of TV/Video viewing experience. With the introduction of the internet technology, however, it becomes more common that people watch TV by themselves, without the physical presence of co-viewers (Harboe, 2009). Furthermore, more and more people go online for watching videos (Defy Media, 2016; Nielsen, 2014), and this is often an activity pursued in physical solitude. Although online video services such as YouTube allow the users to interact with others through the commenting systems and other social networking features, such social interactions, however, often occur after, instead of during, a viewing session. It is not exactly a co-viewing experience that allows the viewers to instantly share their opinions, impressions, and emotional reactions as evoked by the video content.

For many viewers, such synchronous co-viewing experience is desired. A number of recent studies show that many viewers who watch TV shows or online videos in physical solitude are seeking synchronous co-viewing experience by sharing their feelings and opinions through various technology-enabled backchannels (e.g., WhatsApp, Facebook, and Twitter), during watching programs. This phenomenon of social media co-viewing, i.e., co-viewing activity mediated by social media, has been investigated in earlier industrial reports under the names of "second screen" or "social TV." A report from Ericsson ConsumerLab (Ericsson ConsumerLab, 2012)

showed that 62% of TV viewers in seven countries and areas used social media while watching TV. A more recent study (Nagy & Midha, 2014) reported that 72% of primitive-active Twitter tweet while watching live TV shows, and 58% tweet while watching on other content platforms (e.g., Netflix).

A major feature of these social media co-viewing practices is that social elements are separated from the video content. In east Asia, another mediated co-viewing alternative that integrates social elements into the video content, so-called Danmaku commenting, is becoming increasingly popular. Danmaku commenting is a real-time commentary system that displays user-generated comments specific to the current playback time of the video as streams of moving subtitles overlaid on the video screen, as shown in Figure 1. Danmaku commenting originated in Japan and has become popular in other east-Asian countries, including China. According to the Alexa traffic ranks,¹ the biggest Danmaku video-sharing website in China, bilibili.com, was the fourth most popular online video service in China, following youtube.com, youku.com, and tudou.com. Apart from such devoted Danmaku video-sharing websites, nearly all the major video-sharing websites in China, including youku.com and tudou.com, started to support Danmaku commenting in the past years. Danmaku videos are particularly popular among young people. About 67% of bilibili.com users are under 25 years old and more than 100 million users are active.² Watching Danmaku videos have become a routine or a subculture for many people in the post-1990s and post-2000s generations³ in China (He & Zhang, 2014).

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Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/hihc.

¹<http://www.alexa.com/>.

²<http://weibo.com/ttarticle/p/show?id=2309404023202337684456>. Note that in the referred survey, the age of 25% of respondents was unknown.

³Post-1990s generation refers to the generation born between 1990 and 2000 and post-2000s generation refers to the generation born between 2000 and 2010. These two terms often are used in Chinese media to refer to the younger generations.

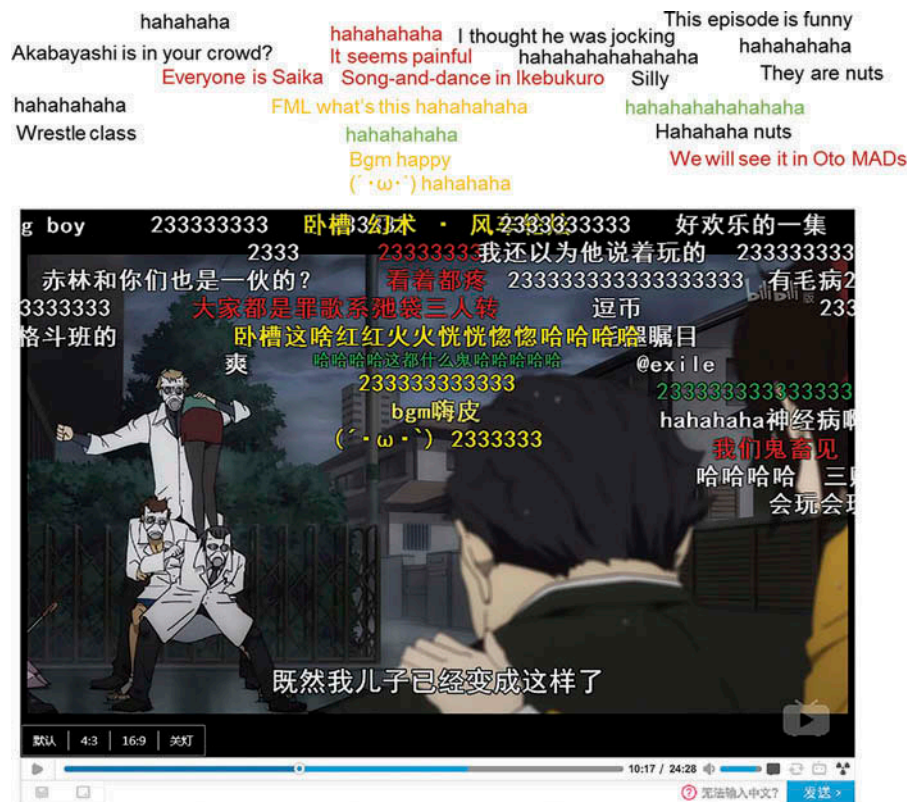


Figure 1. A screenshot of Danmaku comments in a video in bilibili.com (<http://www.bilibili.com/video/av3546699/>).

The wide spread of Danmaku commenting is not without controversy. On the one hand, Danmaku video fans would like to watch all online videos with Danmaku comments. If they happen to watch a video from platforms that do not support Danmaku commenting, they may go to Danmaku video sites to watch it for the second time. On the other hand, many people criticize that flying comments destroy the esthetics and distract them from watching the videos. Despite the growing adoption of Danmaku commenting features in online video-sharing sites in east Asia, little scholarship has been devoted to answer a fundamental question: why do people want to watch Danmaku videos or not?

So far, research on mediated co-viewing experiences focuses exclusively on social media co-viewing (Cohen & Lancaster, 2014; Krämer, Winter, Benninghoff, & Gallus, 2015; Lim, Hwang, Kim, & Biocca, 2015; Lin, Sung, & Chen, 2016). Research on Danmaku video co-viewing is scarce. Though sharing some similarities, co-viewing experience enabled by Danmaku video is different from social media co-viewing experience. First, Danmaku comments are totally anonymous. When people co-view a program with others through social media, they are talking with either a real identity or a virtual identity, which can be recognized and tracked by others. In Danmaku systems, however, every comment is left as its own, and there is no way to track who send a particular comment. It means that social needs based on established self-identities, such as communicating with friends or self-enhancement, do not make sense in Danmaku video co-viewing, though they have been found motivations for engaging in social media co-viewing (Han & Lee, 2014; Krämer et al., 2015). The reduction of

constraints from the awareness of one's self-identity, however, may encourage more honest and free self-expression.

Second, Danmaku commenting provides a "pseudo-synchronic" co-viewing experience, as coined by Johnson (2013). Danmaku video viewers can read comments sent by all the viewers who watched the same video before. This pseudo-synchronicity removes the constrain of synchronicity in social media co-viewing and enlarges the scope of co-viewer communities. Furthermore, as the video is watched by more audience, more interesting comments may come up, which may attract repetitive viewing of the same video. Finally, the pseudo-synchronicity provides stronger common ground for discussing issues specific to the current context of the content. As a result, viewers can exchange detailed, specific, and real-time information (e.g., the name of the current background music), instead of more general impressions and *post hoc* reflections. The short appearance of each rolling comment on the screen (normally no more than 3 s on the screen) also encourages viewers to share their instantaneous emotions and feelings.

Third, Danmaku comments are embedded and overlaid on the video. The positive aspect of such integration is that Danmaku video becomes a recreation work of the original video, combining information and entertainment values contributed by both the video developers and the viewers. In a survey of 413 Chinese Danmaku video viewers, 73% of the participants agreed with the statement that Danmaku comments are more important than or as important as the video content (Jiang, 2014). In addition, Danmaku video viewers are "pushed" about others opinions and enforced to get involved in the discussion, which may elicit their agreement,

disagreement, or emotional resonance, even if they only watch the video passively. The negative aspects of overlaying comments are that comments inevitably obscure the screen and may distract viewers from the content. To process both the video and the social content simultaneously may impose a higher cognitive demand on viewers.

The present study aims to provide a first comprehensive overview of factors that influence the likelihood of watching Danmaku videos. The viewing experience of Danmaku video provides possibilities to satisfy unique user needs, but it also brings unique hindrances for people to accept this form of socialization. Additionally, we believed that there are individual differences in how people are oriented to accept Danmaku videos. In addition to sociodemographic differences, this study examined the impact of three individual differences that may account for Danmaku video viewing behaviors: extraversion, the extent a person is sociable and ambitious; openness to experiences, the flexibility of thought and receptivity of novelty; and polychronicity, the inclination to do multiple things at one time.

1.1. Motivations of Danmaku Video Viewing

To understand the motives for people to consume certain media or not, the uses and gratifications' theory is one of the most widely used frameworks (Katz, Blumler, & Gurevitch, 1973). The theory assumes that the audience actively selects media purposely to satisfy specific needs and desires, and such behavior is mediated by their social and psychological dispositions. Plenty of research has been conducted on the gratifications of traditional media, such as TV, movies, and videos (Bantz, 1982; Conway & Rubin, 1991; Greenberg, 1974; Perse & Courtright, 1993), and interactive media, such as internet and social media (Haridakis & Hanson, 2009; Leung, 2001; Parker & Plank, 2000; Quan-Haase & Young, 2010). Whereas Danmaku videos can be considered as video media interwoven with text-based social media, the motives of watching Danmaku videos may encompass both the motives of consuming TV/videos and the motives of utilizing internet-based media. In addition, a couple of recent studies on the motives for people to engage in social TV activities (Hwang & Lim, 2015; Krämer et al., 2015; Lin et al., 2016) also provide hints about motivations of mediated co-viewing behaviors. By synthesizing findings from these studies and analyzing the characteristics of Danmaku videos, we found the following motivations might be relevant to Danmaku video viewing.

Utilitarian needs (e.g., learning about things, seeking information) have been found a major motivation for consuming media (Greenberg, 1974; Haridakis & Hanson, 2009; Leung, 2001; Perse & Courtright, 1993). Studies of social TV repetitively found that the motivation to obtain additional information related to the program significantly predicts the possibility of social media co-viewing (Haridakis & Hanson, 2009; Hwang & Lim, 2015; Krämer et al., 2015). We assume this motive applies to Danmaku video viewers as well. In addition, with user comments synchronized to the video timeline, Danmaku commenting systems make it more convenient to search information specific to the current interests of the user.

Hedonic needs are another important reason for people to watch TV (Bantz, 1982; Greenberg, 1974; Perse & Courtright, 1993) and to consume social media (Parker & Plank, 2000; Quan-Haase & Young, 2010; Shao, 2009). These media satisfy hedonic needs such as entertainment, passing time, arousal, escaping from the reality, and relaxation (Han & Lee, 2014). Different from other video/TV viewing experiences, the hedonic value of Danmaku videos comes from not only the video content but also viewer comments. Sometimes, the latter becomes the major source of the hedonic value: people watch a poor-quality video just for the fun of ridiculing the content together with others through Danmaku commenting (Yuan, Xing, & Jiang, 2016).

In addition to utilitarian and hedonic needs, a number of social needs may drive viewers to watch Danmaku videos. First, people may seek a feeling as if they are watching videos with someone else to avoid loneliness of watching alone. Earlier studies found that people watch TV or VCRs to overcome loneliness (Greenberg, 1974; Perse & Courtright, 1993); the internet technology has also been found a means to seek company, especially for those with an unsatisfied need for company in real life (Parker & Plank, 2000; Szathmáry, 2011). "Not watching alone" and "feelings of co-viewing" have been found important reasons for people to engage in social media co-viewing (Ericsson ConsumerLab, 2012; Han & Lee, 2014). This need for companionship is related to the concept of social presence (Hwang & Lim, 2015; Perse & Courtright, 1993), i.e., the sense of other people's presence in a mediated environment. It has not been studied, however, whether the social presence of anonymous others, as in the situation of Danmaku video co-viewing, can satisfy such need for company.

Second, to feel a sense of belonging to a larger community has been found a reason for people to use social media during television viewing (Cohen & Lancaster, 2014; Ericsson ConsumerLab, 2012; Han & Lee, 2014; Krämer et al., 2015). Whereas Danmaku video viewers do not know each other, we expected that the shared experience of watching and commenting on the same video allow them to co-experience emotions and share opinions, which may further develop into a feeling of belonging to an anonymous collective sharing similar interests.

Related to the need to belong is the need to keep up with majority peers. Danmaku videos are popular among the younger generation in China. This may impose peer pressure on younger people to catch with the majority. Not watching Danmaku videos may make them feel excluded when other peers are talking about Danmaku videos. In research on motivations to adopt new media, such a need is well recognized, but named inconsistently: whereas studies following the uses and gratifications theory use terms like "maintaining self-status" and "fashion" (Cheng, Liang, & Leung, 2014; Park, Kee, & Valenzuela, 2009; Quan-Haase & Young, 2010), studies following the technology acceptance model use terms such as "social norm" and "normative pressure" (Wirtz & Göttel, 2016). Assuming that the popularity of Danmaku videos among the younger generation may induce pressure from peers, we use the term "peer pressure" in this study.

Finally, Danmaku commenting allows people to express themselves by sharing their opinions. The need of self-expression refers to one's desire to present his/her true self to the world and has been found a motive driving the use of social media (Park et al., 2009; Shao, 2009; Whiting & Williams, 2013). Particularly, individuals who feel highly constrained by their social roles in daily life are more likely to use the Internet for expression (McKenna & Bargh, 1999). Whereas users may concern for the appropriateness of expressed content in social networking sites built upon real identities, such as Facebook (Peluchette & Karl, 2008), such concerns are relieved in Danmaku video sites due to the high anonymity. More honest and open expression may be encouraged. Furthermore, by supplying information that may be useful to others, the users may believe that they have an impact on the others. This contributing experience may support their own sense of personal efficacy (Shao, 2009).

Based on the above review of the literature, we believed that new motivations may underlie the popularity of Danmaku videos. Furthermore, the unique form of overlaying social content on top of video content may cause extra effort for users and impede them from watching Danmaku videos. Our first two research questions are:

RQ1: What are the motivations for watching Danmaku videos?

RQ2: What are the hindrances to watching Danmaku videos?

1.2. Individual Difference Affecting Danmaku Viewing Behaviors

The uses and gratifications' model suggests that the relationship between individuals' motives and their media uses is moderated by individual differences in social and psychological characteristics (Rubin, 2002). Among these characteristics, personality is a leading factor in understanding people's online behaviors. A couple of studies found that personality factors predict internet behaviors better than other individual differences such as cognitive styles (Devaraj, Easley, & Crant, 2008; McElroy, Hendrickson, Townsend, & DeMarie, 2007). In this study, we focus on two personality traits that may account for Danmaku video viewing behaviors: extraversion and openness to new experience.

Extraversion refers to the extent a person is sociable, ambitious, and talkative. Whereas early research on online chatrooms found that introvert people are more likely to rely on the internet to express their true selves (Amichai-Hamburger, Wainapel, & Fox, 2002; McElroy et al., 2007), some later research on instant messaging and social network services found opposite results (Correa, Hinsley, & De Zúñiga, 2010; Hughes, Rowe, Batey, & Lee, 2012; Ross et al., 2009). A recent social TV study (Krämer et al., 2015) found no significant associations between extraversion and social media co-viewing behaviors. Correa and colleagues (2010) suggested that the reason may be the different levels of anonymity in various online social interactions. People talking through instant messengers or Facebook often know each other in daily life, and the real-life behavioral patterns will transfer to online life. People in chat rooms, however, are largely unknown to each other and

this may allow those introverts to express themselves more freely. According to this perspective, we expect that the increased anonymity of Danmaku commenting would attract introvert people who have more difficulty in expressing themselves and connecting with others in offline life.

Hypothesis 1. People who are more introvert will watch Danmaku videos more frequently.

Openness to new experience refers to the flexibility of thought and receptivity of novelty. Openness is related to the willingness to explore new ideas and has been found a significant predictor of general technology acceptance (Devaraj et al., 2008; Svendsen, Johnsen, Almås-Sørensen, & Vittersø, 2013) and social media use (Błachnio, Przepiórka, & Rudnicka, 2013; Correa et al., 2010; Hughes et al., 2012). In addition, people with high openness to experience are more involved in information seeking behaviors (Correa et al., 2010) and are more likely to perceive ease of use for new products (Svendsen et al., 2013), whereas people with low openness to experience are more adhering to established interaction patterns. Given the socially enriched information content and the obvious deviations from traditional video viewing experience of Danmaku videos, we propose the following hypothesis:

Hypothesis 2. People who are more open to new experience will watch Danmaku videos more frequently.

Furthermore, we find that the individual difference in preference to do one thing at a time or multiple things together, defined as polychronicity/monochronicity (Oberlander, 2008), may also influence people's attitude toward Danmaku videos. Although multitasking with media (e.g., tweeting while watching television) has been found emotionally gratifying (Wang & Tchernev, 2012), the studied multitasking behaviors are voluntary, i.e., people can select whether they want to switch to another task and when to switch. When viewing a Danmaku video, users are enforced to process the video content and the comments simultaneously. For those who has a strong tendency to focus full attention at one thing at a time (e.g., more monochromy oriented), the flying comments could be very distracting and annoying. Therefore, we expect that:

Hypothesis 3. People who are more monochromic will watch Danmaku videos less frequently.

2. Pilot Study: Gathering Factors Influencing Attitude and Behavior of Danmaku Video Viewing

2.1. Method

Due to the lack of existing studies on Danmaku videos, we conducted a pilot study with the goal to elicit comments and experiences directly related to Danmaku video viewing. Focus groups were used due to their ability to provide a natural interaction among multiple participants and their advantages in encouraging participants to reflect upon personally relevant and real experiences.

We conducted 2 focus groups with altogether 11 participants, including 4 females and 7 males, aging from 21 to 28 ($M = 23.45$, $SD = 2.21$). The participants were recruited by distributing invitation links through WeChat. All of the participants had experience with Danmaku video viewing, with experience ranging from 1 to 4 years. According to their responses to a five-level item about the viewing frequency of Danmaku videos (i.e., “Very rarely,” “Once or twice per month,” “Once or twice per week,” “More than three times per week but not every day,” and “Every day”), five participants were classified as frequent viewers (watching Danmaku video once a week or more often), whereas the other six were classified as infrequent viewers (watching Danmaku video less than once a week). To stimulate discussions from different perspectives, we assigned three frequent viewers and three infrequent viewers in the first focus group, and two frequent viewers and three infrequent viewers in the second group.

Each focus group was carried out in a quiet room, and both sessions were audio- and video-recorded. After being introduced about the study purpose, the participants signed consent forms and completed questionnaires about their demographic information and Danmaku video viewing experience. The moderator then guided the participants to discuss following issues:

- Their Danmaku video viewing behaviors in general (e.g., websites they used, contexts for viewing Danmaku videos, types of videos, commenting and reading behaviors, etc.)
- The motivations to watch Danmaku videos, particularly those compared with viewing videos without Danmaku.
- The hindrances that prohibit the viewing of Danmaku videos.
- Overall user experience about Danmaku videos, opinions about Danmaku video fans, and conditions where Danmaku commenting was more or less desired.
- Anything else about Danmaku commenting they would like to discuss.

Each focus group session lasted about 1 hr. The audios and videos of both sessions were fully transcribed into written text, which served as the basis for subsequent analyses.

2.2. Motivations for Watching Danmaku Videos

By analyzing the transcripts, we found the following motives for the participants to watch Danmaku videos:

- *Being accompanied.* All the participants considered to get accompanied and avoid watching videos alone an important motivation. All the frequent viewers agreed that “when I could not find others viewing videos with them” was a typical scenario of viewing Danmaku videos. A couple of participants mentioned that, particularly when a video reaches its climax, the viewers’ emotional experiences are maximized by seeing many comments flying across the screen and feeling that many others are getting excited together with themselves.
- *Feeling part of a group of similar interests.* The majority of participants mentioned that Danmaku commenting

allows viewers to connect with others who share similar interests—at least, the interest about the video. In particular, all the participants considered that Danmaku video fans are often interested about animation, comics, and games (ACG). The frequent viewers reported that the shared interests create a community-like feeling so that they can talk to a lot of like-minded people—this is often not easy in real life. One participant considered the world of ACG fans was more lovely than the real world. Two participants mentioned that if they happen to see an interesting video from websites not supporting Danmaku, they would watch it again on their favorite Danmaku website, just to learn other Danmaku video viewers’ opinions about the video.

- *Unique entertaining value of the socially enriched content.* All the frequent viewers highly emphasized the entertaining value brought by other viewers’ humorous comments that ridicule people or things in the video. TuCao, a term specifically coined for such comments, was mentioned 45 times during discussions. Other entertaining Danmaku elements mentioned include funny transliterations in foreign languages, special effects produced by JavaScript code, and interesting interactions among comments. The frequent viewers all mentioned that Danmaku comments enable an entertaining experience for otherwise boring videos (i.e., the content is not sophisticated or already known to the viewer). A couple of frequent viewers mentioned that they would watch a same video for multiple times to see if more humorous Danmaku comments emerge over time.
- *Seeking useful information in an interesting yet efficient way.* All the frequent viewers considered that Danmaku comments are an important and rich source of video-related information and that their being synchronized to the video playback time allows the viewers to get the information when it is needed. Such information includes hidden meanings or symbolic implications of the content, background information (e.g., historical background of the story, background music, information about the cast), and language translations for foreign videos.
- *Being able to share immediate and ephemeral emotions and thoughts.* Danmaku commenting provides an opportunity to share emotions and thoughts as soon as they were evoked by the video content, as recognized by all the frequent viewers. Such experiences easily decayed when they tried to recall afterward.
- *Contributing to the community.* Several participants reported that they had a positive experience in helping others by posting useful information to the video screen, with results that are immediate and obvious to all the other viewers.

2.3. Reasons for Not Watching Danmaku Videos

Mainly from the discussions of the infrequent viewers, we identified three major reasons for not viewing Danmaku videos.

- *Excess of information.* Five infrequent viewers found Danmaku comments conveyed too much information, which added to their cognitive load and distracted them from focusing on video contents. Whereas frequent viewers also recognized the increased amount of information to process with Danmaku videos, they were not bothered by it and, on the contrary, even enjoyed the exciting atmosphere created by many comments.
- *Information pollutant.* Three participants mentioned that there were a large amount of irrelevant, redundant, and low-value Danmaku comments (e.g., release of personal emotions, quarrels between film star fans). Such information contaminated the overall information quality of Danmaku videos. In addition, some comments contained spoiler information about the story in the video, which spoiled the fun for people who watched the video for the first time.
- *Bad looking.* Three infrequent viewers considered that the font styles and colors of Danmaku comments were ugly. They also complained that Danmaku comments often destroyed the esthetic feeling of the original videos.

3. Survey: Identification of the Factors Affecting Danmaku Video Viewing

3.1. Participants

To understand the influences of motivations, hindrances, and individual differences on Danmaku video viewers' attitude and behaviors, an online survey was conducted. The link to the questionnaire was distributed via WeChat, Renren groups (a social network site popular among Chinese college students), and Baidu Tieba (one of the popular online forums in China) in December 2014. The screening criterion was that the participant should have experience with Danmaku video viewing. Two hundred and fifty-three (253) questionnaires were returned, and 248 of them were valid. Sixty-eight percent of respondents were males, whereas 32% were females. This slight bias to the male gender was similar to a recent report, which found that 59% of online video viewers were men and 41% were women (China Internet Network Information Center, 2014). Participants' aged from 15 to 35 years ($M = 20.94$, $SD = 3.06$). The majority (82%) of them were students.

The majority of the participants (73%) had experience with Danmaku videos for more than 1 year. Sixty-nine percent of them viewed Danmaku videos at least once a week, whereas 42% watched Danmaku videos daily. The data suggested that the majority of our participants were Danmaku video fans. Males tended to view more Danmaku videos than females: 84% of the male participants viewed Danmaku videos at least once a week, whereas only 36% of the female participants viewed Danmaku videos at least once a week. A strong positive correlation was found between Danmaku viewing frequency and attitude toward Danmaku videos (Spearman correlation coefficient = 0.72, p value < 0.001). More frequent Danmaku video viewers held a more favorable attitude toward Danmaku videos.

3.2. Questionnaire Design

In the first section of the questionnaire, the participants were asked about their attitudes and viewing frequency of Danmaku videos. The participant's attitude toward Danmaku was measured by the average of two 7-point Likert scale items (Cronbach's $\alpha = 0.74$): "I like watching Danmaku videos" and "I feel uncomfortable without Danmaku videos for several days." The frequency of Danmaku video viewing was measured by a single item with five levels (i.e., "Very rarely," "Once or twice per month," "Once or twice per week," "More than three times per week but not every day," and "Every day"). Furthermore, genres of videos they watched online, genres of videos they liked to watch with Danmaku comments, and their experience with sending Danmaku comments were asked.

The second section was to assess the reasons why people watch Danmaku videos or not and consisted of two parts. The first part was about the motivations for watching Danmaku videos. Based on the literature review and focus group results, we identified 28 gratification items (see Table 1 for details) that cover utilitarian, hedonic, and social needs from the literature, as well as the unique motivations of Danmaku videos (e.g., real-time entertainment, co-viewing in a lively atmosphere) emerged from the pilot study. The second part was about the hindrance to Danmaku video viewing, including six items covering the three major reasons for not watching Danmaku videos (i.e., excess of information, information pollution, and bad looking) identified from the pilot study. The participants rated their agreement or disagreement with each item using a 7-point Likert scale.

The third section measured the individual differences in extraversion, openness to new experience, and polychronicity among the participants. The first two personality traits were measured using the 7-point Ten-Item Personality Inventory (TIPI) (Gosling, Rentfrow, & Swann, 2003). Previous research shows that TIPI reached adequate levels in convergence with the widely used 44-item Big-Five Inventory, test-retest reliability, and convergence between self and observer ratings. Given that each personality trait contains only two items and that the Cronbach's alpha coefficient may underestimate the reliability in this case, Spearman-Brown prediction formula was used to predict the reliability improvement if the number of items is doubled. The predicted alpha of extraversion was 0.81 and that of openness was 0.60. Polychronicity was measured with six 7-point Likert scale items (Cronbach's alpha = 0.73 in this study) (Conte & Jacobs, 2003) adapted from the Inventory of Polychronic Values (Bluedorn, Kalliath, Strube, & Martin, 1999).

At the end of the questionnaire, participants' background information, including age, gender, education background, and occupation, were collected.

4. Results

4.1. Factor Analysis of Gratifications of Danmaku Video Viewing

To identify the major dimensions of gratifications of Danmaku video viewing, principal component factor analysis with varimax rotation was conducted on the 28

gratification items. Two items were dropped because one did not strongly load on any factor (the highest loading was $0.35 < 0.45$) and the other had almost the same values of loadings on two factors (0.52 and 0.51). Table 1 shows the results. A five-factor structure emerged with no cross-loading above 0.45. Altogether, 68% of the total variance was explained by the five factors, indicating a good fit of the model. The Cronbach's alpha coefficients for the five factors were 0.93, 0.89, 0.84, 0.81, and 0.66, respectively, all above the threshold of 0.60 suggested for exploratory research (Hair, 2009).

Factor 1, labeled as information and entertainment, consists of 11 items and explains 24% of the total variance. It covers both utilitarian needs (e.g., seeking useful or interesting information, searching information in an interesting way, and obtaining a large amount of information quickly) and hedonic needs (e.g., reading amusing comments, getting more fun when the story was already known, and killing time). Factor 2, labeled as social connectedness, explains 14% of the total variance. It comprises items related to the need for company (e.g., avoiding solitude, feeling like accompanied by others) and the sense of belongingness (e.g., finding like-minded people and feeling like belonging to a group, sharing the same feelings with others). Overall, it describes a feeling of being connected with others via Danmaku comments. Factor 3, labeled as self-expression, accounts for 12% of the total variance. This factor describes the need to one's feelings and thoughts in real time and to supply useful information to others. Factor

4, labeled as peer pressure, explains 10% of the total variance. This factor addresses the need to keep up with majority others and to not look old fashioned. Factor 5, labeled as escaping, explains 8% of the total variance and refers to the need to escape from interpersonal relationships and happenings in the real world.

4.2. Factor Analysis of Hindrances to Danmaku Video Viewing

The hindrance items to Danmaku video viewing were subjected to principal component factor analysis with varimax rotation. As shown in Table 2, two factors were identified and accounted for 69% of the total variance. The Cronbach's alpha coefficient of the first factor was 0.85. Given that the second factor contains only two items and that the Cronbach's alpha (0.48) may underestimate the reliability in this case, Spearman-Brown prediction formula was used to predict the reliability improvement if the number of items is doubled. The predicted alpha was 0.65. The reliability of both factors was acceptable. Factor 1, labeled as visual clutter, explains 46% of the total variance. The factor describes the detrimental effect of excessive comments and their problematic representation on viewing experience. Factor 2, labeled as information pollutant, explains 23% of the total variance. It addresses concerns about the less-than-satisfactory information (e.g., personal emotional release, opinions that one does not agree with) contained in Danmaku comments.

Table 1. Factor loadings (principal components, varimax rotation) of 26 gratification items.

I watch Danmaku videos...	M	SD	Loadings of factors				
			1	2	3	4	5
Information and entertainment seeking	5.01	1.42					
1. Because Danmaku commenting provides an interesting way to search the information	5.36	1.67	0.79	0.11	0.25	0.13	0.13
2. Because I think Danmaku comments are amusing	5.45	1.73	0.78	0.27	0.17	0.11	-0.13
3. To obtain the information that I am interested in (such as humorous TuCao)	5.58	1.64	0.77	0.24	0.17	0.04	0.12
4. To make the viewing more interesting when I have already known the story of the video	5.19	2.02	0.72	0.14	0	0.15	0.02
5. To kill time and make the boring videos more interesting	4.75	2.05	0.7	0.15	0.14	0.2	0.18
6. To relax	5.38	1.81	0.68	0.42	0.09	0.03	0.23
7. To obtain large amount of information quickly	4.82	1.84	0.65	0.1	0.33	0.2	0.28
8. To seek useful information (such as background information or subtitles)	5.41	1.80	0.63	0.12	0.36	0.02	0.26
9. To know what others are thinking about	5.18	1.69	0.62	0.26	0.21	0.03	0.14
10. Because Danmaku comments are exciting	3.98	1.95	0.58	0.29	0.3	0.38	0.16
11. To seek emotional release	4.03	1.99	0.51	0.32	0.22	0.37	0.32
Social interaction	4.77	1.55					
1. To avoid solitude when watching videos	4.00	2.14	0.17	0.74	0.14	0.21	0.32
2. To feel like watching videos accompanied with others	4.97	1.99	0.34	0.74	0.19	0.05	0.16
3. Because I like watching videos with others	4.67	1.94	0.17	0.72	0.13	0.27	-0.16
4. To enjoy lively atmosphere	5.55	1.66	0.55	0.6	0.14	0.01	0.11
5. To find like-minded people and feel like belonging to a group	4.46	1.93	0.32	0.59	0.32	0.15	0.39
6. To seek the same feelings with others	4.97	1.94	0.41	0.59	0.24	0.11	0.28
Self-expression and actualization	3.64	1.61					
1. To express my opinions	3.88	1.97	0.24	0.15	0.84	-0.04	0.16
2. To express my feelings	4.11	2.02	0.19	0.22	0.83	-0.02	0.11
3. To help others by sending useful Danmaku comments	3.73	2.02	0.29	0.14	0.73	0.19	0.12
4. Because I like telling others what is going on when watching videos	2.85	1.87	0.15	0.15	0.58	0.36	-0.01
Fashion	2.78	1.46					
1. To look fashionable	2.34	1.56	0.08	0.1	0.06	0.88	0.13
2. To not look old-fashioned	2.47	1.63	0.09	0.09	0.05	0.85	0.21
3. Because the people around me watched Danmaku videos	3.53	1.93	0.34	0.26	0.16	0.65	-0.12
Escaping	3.68	1.79					
1. Because I think the worlds described in Danmaku animations are better than the real world	4.04	2.21	0.2	0.14	0.09	0.04	0.8
2. To get away from the current interpersonal relationships	3.31	1.94	0.17	0.18	0.17	0.2	0.73
Proportion variance			0.24	0.14	0.12	0.1	0.08
Cronbach's α			0.93	0.89	0.84	0.81	0.66

Table 2. Factor loadings (principal components, varimax rotation) of factors discouraging Danmaku video viewing.

I think...	<i>M</i>	<i>SD</i>	Factor	
			1	2
Visual clutter	3.64	1.51		
Danmaku comments are too ugly	3.07	1.79	0.88	−0.11
Danmaku comments destroy the feeling of the video	3.33	1.91	0.86	−0.07
Danmaku comments convey too much information and make me tired	3.75	1.78	0.84	0.21
Danmaku comments make me dazzled and cannot catch the video	4.42	1.81	0.71	0.26
Information pollutant	4.22	1.42		
I feel uncomfortable when I see opinions that I do not agree with	3.38	1.83	0.02	0.81
There are too many Danmaku comments about personal emotional release	5.06	1.68	0.08	0.77
Proportion variance			0.46	0.23
Cronbach's α			0.85	0.65*

Note. *Spearman–Brown prediction formula was used to predict the alpha if the number of items is doubled.

Table 3. Hierarchical regressions predicting the attitude toward and the viewing frequency of Danmaku videos.

	Attitude toward Danmaku Videos			Viewing frequency of Danmaku videos		
	ΔR^2	β	<i>p</i> Value	ΔR^2	β	<i>p</i> Value
Stage 1	0.11**			0.22**		
Gender ^a		−0.33	<0.01**		−0.46	<0.01**
Age		0.01	0.85		−0.06	0.26
Stage 2	0.02			0.04**		
Gender		−0.30	<0.01**		−0.40	<0.01**
Age		0.02	0.80		−0.05	0.34
Extraversion		−0.12	0.07*		−0.19	<0.01**
Openness		0.10	0.11		0.13	0.03**
Polychronicity		0.09	0.15		0.07	0.20
Stage 3	0.46**			0.28**		
Gender		−0.10	0.03**		−0.23	<0.01**
Age		0.08	0.08**		−0.01	0.76
Extraversion		−0.04	0.39		−0.11	0.03**
Openness		0.06	0.19		0.10	0.04**
Polychronicity		0.05	0.23		0.04	0.35
Information and entertainment		0.35	<0.01**		0.22	<0.01**
Social connectedness		0.25	<0.01**		0.17	0.02**
Self-expression		0.09	0.09*		0.04	0.47
Peer pressure		−0.04	0.39		−0.13	0.02**
Escaping		0.08	0.11		0.04	0.52
Visual clutter		−0.18	<0.01**		−0.26	<0.01**
Information pollutant		0.004	0.93		0.14	<0.01**

Notes. ^aMale—0, female—1. *Significant at 0.1 level; **significant at 0.05 level.

4.3. Predicting the Attitude and Behavior of Viewing Danmaku Videos

Two hierarchical multiple regression analyses were performed to examine the contribution of individual differences, motivations, and hindrances in explaining the attitude toward and the viewing frequency of Danmaku videos. Preliminary analyses were conducted to ensure no violation of assumptions of independence, singularity, and multicollinearity (all variance inflation factors (VIFs) < 4). In both hierarchical regressions, age and gender were entered at the first stage to control for possible influence of demographic differences. Previous research indicates possible influences of age and gender on the use of social media and online video sites (Correa et al., 2010; Haridakis & Hanson, 2009). At the second stage, extraversion, openness to experience, as well as polychronicity, were included in the model. The identified motivations and hindrances were entered at the third stage. Results of the regression analyses are summarized in Table 3.

At stage one, control variables (gender and age) explained 11% of variance in the attitude toward Danmaku videos ($F_{2,245} = 14.74$, $p < 0.001$) and 22% of variance in the viewing frequency of Danmaku videos ($F_{2,245} = 34.77$, $p < 0.001$). Gender had a significant impact on both the attitude ($\beta = -0.33$, $p < 0.01$) and the viewing frequency ($\beta = -0.46$,

$p < 0.01$). Compared to females, males had a more positive attitude toward Danmaku videos and were more engaged in Danmaku video viewing. At stage two, the increase of R^2 from the introduction of extraversion, openness to experience, and polychronicity was only significant for the viewing frequency ($\Delta R^2 = 0.04$, $F_{3,242} = 4.17$, $p = 0.007$), but not for the attitude toward Danmaku videos. Extraversion ($\beta = -0.19$, $p < 0.01$) and openness to new experiences ($\beta = 0.13$, $p = 0.03$) were two significant predictors of Danmaku video viewing frequency. Introvert people and people with high openness to experiences were more likely to engage in Danmaku video viewing.

At the third stage, the introduction of identified motivations of and hindrances explained an additional 46% of variance in the attitude to Danmaku videos ($F_{7,235} = 38.59$, $p < 0.001$) and an additional 28% of variance in the frequency of Danmaku video viewing ($F_{7,235} = 19.90$, $p < 0.001$). The motivation of information and entertainment was the strongest positive predictor of both attitude toward ($\beta = 0.35$, $p < 0.01$) and viewing frequency of Danmaku videos ($\beta = 0.22$, $p < 0.01$), followed by social connectedness (attitude: $\beta = 0.25$, $p < 0.01$; viewing frequency: $\beta = 0.17$, $p < 0.01$). Visual clutter was negatively associated with both the attitude

toward ($\beta = -0.18, p < 0.01$) and the viewing frequency of Danmaku videos ($\beta = -0.26, p < 0.01$). Furthermore, the viewing frequency of Danmaku videos was negatively associated with peer pressure ($\beta = -0.13, p < 0.01$) and positively associated with information pollutant ($\beta = 0.14, p < 0.01$).

The final models explain 60% of the total variance of the attitude toward Danmaku videos and 54% of the total variance of the viewing frequency of Danmaku videos. Comparisons of the beta values indicated that the prominent predictor of the attitude toward Danmaku video viewing was the need for information and entertainment (positive), followed by social connectedness (positive) and visual clutter (negative). For the viewing frequency of Danmaku videos, the most prominent predictor was visual clutter (negative), followed by the need for information and entertainment (positive) and social connectedness (positive).

In addition, we further analyze the data of self-expression by removing 60 participants who had never sent Danmaku comments before, based on the consideration that people who have experience in sending Danmaku comments were more proper respondents to this question. Analyzing the data of the 188 participants who had experience with sending Danmaku comments, we found the motivation of self-expression significantly correlated with the attitude toward Danmaku videos (Pearson's $r = 0.33, p < 0.001$) but not with the viewing frequency of Danmaku videos (Pearson's $r = 0.17, p = 0.12$).

5. Discussion

5.1. Gratifications of Danmaku Video Viewing

Information and entertainment was the strongest positive predictor to both the attitude toward and the viewing frequency of Danmaku videos. This result is in accordance with previous research on motivations for using traditional television (Rubin, 1981, 1983), YouTube (Haridakis & Hanson, 2009), and user-generated media (Shao, 2009). The unique entertainment value of Danmaku videos, as enriched by the embedded social content, already has been recognized by practitioners.⁴ But we found that the potential of Danmaku commenting to satisfy users' information needs might have been underestimated. As shown in Figure 2, among the top six rated items for watching Danmaku videos, three were related to information needs: "to obtain the information that I am interested in" ($M = 5.58, SD = 1.64$), "to seek useful information" ($M = 5.41, SD = 1.80$), and "because Danmaku commenting provides an interesting way to search the information" ($M = 5.36, SD = 1.67$). A pioneer PARC research social TV (Ducheneaut, Moore, Oehlberg, Thornton, & Nickell, 2008) envisioned a design possibility that individuals can mark their important moments and comments of a program in real time and share them with others who view the same content later. This idea is embodied through the pseudo-synchronic design of Danmaku commenting system. On the one hand, it allows the viewer's questions to be answered during video watching and helps the viewer to find hidden messages and understand obscure plots. On the

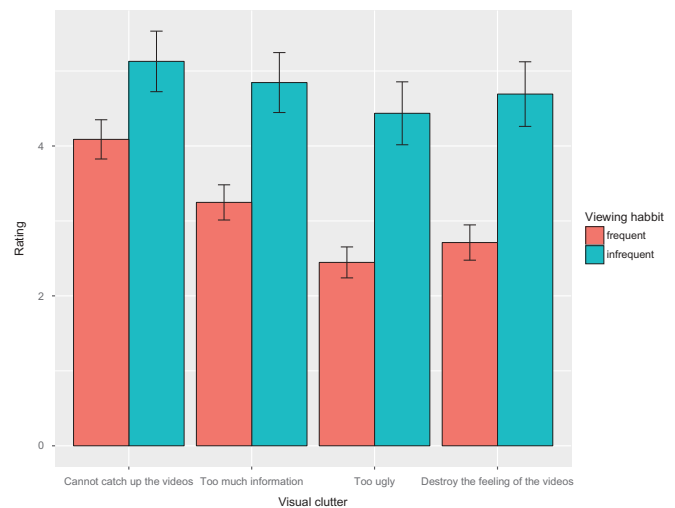


Figure 2. Participants' ratings on the hindrance of visual clutter.

other hand, this feature may encourage viewers to contribute more detailed and in-depth information related to the video, which may help to build a richer information source for other viewers to refer to.

Social connectedness was the second important predictor of the participants' attitude and viewing frequency of Danmaku videos and the item of "to enjoy the lively atmosphere" was the highest rated reason for watching Danmaku videos. Although such a need has been found in previous studies as a motive for using YouTube or engaging in social TV activities (Haridakis & Hanson, 2009; Hwang & Lim, 2015; Lim et al., 2015), a major difference between their study and the current study was that, in Danmaku systems, people are interacting with anonymous others without knowing even their virtual identities. Such extreme anonymity prevents established social relationships in real life to be mixed into such interests-based groups, as well as discouraging development of new relationship between viewers. In spite of such obvious impediments to socialization, Danmaku videos satisfy a unique social need to be connected only with those sharing similar interests. That is to say, the social group of Danmaku videos is formed by, and limited to, shared interests. It releases all the pressure resulting from social desirability or impression management. On the one hand, it may liberate viewers' creativity to generate unique and interesting comments (Ellison, Heino, & Gibbs, 2006; Krämer & Winter, 2008; Lajunen & Summala, 2003). On the other hand, the anonymity reduces social uncertainty and encourages disclosure of one's inner selves (Tidwell & Walther, 2002). Prior research has found that people who can better disclose their inner self to others on the Internet are more likely to form close and meaningful online relationships online (Bargh, McKenna, & Fitzsimons, 2002; McKenna, Green, & Gleason, 2002).

It was different from our expectation that peer pressure was negatively associated with Danmaku video-viewing behavior. The average score of this factor was lower than the neutral

⁴http://archive.wired.com/techbiz/people/magazine/16-06/mf_hiroyuki?currentPage=all.

point 4 among both frequent viewers ($M = 2.86$, $SD = 1.50$) who watched Danmaku video once a week or more often, and infrequent viewers ($M = 2.61$, $SD = 1.38$) who watching Danmaku video less than once a week. Frequent viewers had more fellows around them who watched Danmaku videos ($M = 3.73$, $SD = 2.04$) than did infrequent viewers ($M = 3.09$, $SD = 1.58$). This may explain the negative correlation between the peer pressure gratification and the watching frequency of Danmaku videos. Overall, the results indicated social influence of peers is not a reason for people to watch Danmaku videos.

5.2. Hindrances to Danmaku Video Viewing

The strongest negative predictor to both the attitude toward and the viewing frequency of Danmaku videos was visual clutter. In the final model of viewing frequency of Danmaku videos, visual clutter was the most prominent predictor. It suggests that how much people can accept or tolerate the visual clutter predicts the tendency to watch Danmaku videos more than the motivations of Danmaku videos does. Further analysis suggested that significant differences existed between the frequent and the infrequent viewers, as shown in Figure 2. For the infrequent viewers, the biggest problem was the difficulty of catching up on the videos while reading Danmaku comments ($M = 5.13$, $SD = 1.79$), followed by the large amount of information to process ($M = 4.85$, $SD = 1.77$), and the degraded feeling of the video ($M = 4.69$, $SD = 1.91$). The frequent viewers, however, did not consider visual clutter issues problematic, except for the issue of catching up on the videos while reading comments. About this issue, their attitude was neutral ($M = 4.09$, $SD = 1.73$). It seems that reading running comments while watching the video is a demanding job for not only infrequent viewers but also for many frequent viewers.

The negative coefficient of information pollutant in the regression analysis of view frequency of Danmaku videos was surprising. A possible reason was that people who watched Danmaku videos frequently were more likely to encounter low-quality content, whereas people who watched Danmaku videos infrequently may not be aware of the issue. The frequent viewers ($M = 4.42$, $SD = 1.41$) rated the content imperfection as more severe than did the infrequent viewers ($M = 3.78$, $SD = 1.36$, $t_{246} = -3.34$, $p < 0.001$). The results suggest that frequent viewers keep watching Danmaku videos despite possible information pollutant, and that low-quality information is not a major concern that prevents infrequent users from viewing more Danmaku videos.

5.3. Extraversion, Openness to Experiences, and Polychronicity

The regression analysis showed that introvert users were more likely to watch Danmaku videos and Hypothesis 1 was supported. This finding is consistent with Correa and colleagues' (Correa et al., 2010) argument that online social interactions with high a level of anonymity would favor introverts more than extroverts. Previous literature gave two possible reasons: One was that shy and introverted people found the Internet a less stressed way to express

themselves (Amichai-Hamburger et al., 2002; Ebeling-Witte, Frank, & Lester, 2007). Another was that the Internet enabled introverts to be understood and to belong to a group despite their communication apprehension in face-to-face social contexts (Loffredo, 2000). Further analysis of our data showed that extraversion slightly correlated with the gratification of social interaction (Pearson's $r = -0.11$, $t_{246} = -1.80$, $p = 0.07$) but not with the gratification of self-expression (Pearson's $r = 0.01$, $t_{246} = 0.19$, $p = 0.85$). This implies that introverted people enjoy Danmaku more for social connectedness than for self-expression. Danmaku videos allow them to become part of a community through a passive socialization strategy, as described by Tidwell and Walther (2002), to observe, drawing comparisons with, and get connected to others without directly interacting with others.

Users with higher openness to experiences were more likely to view more Danmaku videos and Hypothesis 2 was supported. This finding was consistent with previous studies, which found a positive association between openness to experiences and new technology acceptance (e.g., Zhou & Lu, 2011). Our results suggest that people with higher openness are more likely to appreciate the unique benefits of Danmaku commenting and tolerate the very different visual experience for the sake of such benefits. In addition, the abundant and continuously updating information provided by Danmaku commenting may satisfy their seeking for novelty and broad information (Heinström, 2003).

Polychronicity was not a significant predictor to either Danmaku video related attitude or behavior. Hypothesis 3 was not supported. Although watching Danmaku videos is a multitasking behavior by definition, users' attitude and use behavior with Danmaku commenting was not influenced by their inclination to do several things at once or not. The result indicates that monochronic people may accept the simultaneous-processing style of Danmaku videos if they consider the gratifications obtained from Danmaku videos are important enough to them.

6. Conclusions

6.1. Theoretical Implications

For many people who are new to Danmaku videos, the flying comments can be incredibly distracting and annoying. But the extreme popularity of Danmaku commenting among the younger generation of Chinese shows that Danmaku videos provide a desired co-viewing experience, though different from in-person co-viewing and social TV experiences. To the best of our knowledge, this article is the first initiative to explore the motivations of Danmaku video viewing. The results highlight two major motivations of Danmaku videos: the additional information and entertainment value enriched by social content, and the sense of being socially connected without direct interacting with others. In addition, this study integrates both motivations of and hindrances to Danmaku video viewing, in addition to individual characteristics, in order to predict people's attitude toward and viewing frequency of Danmaku videos. The majority of previous research

considered only motivations (Hwang & Lim, 2015; Krämer et al., 2015; Lim et al., 2015; Lin et al., 2016) and some took individual differences into considerations (Cohen & Lancaster, 2014; Haridakis & Hanson, 2009). By integrating hindrances that prevent people from engaging more with Danmaku videos into the model, we believe our approach can develop a more complete understanding of the reasons for watching Danmaku videos or not. Finally, this study provides more evidence for the interaction effect between extraversion and anonymity of online social interaction—whereas extroverts are more engaged in online social applications that restrict anonymity (e.g., Facebook, Instant Messengers), introverts are more engaged in online social applications that encourage anonymity, such as Danmaku commenting systems. This finding is also in agreement with Cohen et al.'s (Cohen & Lancaster, 2014) finding that people who have a strong need for solitude prefer to be physically alone when watch television but do not mind computer-mediated presence of other co-viewers.

6.2. Practical Implications

From the perspective of Danmaku video system developers, our results highlight the importance of balancing the benefits and costs of integrating social content into videos. Although the informational, entertainment, and social value of such integration is appreciated by users, the visual clutter is the most important factor determining the viewing frequency of Danmaku videos. Catching up on a video while reading flying comments is still a challenging job, particularly for infrequent users. Although most Danmaku video websites allow users to adjust the amount, transparency, and speed of comments for themselves, such customization works the best when users know their goals and needs clearly. Infrequent users of Danmaku videos are often not clear about what they actually need about Danmaku displays; sometimes tweaking the user interface seems just too much work to do for enjoying a video. A more effective approach may be that the system profiles the users and delivers experiences that match their needs, with minimum effort from the users. To do this, more studies are needed to address ergonomics issues such as the acceptable amount of information and scrolling speed of Danmaku comments for people with average reading capabilities. In addition, more effort is needed for developing smarter filtering mechanisms and representation forms so that the most interesting comments are presented to viewers. Handling comments about personal emotional release properly would be a critical issue. Whereas a certain amount of emotional release comments is indispensable to forming a lively atmosphere, too many such comments would dilute the entertaining and informational value of Danmaku comments.

Furthermore, the highly rated information value of Danmaku videos of our study suggests a promising strategy to deliver video-related information to facilitate information-seeking activities. This unique value of Danmaku commenting could be magnified in a context when the purpose of watching videos is more for knowing and learning than for entertaining. For example, knowledge is delivered through videos in massive open online courses (MOOCs). An innovative

integration of Danmaku commenting into MOOCs may allow questions about particular sections of the video to be raised and answered immediately. It also can reduce users' effort for taking notes during watching and searching for answers later in forums. Reading the real-time discussion of the videos may inspire more personal reflection on the content and encourage learners to engage in deeper learning. More research effort is needed to explore this design opportunity and to investigate its influence on learning performance and user experience.

6.3. Limitations and Future Research

A major limitation of our study was that the usage behavior was measured using a single self-reported item of viewing frequency. The simple measurement cannot provide richer information about usage behaviors, such as when viewers would turn the Danmaku function on and off, how much time they would watch Danmaku videos and non-Danmaku videos, and what they would do when too many comments obscure a screen. In addition, the self-reporting method is vulnerable to memory deficiency and subjective biases. Analysis of system log data, in combination with subjective reporting, would provide more detailed and reliable information about usage behaviors and should be considered in future research.

A very interesting topic for future research is to explore whether or not Danmaku commenting can provide enough gratification for people outside east Asia. People in different cultures have different communication styles and tolerance levels for distraction from abundant information. Different languages also feature different information entropy per character. These might influence users' acceptance of Danmaku commenting. Whereas visual clutter is an obvious bias for people to accept Danmaku commenting, it seems young Asian users accept this imperfection to obtain unique gratifications satisfied by Danmaku commenting. Are these gratifications specific to eastern Asians only or do they exist among people from other cultures as well? This question needs further research to answer.

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