How danmaku influences emotional responses : exploring the effects of co-viewing and copresence

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**NANYANG
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**HOW DANMAKU INFLUENCES EMOTIONAL RESPONSES:
EXPLORING THE EFFECTS OF CO-VIEWING AND
COPRESENCE**

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2018

**How Danmaku Influences Emotional Responses:
Exploring the Effects of Co-viewing and Copresence**

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ABSTRACT

With the development of mass communication technology, audiences have become more active and engaged. A novel online commentary system, *danmaku*, enables users to generate content-synchronous comments overlaid on a video at any time point. Several unique features of danmaku (synchronization and positioning) distinguish it from YouTube comments and Social TV. This study was designed to determine whether danmaku generated copresence, and how copresence influenced viewers' emotional responses to horror films and comedy. A 3 (danmaku comment amount) x 2 (genre) factorial experiment was carried out in a lab. The danmaku comment amount (none, a moderate amount, and an excessive amount) was manipulated between-subjects, and genre (comedy and horror) was manipulated within-subjects. The results of the study indicate that danmaku can generate a certain level of copresence. Danmaku also has some effects on positive affect to horror. Theoretically, danmaku provides a novel co-viewing pattern and the concept of co-viewing needs to be extended. The co-viewing experience induced by danmaku is asynchronous virtual co-viewing experience, and co-viewing can go beyond the traditional form of physically sitting together and watching simultaneously. This study also provides insights for danmaku popularization and promotion, and has implications for the online video industry.

Keywords: danmaku, co-viewing, copresence, user-generated comments

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CHAPTER ONE INTRODUCTION

Media usage patterns have evolved beyond the traditional mass-oriented linear-structured paradigm (Guo & Holmes, 2015). Audiences have become increasingly more active, as well as interactive. The traditional appointment model of broadcasting has been challenged by time-shifting technologies such as VOD (Video on Demand) or Pay-Per-View (Pittman & Tefertiller, 2015). Viewers can use a video streaming service, such as Netflix, to choose their films and watch them for a modest price. Unlike the traditional broadcasting pace, viewers have choices and control the time and amount of viewing.

People not only receive media messages, but also interact with media creations online, as well as possessing the ability to produce their own original programs. In the world of YouTube, everyone is not only a receiver, but also a potential content provider. YouTube enables people to upload their own videos and to post comments on videos uploaded by others. YouTube allows participative and collaborative communication, since viewers no longer merely consume broadcast content, but also share feedback about the content with their peers (Harmer, 2010).

New media does not replace old media; the emerging convergence trend breaks down the walls between separating media channels (Jenkins, 2007). Cross-platform media usage becomes a common practice and media content flows through different media. The advent of social TV improves television watching's interactivity and sociability. "Social TV" refers to "real-time backchannel communication on social networking sites (SNSs) during a live television broadcast" (Lim, Hwang, Kim, & Biocca, 2015, p.158). Second-screen viewing has been seen as the latest trend in TV watching (Pittman & Tefertiller, 2015).

Social TV contributes to active audience and user engagement in three aspects: First, the second screen creates a communal group viewing experience (Hwang & Lim, 2015). Many viewers enjoy sharing opinions about programs when they watch broadcast television

programs. Pittman and Tefertiller (2015) found that more than 36 million Americans tweeted during broadcast shows, discussing the TV program content. People who are geographically dispersed are now able to cheer together by sharing their reactions via a second device when they watch a live football game (Cohen & Lancaster, 2014). Some topics related to a live TV program during broadcasting frequently rank high in Twitter's trending topics. Private forms of communication such as WhatsApp or SMS are also popular platforms for second screens (Raney & Ji, 2017). Second, social TV enables media producers to track audiences' real-time reactions at a temporal perspective (Harrington, Highfield, & Bruns, 2013). Social TV can reflect viewers' feedback for some key moments of a TV show. This may be interesting when analysing a television political debate during presidential elections. Third, social TV fosters a new participatory framework between audience and screen (Holmes, 2004). The audience can be part of the show. In some reality shows, viewers vote for their favourite contestants and determine the results of the programs. For example, there were more than 20 million text messages or phone calls per episode during the *American Idol* 2003 season. TV viewers are no longer simply passive receivers.

A novel technology, *danmaku*, provides real-time feedback for online videos, and it combines the two screens (videos and comments) into one. Danmaku is a content-synchronous commentary system that enables Internet users to place their comments on a video clip at specific time points. Unlike social TV, danmaku comment is overlaid on the video, and users do not need a second device. It is also different from YouTube comments, where comments are displayed below the video in a column format. Besides the positioning of the comments on top of the streaming video, another unique feature of danmaku is that the comments are in synchronization with the video content. For example, when a specific scene occurs, several danmaku comments related to it appear. Viewers can see all the danmaku comments created by previous viewers in a log adjacent to the video display window, but

most typically they see it scrolling across the screen as the video plays. These two key features distinguish danmaku from traditional YouTube comments and social TV.

The advent and popularity of danmaku offer research potential. Although danmaku has been popular for many years in Japan and China, so far, there is limited research on the phenomenon. Existing danmaku studies have focused on various perspectives: the synchronicity attribute of danmaku (Johnson, 2013); the design of danmaku and consumer evaluations (Shen, Chan, & Hung, 2014); uses and gratifications (Chen, Gao, & Rau, 2015); media capabilities (Liu, Suh, & Wagner, 2016); motivational affordances (Zhao & Tang, 2016); user intention and the affective response model (Liu, Suh, & Wagner, 2016); as well as perceived coolness and subculture identity (Peng, Zhao, & Teo, 2016). Most of these studies are at the exploratory and descriptive, so controlled experiments are needed to test the effects of this new technology.

This study tests if danmaku generates a sense of copresence, and whether copresence influences viewers' emotional responses to horror films and comedy. Before the relevant theory and research design are presented, an overview of danmaku is provided.

CHAPTER TWO LITERATURE REVIEW

An Overview of Danmaku

The concept of danmaku originated from Japan in 2006, and the first danmaku video-sharing website, Nicovideo, quickly became popular in the Japanese ACG (animation, comics, and games) industry (Johnson, 2013). In 2010, Nicovideo began to offer multilingual services (English, Chinese, and Japanese), and became more influential across Asia. Danmaku was introduced into China by the Acfun video-sharing website in 2008. Currently in China, an increasing number of video sharing websites (e.g., tudou.com, iqiyi.com, and letv.com) and mobile apps (e.g., Echo and Ximalaya FM) have introduced danmaku technology. According to Alexa rankings, Nicovideo was the eighth most visited website in Japan during 2015. Almost three million users visit Nicovideo every day, and one out of three Japanese people consider themselves regular visitors (Johnson, 2013). There are two types of danmaku: Live show danmaku and uploaded video danmaku. Sometimes there is a live broadcast show on a website (a sports broadcast or live concert), where people watch the live show together and post comments at the same real time. In this case, it is similar to social TV. However, most of the time, there is no live show, and the videos are uploaded by users. In this paper, we focus on uploaded video danmaku.^{[1][2][3][4][5][6][7][8][9][10]}

Positioning is one of the unique features of danmaku. With danmaku, the location of comments shifts from a sidebar or below the video to being right on the video image itself. Users can choose to post a scrolling message (usually from right to left) or a static message (that stays in the middle of the screen for a few seconds). Sometimes, so many comments get posted that they nearly obscure the visual narrative that prompted the reactions (the English meaning of danmaku is *barrage*). If the danmaku comments obstruct the video image, users can click on a “Block” button to hide the comments, leaving only the original video visible.

The other unique feature of danmaku is that comments are synchronized with the

video content. Danmaku comments can be posted at a specific time point, or on a specific scene. As soon as a user posts a comment, danmaku instantly appears on the video. Viewers at sites like AcFun see all the danmaku comments created by previous viewers cumulatively scrolling on the screen. Therefore, when it comes to a specific scene, all the danmaku comments that are related to this scene appear. For example, when a hero in a video cries, viewers may see “I feel sorry for him” or “poor guy” on the screen. Unlike YouTube, where users can only control the content of comments, danmaku consists of three dimensions: form (font, text size, color, position, etc.), content, and time. Danmaku enables users to post comments on any time point, and when it comes to that time point, other users can see the danmaku. Therefore, danmaku enables viewers to share their real-time feedback.

Co-viewing

Traditionally, co-viewing is defined as family members watching television together in the same household. Research in this area has focused on parents and children co-viewing (Hicks, 1968), siblings co-viewing (Wilson & Weiss, 1993), and co-viewing by various gender combinations (Zillmann, Weaver, Mundorf, & Aust, 1986). New technology makes co-viewing possible across geographic distance and time.

Social TV makes co-viewing geographically independent, and danmaku extends co-viewing beyond time. Social TV enables people who are geographically dispersed to watch a show together and interact with each other via a second device. This enhances viewers' engagement (Lim, Hwang, Kim, & Biocca, 2015) and generates a virtual co-viewing experience. Even though viewers do not need to watch simultaneously, they can still feel a sense of co-viewing. Danmaku is generated by anonymous people at different time. Danmaku can provide real-time feedback for specific content, and the near-simultaneous experience of the reaction invokes an illusion that the person is not alone, with unknown people watching together. The mechanism will be elaborated in greater details in the copresence section.

Danmaku's asynchronous co-viewing experience has been reported by some users in qualitative studies. In a focus group study (Chen, Gao & Rau, 2015), a subject reported that he liked the feeling of co-viewing, and it was just like watching together with friends although he didn't know who they were at all. The founder of nicovideo website, Hamano Satoshi, called it "pseudo-synchronicity" (Johnson, 2013). I would define this type of co-viewing as asynchronous virtual co-viewing.

Generally speaking, co-viewing experiences induce more emotional gratification than watching alone, but co-viewing effects vary across genres and audiences. For example, people feel discomfort when watching sexual content with parents (Harris & Cook, 2010). When children watch violent programs, they sometimes imitate the violent behaviour, but if they watch with their parents, parents' negative comments restrain the imitation (Hicks, 1968). Children experience less arousal and fear when they watch suspenseful movie scenes with their siblings (Wilson & Weiss, 1993). Watching comedy with others can facilitate the perceived humor of the jokes (Chapman, 1973; Malpass & Fitzpatrick, 1959).

This study will use comedy and horror as the video contexts to explore danmaku effect. The reason for selecting these two genres is that there have been a few studies (Cantor & Wilson, 1988; Chapman, 1973; Malpass & Fitzpatrick, 1959; Wilson & Weiss, 1993) working on how physical copresence of others can influence viewers emotional responses, and the results turns out that the emotions can be significantly different, when watching comedy/ horror alone, compared to watching with others. Therefore, it is easier to test danmaku effect when using comedy and horror as contexts.

Copresence

Long before the advent of computer-mediated communication (CMC), copresence and social interaction between people had been extensively studied. Triplett (1898) examined how the presence of others influenced individuals' behavior, and found that children's riding

speed was improved when they were in pairs than when alone. Allport developed the term “social facilitation” to explain this phenomenon (Strauss, 2002). Markus (1978) extended the experiment and found that people performed better in the presence of others, except when the task was too complex. Cooley’s (1902) “looking-glass self” concept stressed the significance of the perceptions of others. Mead’s (1913) “generalized other” concept also focused on the influence of perspective and expectations of others in society. Goffman coined the term “copresence,” and came up with what remains the classic definition: “Persons must sense that they are close enough to be perceived in whatever they are doing, including their experiencing of others, and close enough to be perceived in this sensing of being perceived” (1966, p.17). Goffman defined copresence as a sociological concept, and pointed out that richness of information flow and feedback were two important features of face to face interaction.

With the development of Internet technology, the experience of copresence is not only limited to physical proximity. CMC can also provide the dynamics of copresence. People can experience the sense of being with another, through technological mediation such as text, images, and videos (Biocca, Harms, & Burgoon, 2003). Harms and Biocca (2004) defined copresence as the degree that a person believed he/she was not alone, and the level to which that person was aware of others. Zhao (2004) reconciled the two notions of copresence (physical copresence and CMC copresence), and came up with a two-by-three typology of copresence.

There are conflicting views on the relationship between social presence and copresence. Some scholars believe that copresence is one of the sub-dimensions of social presence (Harms & Biocca, 2004), but other scholars use the two terms interchangeably (Bailenson et al., 2015), and still other scholars, such as Lee (2004), argue that copresence is quite different from social presence, because copresence requires “mutual awareness,” while

social presence does not. In the next section, I will discuss on directionality and argue that mutual awareness is not a necessity.

Danmaku and Copresence: Unidirectional Non-contemporaneous Copresence

Danmaku copresence mode is different from the traditional copresence mode, because danmaku generates unidirectional non-contemporaneous copresence. Some scholars have argued that copresence requires mutual awareness of each entity (Biocca, Harms, & Burgoon, 2003; Lee, 2004), I question whether mutual awareness is still essential for mediated copresence. The requirement of mutual awareness was established by Goffman in 1966 for physical copresence, but I would argue that the concept of copresence should be extended.

The concept of copresence consists of physical copresence and CMC copresence. Video conference can provide CMC copresence, however, danmaku, can provide another type of CMC copresence. I would define danmaku users' perception of copresence as unidirectional non-contemporaneous copresence. Users are not mutually aware of each other, but only the latter users are aware of the previous users. Just as with graffiti, observers become aware of previous visitors and possibly know their feelings (depending on what was written or drawn). As for danmaku, each viewer can perceive the prior commentators, and each commentator could be perceived by latter viewers. This process runs repeatedly.

Mechanism. Danmaku's content synchronous feature contributes to an illusion that people are watching the video together simultaneously. Since the danmaku timeline is manipulable, viewers could post comments at any time point. The comments are presented based on video time points, not simply in order of input. When it comes to a specific scene, all the danmaku comments that are related to this scene appear. The danmaku comments appear on the screen as soon as the users post them. Comments can reflect real-time feedback at this very minute. The near-simultaneous experience of reaction is likely to induce a sense of copresence. Viewers do not need to share the same feelings, but when they realize others

are responding to what he/she is watching, they may feel a sense of copresence. A hypothesis can be put forth:

H1: Viewers who watch video clips with danmaku experience a higher level of copresence than viewers who watch video clips without danmaku.

A research question is raised to explore whether the relationship between the amount of danmaku and the level of copresence is linear. Viewers have reported that sometimes there is an excessive amount of danmaku comment (see Figure 1), which obstructs the video image (Shen, Chan, & Hung, 2014). More danmaku comments mean the perception of more viewers and viewers may get higher level of copresence based on multiple source effect.

H2: Viewers who watch video clips with an excessive amount of danmaku experience a higher level of copresence than viewers who watch video clips with a moderate amount of danmaku.

Figure 1. An excessive amount of danmaku comment

Copresence and Horror

The concept of horror can be traced back to early cave drawings and primitive rituals (Zillmann & Gibson, 1996), but even today it is still difficult to understand its appeal

amongst audiences. Walters (2004) defined horror as a genre designed to evoke terror through supernatural or grossly abnormal forces. Fear is seen as an evolutionary necessity that can increase the likelihood of survival. The experience of fear is provided by multiple systems within the body and in the brain (Rosen & Shulkin, 1998). Therefore, fear is a natural emotional response to horror films.

Being physically present with others when watching horror films can reduce fear. Cantor and Wilson (1988) suggest that being in proximity to others is one of the common coping strategies to help alleviate fright responses. They argue that when people face fear and anxiety, people often want to be accompanied by other people. Children experience less arousal and tend to report greater liking of a movie when they watch suspenseful movie scenes with their siblings (Wilson & Weiss, 1993). The mere presence of a sibling, even without conversations, may distract people from the terrifying scene. Also, their siblings can provide direct support through words of comfort. Thus, the presence of others may help reduce fear and increase the liking of horror films.

Physical copresence helps alleviate fear responses to horror films, so I hypothesize that a virtual feeling of togetherness will also reduce fear. Danmaku may have the same mechanism with physical copresence and reduce fear. Danmaku helps create a sense of virtual companion, so people may feel that they are not alone. Also, it may include comments that comfort the viewers. Furthermore, it may distract viewers from scary scenes and makes them fail to receive some scary messages.

H3a: Viewers who watch horror video clips with danmaku experience a lower level of fear than viewers who watch horror video clips without danmaku.

As for the relationship between fear and enjoyment, a previous study has shown that the relationship pattern can differ between genders (Zillmann, Weaver, Mundorf, & Aust, 1986). For males, fear was positively connected with enjoyment, while females' data did not

show a significant relationship. Excitation transfer theory can explain the nature of horror enjoyment. The fear-induced arousal serves to intensify viewers' positive reactions to a satisfying resolution. However, when taking copresence into consideration, the emotional gratification can be obtained from the feeling of not alone, and the sense of virtual companion. Therefore, it is hypothesized that danmaku may have the same mechanism with physical copresence and increase enjoyment.

H3b: Viewers who watch horror video clips with danmaku experience a higher level of enjoyment than viewers who watch horror video clips without danmaku.

Copresence and Comedy

Comedy does not work well without an audience. Comedy viewing is typically a communal experience (Neuendorf & Fennell, 1988). The physical presence of a laughing confederate has been shown to enhance viewers' smiling behavior and the perceived funniness of a comedic performance (Chapman, 1973). Young and Frye (1966) found a laughing companion could induce more laughter, but could not increase the humor rating of jokes. Thus, physically being present with others when watching a comedic performance may induce smiling behaviour and increase the enjoyment of comedy.

The virtual copresence of a laughing companion may also induce more enjoyment. The success of pre-recorded "laugh tracks" in comedy indicates the effectiveness of a virtual laughing companion. Although danmaku comment is text-based, it is common to see some laughing expressions there, such as "haha" or "2333," which are the symbolic ways of conveying laughter in danmaku comments.

H4: Viewers who watch comedy video clips with danmaku enjoy the comedy more than viewers who watch comedy video clips without danmaku.

A research question asks whether the amount of danmaku comments will influence viewers' enjoyment of the videos. Guo and Holmes (2015) studied the visual attention

distribution between television and second screens, and found second screens garner considerable attention. Weisz (2009) studied distraction and collaborative watching and found that although distraction existed, people still enjoyed chatting while watching videos with friends. An excessive amount of danmaku comments may distract viewers from video content, but it remains to be explored whether people will lose interest or gain more enjoyment from it. Therefore, a research question will be raised:

RQ1: Will the enjoyment of the videos increase when the amount of danmaku comments increases?

Confounding Effects

Numerous studies have shown that gender differences exist in the emotional responses to horror, and male viewers tend to report less fear but more enjoyment (Hoffner & Levine, 2005). Gender socialization theory (Zillmann, Weaver, Mundorf, & Aust, 1986) suggests that the precept for males stipulates that the exposure to horror be non-distressing, which means males should show their mastery of distress. However, the precept for females stipulates that they are expected to demonstrate their sensitivity through being dismayed.

Gender differences also exist in people's rating of humor. Jackson (1997) found that females tend to give higher ratings when the joke target is a male rather than a female, but it made no differences for male respondents. As for humour types, males prefer sexual humour, while females tend to prefer absurd humour (Brodzinsky, Barnet, & Aiello, 1981). Therefore, participant gender will be controlled when analysing viewers' responses to comedy.

Empathy is an important predictor of people's responses to horror movies (Tamborini, 1996; Zillmann, 2006). Empathy is a multidimensional construct including perspective taking, fantasy, empathic concern and personal distress (Davis, 1980). Tamborini (1996) proposed a model saying that people with higher empathy tend to have more negative feelings when viewing horror and enjoy it less. He hypothesized that people who were

empathic reacted strongly to others' sufferings and misfortunes. Harris, *et al.* (2000) found empirical evidence to support Tamborini's model that empathic people experienced more fear responses. In 2009, Hoffner investigated two sub-dimensions (empathetic concern and personal distress) and found that people with more personal distress tended to enjoy horror films less. Therefore, empathy can influence fear responses to horror.

Empathy also has something to do with people's appreciation of humor. For example, Hampes (2001) found a positive relationship between humor and certain types of empathy; people with higher level of empathic concern preferred affiliative humor, and people with higher level of perspective-taking empathy liked aggressive humor. Therefore, empathy may also influence people's responses to humor, and will therefore be measures and controlled for.

Sensation seeking is another individual trait that can predict people's reaction to horror (Hoffner & Levine, 2005). Sensation seeking is the seeking of novel and intense sensations, and the willingness to take risks for such sensations (Zuckerman, 1994). Sensation seeking has four sub dimensions: thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility. Zuckerman's (1994) sensation seeking theory notes that those scoring high in sensation seeking tend to enjoy horror more, due to the increased levels of sensation. This theory has been tested in empirical studies frequently and sensation seeking has been shown to be a powerful moderator in predicting people's reaction to horror in many settings.

Danmaku frequently contains forewarning messages, that is, some of the comments contain information about what is coming up in the video (sometimes called "spoilers"). Some researchers have found that forewarning messages increase the level of fear (Cantor, Ziemke & Sparks, 1984; Neuendorf & Sparks, 1988; Hoffner & Cantor, 1991). In Cantor, Ziemke and Sparks' (1984) forewarning experiment, participants were given audio

forewarning introductions about the scary plot before they started watching the film. Contrary to the common sense dictum of “forewarned is forearmed,” the results from the experiment show that these audio forewarnings actually increased fear responses. In 1988, Neuendorf and Sparks extended this experiment to include written forewarning instructions and found the same result. Forewarning can influence emotional responses, so I will exclude forewarning messages in the danmaku used as stimuli in the experiment.

Humor is universal, but differences exist across cultures in the content that elicits it (Ruch & Forabosco, 1996). Many jokes do not translate well, due to the differences in culture and social norms. A comedy that is popular in one culture may be boring for viewers in another culture. There is no universally appreciated joke. There is evidence that American TV programs prefer to use aggressive and self-defeating humor, Hungarians prefer to use ethnic stereotype humor, and Chinese feel more discomfort with sexual humor (Martin & Sullivan, 2013). Therefore, only participants from the same cultural background will be recruited.

Prior exposure to danmaku may influence viewers perceived copresence level. Previous research has found that people with more danmaku experience tend to report higher levels of perceived salience of virtual others than those with less danmaku experience (Ni, 2017). Also, viewers with more danmaku experience are more easily gratified by the joint viewing experience. Ni (2017) measures danmaku experience in two ways: experience of watching videos with danmaku, and posting danmaku (i.e., commenting videos with textual overlays). Thus, danmaku watching experience will also be measured in the present study.

To conclude, gender, empathy, sensation seeking, and danmaku experience are covariates that will be controlled when analyzing the data. Forewarning messages will be excluded, and only participants from the same culture (Chinese culture) will be recruited as participants.

CHAPTER THREE METHOD

Design

A 3 (danmaku amount) x 2 (genre) factorial experiment was carried out in a lab at Nanyang Technological University. The experiment was designed to determine whether danmaku generated a sense of copresence, and how copresence influenced viewers' emotional responses to comedy and horror films. The amount of danmaku comments (none, a moderate amount, and an excessive amount) was manipulated between-subjects, and genre (comedy or horror) was manipulated within-subjects. Participants were randomly assigned into conditions, and after viewing each video clip, they completed a questionnaire measuring copresence level and emotional responses.

Participants

The recruitment email was sent to all NTU research students and a SONA system sign-up link was included in the email. The inclusion criteria were above 18 years old, be fluent in Chinese reading and listening, and be familiar with Chinese culture. Danmaku experience was preferred, but not necessary.

One hundred students from NTU participated in the study, but one person did not complete the questionnaire, so there are 99 participants in the final sample (62% female). After coming to the lab, participants were randomly assigned to one of the three treatment groups. There were 33 students in Condition 1 (no danmaku), 32 students in Condition 2 (moderate danmaku comments), and 34 students in Condition 3 (excessive danmaku comments). The gender ratio is almost equivalent across conditions. A cross tabulation of gender and condition is shown in Table 1.

Table 1

Gender and Condition Cross Tabulation

		Male	Female	Total
Condition	No Danmaku	12	21	33
	Moderate Danmaku	13	19	32
	Excessive Danmaku	13	21	34
Total		38	61	99

Procedure

After signing up through the SONA system, participants were required to complete an online questionnaire measuring their empathy, sensation seeking, and danmaku experience. When participants arrived in the lab, they were randomly assigned to different conditions. Before starting, participants were required to sign a consent form. Each individual was escorted in a separate room. Lab assistants left the room after giving participants instructions, and participants were required to watch the videos by themselves. After each video clip, participants completed a questionnaire measuring their copresence level and emotional responses. The entire procedure usually took 30-40 minutes. Participants were paid \$10 after completion.

Stimuli

Participants first watched a 7-minute comedy clip from the situation comedy, *Home with Kids*, and then watched a 7-minute horror film clip from the Hollywood film, *Scream*. *Home with Kids* is a Chinese production, which is considered to be equivalent to shows like *Growing Pains* in the United States (see Figure 2). The *Scream* series consists of four horror films, and *Scream I* (1996) was chosen for this study (see Figure 3).

Figure 2. Comedy stimulus video: *Home with Kids*

Figure 3. Horror stimulus video: *Scream I* (1996)

These two video clips were edited in Final Cut Pro, and then were uploaded to the Nicovideo website to add danmaku comments. All of the prepared comments were added onto the video clips by the author. The screen recording software QuickTime Player was used to record videos with moving danmaku. Overall, 6 videos (3 danmaku comment levels in 2 genre) were prepared.

As for the content of the comments, the stimuli danmaku comments were produced to resemble those of similar film clips on the danmaku websites. An excessive amount of danmaku comments means that comments cover half or more of the screen and obstruct the image. A moderate amount of danmaku comments means that comments cover less than a quarter of the screen. In this study, the moderate danmaku condition had 150 comments appearing during the seven-minute video presentation, while the excessive danmaku condition had 300 comments.

Although the amount of danmaku comments varied by condition, the type of danmaku contents for each genre was designed to be comparable (see Table 2). Five categories of danmaku comment content were created to guide the stimulus presentation, and the proportion of each appearing in the moderate and the excessive danamku condition remained the same. Although they are typical among danmaku videos, forewarning and spoiler messages were excluded for the reasons given above.

Table 2

Danmaku Stimuli Content Categories and Examples

Categories	Comedy	Horror
Functional information (5%)	Lyrics of background music	Direction: “click me if you want to see the highlight only” (a hyperlink on danamku)
Interactive conversation with other audience (15%)	<p>“Anyone knows the actor’s name?”</p> <p>“The actor is ...”</p> <p>“+1” (I agree with you)</p>	<p>“Say hello to other friends online”</p> <p>“Hey, the guy before me, don’t run away! Take me with you!” (we share the same idea)</p>
Comments on the plot/scenario (20%)	“OMG, her father is angry”	<p>“This girl should call the police”</p> <p>“She is an idiot”</p>
Comments on actors/ actress and video production (20%)	<p>“The resolution is low”</p> <p>“Poor make-up”</p>	<p>“The ghost’s costume looks cheap”</p> <p>“Bad special effect”</p>
Self-expression of feeling (40%)	<p>“hahaha”</p> <p>“233333” (the sounds of laughter)</p>	<p>“So scary”</p> <p>“Uploader, please take my kneeling” (Uploader, please accept my admiration)</p>

Measures

Virtual Copresence

To measure participants' experience of copresence, we developed the Virtual Copresence while Viewing Scale (VCV). It consists of 8 items: two each from three existing scales, and two new items developed to include more reversed items. Items were adapted to make the scale fit the danmaku scenario. After revision, the items are: I felt alone when watching the video clip; I felt like there was someone else watching the video clip at the same time with me (Bailenson, Swinth, Hoyt, Persky, Dimov, & Blascovich, 2005). Two items come from Hwang and Lim's (2015) social TV social presence scale: I feel like many people were watching at the same time; I feel like I was watching the video with friends. Two items are adapted from Xu and Yan's (2011) feeling connected via television scale: I can imagine others watching the video; watching the video I felt connected to others. The two new created items are: Watching the video was a private experience; I felt a sense of solitude while watching the video. The response options range from 1 (*strongly disagree*) to 7 (*strongly agree*). The VCV scale was tested twice in this study, measuring copresence level after both comedy (Cronbach's $\alpha = 0.87$) and horror film clips (Cronbach's $\alpha = 0.90$). After deleting the 8th item "I felt a sense of solitude while watching the video," Cronbach's α went up to 0.88 for comedy and 0.91 for horror.

Affective Responses

The Positive and Negative Affect Schedule (PANAS) was used to measure emotional responses. It was developed by Watson, Clark, and Tellegen (1988) to provide a means of measuring positive and negative affect. It consists of 20 items, ten of them measuring positive affect (PA) and the other ten measuring negative affect (NA). PA represents a state of pleasurable engagement, such as inspired, attentive, interested, etc. NA reflects subjective distress and unpleasurable engagement, including aversive mood states: Scared, upset, nervous,

etc. PA is highly reliable (Cronbach's $\alpha = 0.90$ for comedy; Cronbach's $\alpha = 0.83$ for horror). Cronbach's α for NA after viewing horror is 0.88, while Cronbach's α for NA after viewing comedy is 0.98 (most participants choose "strongly disagree" for all the 10 negative items after watching the comedy).

Sensation Seeking

A brief version of Sensation Seeking Scale Form V (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew, 2001) was used. Sensation Seeking Scale Form V (SSS; Zuckerman, 1978) consists of 40-items, with four different subscales: Thrill and adventure seeking; experience seeking; disinhibition; and boredom susceptibility. Each is measured on a 7-point scale. A brief version of SSS has been developed and tested by Hoyle, Stephenson, Palmgreen, Lorch and Donohew (2001). They retained 2 items in each subscale and developed an 8-item Brief Sensation Seeking Scale (BSSS) with good validity and reliability. In this study, the reliability of BSSS is good (Cronbach's $\alpha = 0.77$).

Empathy

Davis's (1983) Interpersonal Reactivity Index (IRI) was used to measure empathy. IRI consists of 28 items with four subscales: Perspective taking, fantasy, empathic concern, and personal distress. In this study, the fantasy dimension (Cronbach's $\alpha = 0.38$) and personal distress dimension (Cronbach's $\alpha = 0.50$) were not reliable. Therefore, we dropped this variable in the subsequent analysis.

Danmaku Experience

Viewers were asked if they had prior experience with danmaku before. If participants answered yes, they received two more open-ended questions to gauge their previous danmaku experience. The questions were: How many times per month do you watch videos online; how many times per month do you watch online videos with danmaku. Danmaku usage percentage was calculated as the percentage of times watching video with danmaku

compared to watch video online. Therefore, danamku experience is a continuous variable, ranging from 0 to 1.

CHAPTER FOUR RESULTS

The first section presents the relationships between dependent and control variables to determine which measures should be included as covariates in subsequent tests. These analyses use the Pearson correlation and two-tail t -test. The second section focuses on danmaku effects and tests hypotheses. These analyses use profile analysis (MANOVA) with planned comparisons.

Bivariate Analysis

Correlations between the main dependent variables and possible covariates are presented in Table 3. Sensation seeking is positively correlated with the positive emotional responses after viewing the horror film and negatively correlated with the negative affect. This result is consistent with a previous empirical study (Hoffner & Levine, 2005) and supports Zuckerman's (1994) Sensation Seeking Theory. Danmaku experience is not significantly related to perceived copresence level after viewing comedy, but it is negatively correlated with perceived copresence level after viewing horror, so danamku experience will be considered as a covariate in the MANOVA model.

Table 3

Correlations between Dependent Variables and Covariates

	VCVc	VCVh	PAc	PAh	NAc	NAh	BSS	Exp
VCVc	1							
VCVh	0.57**	1						
PAc	0.56**	0.31**	1					
PAh	0.20*	0.25*	0.25*	1				
NAc	-0.04	0.15	-0.13	0.07	1			
NAh	0.16	-0.08	0.17	-0.21*	0.14	1		
BSS	-0.05	-0.08	0.03	0.30**	-0.13	-0.35**	1	
Exp	-0.19	-0.32**	-0.92	0.18	-0.08	-0.05	0.24*	1

Note. VCVc = Virtual Copresence while Viewing Scale for comedy; VCVh = Virtual Copresence while Viewing Scale for horror; PAc = Positive Affect for comedy; PAh = Positive Affect for horror; NAc = Negative Affect for comedy; NAh = Negative Affect for horror; BSS = Brief Sensation Seeking scale; Exp = Danmaku experience.

* $p < .05$, ** $p < .01$, *** $p < .001$;

Gender only influences participants' positive emotional responses to horror. There were no other significant differences on any of the dependent measures (Table 4). Males report higher level of positive affect than females after watching the horror film, which supports Gender Socialization Theory (Zillmann, Weaver, Mundorf, & Aust, 1986).

Table 4

Comparison of Dependent Variables by Gender

Variables	Gender	Mean (SD)	<i>t</i>	Sig.	95% Confidence Interval	
					Lower	Upper
VCVc	Male	4.20 (1.23)	-0.501	0.618	-0.703	0.420
	Female	4.34 (1.45)				
VCVh	Male	4.06 (1.45)	0.326	0.745	-0.508	0.708
	Female	3.96 (1.51)				
PAc	Male	4.26 (1.05)	0.041	0.967	-0.379	0.395
	Female	4.25 (0.87)				
PAh	Male	3.82 (0.97)	2.351	0.021	0.077	0.914
	Female	3.32 (1.05)				
NAc	Male	1.90 (1.47)	1.166	0.247	-0.224	0.862
	Female	1.58 (1.22)				
NAh	Male	4.05 (1.08)	0.862	0.078	-0.885	0.048
	Female	4.46 (1.17)				

Note. Degrees of freedom = 97. VCVc = Virtual Copresence while Viewing Scale for comedy; VCVh = Virtual Copresence while Viewing Scale for horror; PAc = Positive Affect for comedy; PAh = Positive Affect for horror; NAc = Negative Affect for comedy; NAh = Negative Affect for horror.

Perceived Level of Copresence

Profile analysis—an MANOVA approach to analyse split-plot design, was conducted to compare the effect of danmaku on copresence in three danmaku comment amount conditions. Genre was considered as a within-subjects factor and danmaku comment amount was considered as a between-subjects factor. In the bivariate analysis, danmaku experience is negatively correlated with copresence, so danmaku experience is considered as a covariate in

this model.

Figure 4 shows the mean of perceived copresence level in each condition. The result shows that the main effect of within-subjects factor is not significant, $p = 0.216$, which means there is no significant difference between two genres on copresence level. For both comedy and horror genre, the amount of danmaku comment has a significant effect on participants' perceived copresence level, $F(2, 95) = 26.526$, $p = 0.000$. The planned comparison result shows that there are significant differences between the no danmaku comment condition and the moderate danmaku comment condition, $p = 0.000$, as well as in the no danmaku comment condition and the excessive danmaku comment condition, $p = 0.000$. That is, the perceived copresence levels in the moderate danmaku comment condition and excessive danmaku comment condition are significantly larger than that in no danmaku comment condition. However, no significant differences are found between the moderate danmaku comment condition and the excessive danmaku comment condition, $p = 0.749$. To echo H2, danmaku can induce virtual copresence, but the increase of danmaku amount used in the present study does not have a significant effect on perceived copresence level.

The interaction effect of genre and danmaku comment amount is not significant, $p = 0.098$. Also, there is no interaction effect of genre and danmaku experience.

Figure 4. Perceived copresence (mean) by amount of danmaku comment in two genres

Positive Affect

Likewise, profile analysis was conducted to compare the effect of danmaku on positive affect to comedy and horror video clips in three danmaku comment amount conditions. Genre was considered as a within-subjects factor and danmaku amount was considered as a between-subjects factor. In the bivariate analysis, sensation seeking and gender are correlated with positive affect to comedy, so sensation seeking and gender are considered as covariates in this model.

Figure 5 shows the mean of positive affect in each condition. The result shows that the main effect of genre is not significant, $p = 0.216$, but the effect of danmaku comment amount is significant. The planned comparison result shows that there are significant differences between the no danmaku comment condition and the moderate danamku comment condition, $p = 0.03$. There is no interaction effect of genre and danmaku comment amount.

When we test comedy and horror separately by one-way ANOVA, the results reveal that there is no significant difference in PA among the three conditions when they watch comedy, $F(2, 96) = 0.61$, $p = 0.543$, but significant effect when they watch horror, $F(2, 94) = 4.48$, $p = 0.014$. Watching the comedy with or without danmaku does not significantly influence participants' enjoyment of the comedy, however, watching horror with danmaku can improve their enjoyment of horror.

Sensation seeking significantly influences positive emotional responses to horror, $p = 0.001$, $\eta^2 = 0.11$, but the effect size of sensation seeking, $\eta^2 = 0.11$, is larger than the danmaku effect, $\eta^2 = 0.09$. Gender also influences positive emotional responses to horror, $p = 0.025$, $\eta^2 = 0.05$. Danmaku influences participants' enjoyment of horror even after controlling for their personality variable.

Figure 5. Positive affect (mean) by amount of danmaku comment in two genres

Negative Affect

Likewise, profile analysis was conducted to compare the effect of danmaku on Negative Affect to comedy and horror video clips in three danmaku comment amount conditions. Genre was considered as a within-subjects factor and danmaku comment amount was considered as a between-subjects factor. In the bivariate analysis, sensation seeking is correlated with NA to horror, so sensation seeking is considered as a covariate in this model.

Figure 6 shows the mean of negative affect in each condition. The result shows that the main effect of genre is significant, $p = 0.06$, which means participants have different emotional responses to comedy and horror. However, there is no interaction effect of genre and danmaku comment amount.

The sensation seeking significantly influences negative emotional responses to horror, $p = 0.000$, but the effect of danmaku comment amount remains insignificant, $F(2, 95) = 0.91$, $p = 0.406$. Sensation seeking is a better indicator of negative emotional responses to horror than the presence of danmaku.

Figure 6. Negative affect (mean) by amount of danmaku comment in two genres

CHAPTER FIVE DISCUSSION

The results of the study indicate that danmaku can generate a sense of copresence. Viewers who watch video clips with danmaku experience a significantly higher level of copresence than those without danmaku, which supports Hypothesis 1. While watching comedy or horror video clips, viewers can feel a sense of being with others when they watch the video with danmaku. This finding fits with a previous focus group study (Chen, Gao & Rau, 2015), which found that people's motivation for using danmaku was to find co-viewers and have a sense of belonging. In contrast to other types of co-viewing experience, danmaku users' co-viewing experience is asynchronous. How danmaku extends the concept of co-viewing concept and the evolution of co-viewing pattern will be discussed in the next section.

Reconsidering Co-viewing

Technology influences humans' media consumption behaviour, and vice versa. The co-viewing pattern has changed significantly with the development of television and Internet technology. People used to get together around TV screens and share their comments on the TV programs they were watching (Laiola Guimarães, Cesar, & Bulterman, 2012). In the 1970-80s, co-viewing researchers usually focused on the context of the family gathering in the living room (e.g., Lull, 1980; Morley, 1986). Television viewing was considered as a family routine, which could facilitate family cohesion, family connection and elicit family harmony (Courtois & Nelissen, 2017). However, watching TV with one's parents mostly occurred during early youth; its frequency tended to decrease as children grew up into adolescence. Researchers found that since the 1990s, adolescents preferred to watch TV in their own bedrooms, leaving parents in the communal space without children, thereby forming "bedroom culture" (Sang, Schmitz, & Tasche, 1992). The phenomenon of bedroom culture was attributed to the increasing number of TV screens in families and the growing desire of adolescents for autonomy and privacy. Researchers (e.g., Wilson & Weiss, 1993)

focused more on siblings co-viewing during that period. Whether co-viewing with parents or siblings, people typically watched TV with their familiar others.

With the advent of social TV, people have been able to experience co-viewing with unfamiliar and anonymous others. Cross-platform media use became more and more common, and many people liked to tweet while watching broadcast shows (Su, Chan-Olmsted, 2017). It enables people to interact and exchange opinions with a larger number of viewers sharing the same interests but who are otherwise unknown to each other (Tsay-Vogel, Lin, Tsai, 2017). Social TV enables viewers who are geographically dispersed and unfamiliar to share a co-viewing experience. Physical proximity is no longer a prerequisite for co-viewing.

Danmaku offers viewers an asynchronous virtual co-viewing experience. Danmaku extends the co-viewing concept beyond time and space. Its content-synchronous feature provides viewers with the sense that there are others watching it simultaneously. When users believe that others are responding to events onscreen they are watching at that instant, they feel a sense that others are experiencing the events with them. A certain level of co-viewing can be achieved through an asynchronous form of media. Danmaku enables viewers who are watching the video at different times and places to share a co-viewing experience and sense they are not watching alone.

To conclude, with the development of technology, the co-viewing concept and co-viewing pattern should be reconsidered. Co-viewing can go beyond the traditional form of physically sitting together and watching simultaneously; an asynchronous form of media can also induce a sense of co-viewing.

VCV Scale: A Measurement of Virtual Copresence

How to measure copresence is a crucial issue addressed in this study. Previous studies of copresence have focused on the settings of online collaborative learning (Lin, 2004),

virtual reality (Bailenson et al., 2005), and e-commerce (Gefen & Straub, 2004). Some classic copresence scales (e.g., Nowak, 2001; Harms & Biocca, 2004) included a dimension of the interaction partner. However, danmaku provides unidirectional non-contemporaneous copresence. Users are not mutually aware of each other, since only the subsequent users perceive the previous users. Therefore, a new copresence scale, suitable for the danmaku context, needed to be established.

The virtual Copresence while Viewing Scale (VCV) appears to be a good means to measure virtual copresence. This scale had good reliability for two different genres, comedy and horror. The combination of items from other scales along with new items seems to reasonably capture a special kind of copresence. Future danmaku research can use the VCV scale to measure perceived virtual copresence with other types of content and apply it to other contexts where non-contemporaneous virtual copresence exists.

Danmaku and Emotional Responses to Videos

In this study, danmaku increased viewers' positive emotional responses (PA) to the horror video clip, but did not significantly reduce their negative emotional responses (NA), which partially supports Hypothesis 2. The findings indicate that virtual copresence may have the similar effects as physical copresence. Previous research (Wilson & Weiss, 1993) shows that being physically present with others helps to alleviate fright responses and increase the liking of scary programs, and this study shows that virtual copresence helps increase the enjoyment of horror films. However, Hypothesis 2 is only partially confirmed in this study, and it is worth replicating in future study.

In contrast, danmaku had no significant effects on emotional responses to the comedy video clip, and Hypothesis 3 was not supported. To help determine whether the lack of influence pertains to the entire genre or just the particular video clip used in this study, future research should continue to explore how danmaku might affect the enjoyment of comedy.

Individual Differences

A possible explanation for the non-significant result (NA to horror) is that personality variables, such as sensation seeking and gender, are more important indicators of horror responses than danmaku creating virtual copresence. This study finds gender influences viewers' positive emotional responses to horror, and the result fits with Gender Socialization Theory (Zillmann, Weaver, Mundorf, & Aust, 1986). Sensation seeking contributes significantly to a person's horror responses, which supports Zuckerman's (1994) Sensation Seeking Theory. What's more, the effect size of sensation seeking is larger than the danmaku's effect. It indicates that viewers' horror responses are mostly attributed to their individual differences. Danmaku can influence viewers' emotional responses, to some extent, but it is not the crucial reason.

Effects Vary with Genre

This study finds danmaku's significant effects on emotional responses to horror, but no significant effects on emotional responses to comedy. This indicates that the virtual co-viewing experience induced by danmaku appears to have different effects depending on genre, as we predicted. Physical co-viewing's effect can vary with genre: violent content, sexual content, sports, horror, comedy, etc. (Chapman, 1973; Harris & Cook, 2010; Hicks, 1968; Rubenking & Lewis, 2016; Wilson & Weiss, 1993). The same is true for virtual co-viewing. It is worth replicating this study with stimuli from other genres to find which genre is the most suitable for danmaku usage. This may provide insights to the online video industry and danmaku promotion. That is, research may help danmaku website companies find their target audience by figuring out the most suitable genre for danmaku. Sports, serious political news and pornography are recommended to be tested in further studies, and this will be discussed more in the further study section.

Danmaku Amount

In this study, the author manipulated different levels of danmaku amount. It is worthwhile studying the relationship between danmaku amount and viewers' responses to both danmaku and videos, because it makes sense for commercial sites and has practical meaning for danmaku technology promotion. In a previous uses and gratification study (Chen, Gao, & Rau, 2015), some users reported that the main reason they disliked danmaku was overly abundant information and overwhelming danmaku could obstruct the image, distracting viewers from video content.

This study has some practical implications for online video industry. Some danmaku websites have realized the distraction issue and taken actions to adapt. From the users' perspective, the Bilibili website supports a transparency function, enabling users to adjust the transparency of the comments scrolling across the video if they feel distracted or annoyed. Also, users can choose to block danmaku or block certain parts of danmaku comments (e.g., block all the danmaku at the bottom and only show danmaku at the top of the screen). From the video uploaders' perspective, some danmaku websites (e.g., nicovideo.jp) support filter functions, and enable video uploaders to block some IP address' comments or delete some rude comments. I would suggest that danmaku websites enable video uploaders to set an upper limit of amount, and automatically delete the redundant and duplicate danmaku if there are overwhelming comments. Sometimes users tend to repeat the same comment many times to express their excitement, covering the whole screen and making it a "message flood." It would be better if danmaku websites company can develop an algorithm to automatically detect these redundant comments or dirty words. Although this study did not find a significant relationship between danmaku amount and emotional responses to videos, it is still worth testing in future study. Future academic study or commercial study may continue focus on the danmaku amount and find the threshold of attitude change.

CHAPTER SIX LIMITATIONS

First, more interesting results might have been found if this study tested viewers' emotional responses to videos and their attitudes towards danmaku separately. This study did not find significant differences in emotional responses to videos when the amount of danmaku increased. However, an excessive amount of danmaku may reduce viewers' enjoyment of danmaku itself. When viewers watched a video with danmaku, their emotional responses were a combination of feelings induced by danmaku and the video clips. It will produce a clearer picture if we test the two stimuli separately. This study did not explicitly ask viewers' attitudes towards danmaku because one condition (control group) has no danmaku. Future research should explicitly gauge viewers' attitude change with differing amounts of danmaku.

Second, this study ignored a potential confounding variable that may have influenced the perceived copresence level and emotional responses. Multitask preference is an important indicator when conducting danmaku research. A previous focus group study (Chen, Gao & Rau, 2015) found that people who prefer multitasking tend to use danmaku more. Ni and Biocca (2017) also found that the self-reported attention to danmaku and self-reported attention to video are negatively correlated in subjects with low multitasking tendencies. This means that multitasking preference should be considered as a potential individual difference in future studies examining danmaku's effects.

Third, more attention should be paid to stimulus materials. The stimuli consisted of two parts: video stimuli and comments stimuli. This study did not ask participants whether they had seen these two video clips previously. Familiarity with the videos may have influenced viewers' attention allocation. Subjects who have seen the video clip know the plot and can thus pay more attention to other viewers' comments, while subjects who have never seen the video clip may focus on video content and ignore the comments. Therefore, prior

exposure to the test videos may somehow have influenced the danmaku's effects. Also, the colour and position of danmaku stimuli may have slightly influenced danmaku's effects. This study did not unify the colour and position of the comments, as danmaku is typically presented. Generally, danmaku generated by users in the real world is not only white, but employs a variety of colours. Most of the time, danmaku was scrolling from right to left at the top of the video, but there were a few danmaku remaining static in the middle of the screen, and a few others that stay at the bottom (VIP users have this function). This study did not differentiate the effects of danmaku colours and positions. Future studies may take these two factors into consideration and explore colour and position's effects.

CHAPTER SEVEN FUTURE STUDY

The results of this study highlight the effects of “danmaku presence” or the existence of danmaku; that is, as long as some danmaku is onscreen, it can generate a sense of copresence and provide a virtual co-viewing experience. Future studies could focus on the effects of danmaku content. This section will provide two experimental plans to test danmaku content’s effects, one is regarding to interactivity and user engagement, the other is regarding to valence.

The interactive conversations among danmaku users are different from traditional YouTube users’ interaction and can reflect danmaku’s temporal nature. As in the example in Figure 2, when an actor’s face appears on the screen, a user posts a comment “Anyone knows the actor’s name?” Another user who sees this comment may answer “The actor is ...” right after the comment. Also, sometimes, users post “+1” following certain danmaku to express their agreement with that comment. Some users even post messages like “say hello to other viewers online, 2017-05-18 18:45” to seek social interaction when they watch videos. Future studies might profitably focus on these interesting interactive conversations. Obviously, such communication among users can increase interactivity and improve the level of engagement. This study only asked participants to watch videos with danmaku, but future studies could ask participants to post comments when they watch and place a confederate in the lab to interact with participants. Future studies can also design an experiment with different levels of interaction, to see if these interactions will increase viewers’ enjoyment of the danmaku and video.

Another aspect of danmaku content that is worth studying is valence. Some typical YouTube comments studies can be replicated in the scenario of danmaku. Future studies might test how supportive or derisive danmaku influences are on viewers’ emotional responses to videos. “Tucao” or “tsukkomi,” which refers to ridiculing someone humorously,

are frequently used in the context of danmaku. Danmaku may make a serious political video funny, or make a boring TV soap attractive. Danmaku sometimes can change the valence of video content. Future studies should test different combinations of danmaku and video valence, to determine how danmaku valence influences viewers' attitudes toward video content.

Futures studies can replicate this study in different genres, to see in which genre danmaku has the strongest effect and for which genre danmaku is the most suitable. This study tested danmaku's effects on horror and comedy videos. Future studies may test it in sports videos, serious political news videos, advertising videos, or even pornography. Watching sports is usually a communal activity, while watching pornography is private. It could be interesting to test how virtual copresence of anonymous people influences viewers' emotional responses to sports and pornography. It may also prove worthwhile to test how derisive danmaku influences viewer's perception of a serious news video or an advertisement.

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Appendices

Appendix A: Pre-questionnaire

Please indicate the extent to which you agree or disagree with the following statements.

All items are rated from 1 (*strongly disagree*) to 7 (*strongly agree*).

Brief Sensation Seeking Scale

Experience seeking

- I would like to explore strange places.
- I would like to take off on a trip with no pre-planned routes or timetables.

Boredom susceptibility

- I get restless when I spend too much time at home.
- I prefer friends who are excitingly unpredictable.

Thrill and adventure seeking

- I like to do frightening things.
- I would like to try bungee jumping.

Disinhibition

- I like wild parties.
- I would love to have new and exciting experiences, even if they are illegal.

Empathy Scale

Fantasy items

- When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me.
- When I watch a good movie, I can very easily put myself in the place of a leading character.
- Becoming extremely involved in a good book or movie is somewhat rare for me.
- After seeing a play or movie, I have felt as though I were one of the characters.
- I really get involved with the feelings of the characters in a novel.
- I am usually objective when I watch a movie or play and I don't often get completely caught up in it.
- I daydream and fantasize, with some regularity, about things that might happen to me.

Perspective-taking items

- I sometimes try to understand my friends better by imagining how things look from their perspective.
- Before criticizing somebody, I try to imagine how I would feel if I were in their place.
- I sometimes find it difficult to see things from the "other guy's" point of view.

- I believe that there are two sides to every question and try to look at them both.
- I try to look at everybody's side of a disagreement before I make a decision.
- If I'm sure I'm right about something, I don't waste much time listening to other people's arguments.
- I believe that there are two sides to every question and try to look at them both.

Empathic Concern Items

- I often have tender, concerned feelings for people less fortunate than me.
- When I see someone being taken advantage of, I feel kind of protective toward them.
- When I see someone being treated unfairly, I sometimes don't feel very much pity for them.
- I am often quite touched by things that I see happen.
- I would describe myself as a pretty soft-hearted person.
- Usually I am not extremely concerned when I see someone else in trouble.
- Sometimes I don't feel sorry for other people when they are having problems.

Personal Distress Items

- I am usually pretty effective in dealing with emergencies.
- When I see someone get hurt, I tend to remain calm.
- I sometimes feel helpless when I am in the middle of a very emotional situation.
- In emergency situations, I feel apprehensive and ill-at-ease.
- I tend to lose control during emergencies.
- Being in a tense emotional situation scares me.
- When I see someone who badly needs help in an emergency, I go to pieces.

Basic questions	Measure
Age	Number
Gender	Male / Female
What is your ethnicity?	Chinese / Malay / Indian / Others (Specify)
Which school are you from?	Business / Engineering / Humanities, Arts and Social Sciences / Science / Medicine / Others (specify)

Do you know what danmaku (弹幕) is? (Famous danmaku websites: bilibili, acfun, nicovideo, youku, etc.)	Yes/ No
When did you first see danmaku? (Month/Year)	Date
When was the last time you watched a video with danmaku? (Month/Year)	Date
How many times per month do you watch videos online?	Number
How many times per month do you watch online videos with danmaku?	Number
What are the last 6 numbers of your mobile phone? (Since we won't ask your name, this 6-digit number will be your unique ID for this experiment)	Number

Appendix B: Questionnaire in the lab

Below is a list of emotions that people sometimes feel in response to the video. Please indicate the extent to which you agree or disagree that they reflect your experience. All items are rated from 1 (*strongly disagree*) to 7 (*strongly agree*).

Positive and Negative Affect Schedule

- Enthusiastic
- Interested
- Determined
- Excited
- Inspired
- Alert
- Active
- Strong
- Proud
- Attentive
- Scared
- Afraid
- Upset
- Distressed
- Jittery
- Nervous
- Ashamed
- Guilty
- Irritable
- Hostile

Please indicate the extent to which you agree or disagree with the following statements.

All items are rated from 1 (*strongly disagree*) to 7 (*strongly agree*).

Copresence Scale

- I still felt alone when watching the video clip.
- I felt like there was someone else watching the video clip at the same time with me.
- I feel like many people were watching at the same time
- I feel like I was watching the video with friends.
- I can imagine others watching the video.
- Watching the video, I felt connected to others.
- Watching the video was a private experience.
- I felt a sense of solitude while watching the video.

Basic questions	Measure
Please fill in your 6-digit number in the pre-questionnaire (The last 6 digits of your mobile phone number)	Number
Gender	Male / Female
What is your subject ID (code given to you on a post-it-note by the lab assistant)?	Number
The video you watched just now is	Video 1: A comedy video clip Video 2: A scary video clip