

Social Viewing, Bullet Screen, & User Experience: A First Look

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Abstract

This paper examines the viewing experience of a new social experiment that combines videos with text messaging technology called Bullet Screen. Our results show that this technology provides a more engaging viewing experience than a traditional online video. Our results also show that bullet screen can increase viewers' attention to content. These results have important implications for social media websites, advertisers, and companies that use video ads to promote their products and services.

1. Introduction

Viewers continually find ways to express and engage in conversation by repurposing social network sites [37]. Social media sites, such as YouTube, Vimeo, Snapchat, and Facebook allow viewers to share videos with their network of friends thereby sharing their viewing experiences through comment boxes and *like* buttons, creating an interactive social viewing experience.

Recently a new social viewing experience has been introduced in China and Japan, where viewers watch online videos while reading and sharing comments real time. The videos are overlaid with the comments, appearing on the screen simultaneously as the video content (see Figure 1). In addition to real-time sharing, the video and comments can be seen after the live showing of the video. That is, a user can access the video days later and the real-time comments will still be available for viewing. This new type of viewing experience, called bullet screen, is currently available in Chinese movie theaters, where patrons can text comments that appear on the large cinema screen [27], allowing the audience to actively engage with each other while still viewing the original movie. This new experience blurs the line between content and comments [4, 5, 21, 30, 31, 34]. Viewing the comments as part of the video viewing experience, adds to the provided entertainment. Generation Y seems to be more enthusiastic about bullet screen than

older consumers [27], perhaps because bullet screen combines two of Generation Y's favorite technology based activities: texting and watching online videos. According to a 2015 PEW Research report, 88% of 13-17 year olds have their own or access to a smartphone, and on average send or receive roughly 30 messages per day [23]. This figure is much larger for 18-24 year olds who tend to send or receive about 100 messages daily [29]. Generation Y makes up about half of the digital video viewer population [15] and tends to be an avid YouTube user [37]. In fact, YouTube is the most popular site among users as young as 2 years old and as old as 24 [20].

Research suggests that Generation Y frequently uses social media. For example, Bolton et al. concluded in their study that Generation Y spends a considerable amount of time using social media for information and entertainment [3]. Moreover, this generation uses sites like YouTube to socialize and experience a sense of community, and to stay in touch with friends [22, 33]. Additionally, Generation Y users use their cell phones heavily and favor multitasking, so naturally it is hard for them to watch a video for two hours without texting their friends [26]. Because of this, bullet screen seems to offer this younger generation a new online experience that could fit well with their needs and habits. The combination of video and text within the same screen space would allow viewers to watch a video with a group of friends and simultaneously exchange texts with them without having to take their eyes off the video. Additionally, this new viewing experience, would offer viewers an opportunity to not only exchange ideas, but also to participate in enriching the available content. Users can watch and write their comments on the same areas of the screen that are playing the video in real time. Likewise, the same comments can be viewed anytime the video is viewed on a future date/time, with the comments displaying the same timestamps as if it was real-time viewing. Thus, the social viewing experience offered by bullet screen technology can serve as an excellent example of *innovation with user experience*

[12] by media channels as an attempt to meet their viewers' needs in novel and engaging new ways [19].

Despite its popularity in China and Japan [5, 26, 27, 31], bullet screen is relatively unknown to the U.S. audience and thus has a great potential for growth in the U.S. market. To the best of our knowledge, there has been no study testing the user experience of bullet screen for U.S. Generation Y users. Given that user experience has been shown to have a significant impact on the growth of website usage [14], this study forms the first steps of a larger research project that looks into examining the factors that impact the user experience of bullet screen for the younger American user. In order to examine factors that can impact the viewing experience of this innovative technology, we conducted two studies. Study 1 was a controlled experiment comparing the impact of bullet screen on viewing experience along with several relevant dimensions for Generation Y users. Study 2 refined the results of Study 1 to help improve our understanding of viewers' experience with bullet screen.

2. Background and Hypotheses

Given the social nature of bullet screen and the way it combines text and video to create a new experience, social presence and media richness theories seem to provide an appropriate theoretical backdrop for this exploratory study. Because information technologies have the ability to impact our feelings [39, 40] a user's moods may also help to better understand a user's reaction to this new viewing experience. In this section, we briefly discuss these theories and explain their relevance to our study.

2.1. Mood

IS research shows that information technologies can impact our moods [39, 40], which in turn can affect our performance, judgment, and evaluations [9, 40]. Mood refers to how we feel while completing our daily activities. Our mood provides a context in which we can experience our thoughts and behavior [24]. Some moods do not have a specific cause, and therefore they do not disrupt our thought processes [24]. Social interactions can have a major impact on our moods [17]. As social beings, we enjoy being around other people and interacting with others, which has a major impact on how we feel [17]. Because bullet screen facilitates social interactions, it is likely that viewing bullet screen would affect a user's mood positively:

H1a) Positive mood scores in the experimental group will be greater than the average positive mood scores in the control group.

H1b) Negative mood scores in the experimental group will be smaller than the average negative mood scores in the control group.

2.2. Media Richness

Media richness theory was first discussed by Daft and Lengel in 1984 [7], to describe a communication medium by its ability to transmit information. In their 1988 article, Daft and Lengel defined media richness as a function of four specific characteristics: handling multiple information cues simultaneously, facilitating rapid feedback, establishing a personal focus, and utilizing natural language. These characteristics are likely to impact how users find a medium engaging. A more recent study by Webster and Ahuja [35] suggests that the richness of medium, such as animations and video, has an impact on users' engagement. Bullet screen uses both video and animated text (i.e., textual comments that move on the screen in real-time from right to left), thus viewing bullet screen is likely to be more engaging than watching a traditional video:

H2) Perceived engagement in the experimental group will be greater than perceived engagement in the control group.

Increased engagement can also be measured objectively. Engagement can impact attention to content [10], thus it is likely that more engaging medium will have an impact on what users can remember about the provided content.

H3) Compared to the control group, the accuracy of responses to questions about the video content will be greater in the experimental group.

2.3. Social Presence

Developed by Short, William, and Christie in 1976 [28], social presence theory emerged with the development of computer-based communication. From this perspective, social presence for a technology is the degree to which the technology is seen as being sociable, warm, and personal. Studies show that online-based interactions can facilitate social presence [14, 32]. Additionally, it has been shown that increased media richness leads to increased social presence [8, 40]. Since bullet screen provides a richer medium than a traditional online video, it is reasonable to argue that bullet screen is likely to affect the perception of social presence more than a traditional video:

H4) Social presence in the experimental group will be greater than social presence in the control group.

3. Study

In this section, we discuss the methodology used for each study, details on the sample, the related measurements, as well as the results.

3.1. Study 1

To assess the viewing experience of bullet screen on Generation Y users, we conducted a moderated controlled experiment, which is explained in this section.

3.1.1. Experimental Material

We used an existing 30-second GEICO Insurance commercial [18] for the control group (Figure 2) in our study. This video was selected because it is short, easy to understand, and entertaining to watch. We also chose this video because our participants were likely to be familiar with this commercial, which has been aired on TV and was available on the Internet at least for a year before this study took place. In China and Japan, where bullet screen is popular, older videos are often used for social viewing. Next we developed the bullet screen prototype version of this video for our experimental group.

Our bullet screen prototype included a total of 23 comments, which appeared on the video screen as animated text entering from the right side of the screen, running across the video and then exiting the screen on the left side of the screen (Figure 1). The comments that we used to populate our bullet screen prototype were selected from real-life viewers' comments about this video that were posted in the comments section on the YouTube page for the original video. Specifically, we chose comments that had several replies, with the assumption that those comments were more entertaining to the viewers. Further, the comments that were used in our prototype (overlaid on the video screen) highlighted content or information offered by the video clip. We showed the videos to both groups in full screen mode because we wanted to focus on the viewing experience in this study and not the surrounding page content that can be seen when a video is not in full screen mode.

3.1.2. Participants and Design

A sample of 37 users, from a university in the northeastern United States participated in the study. While all the participants were familiar with the video clip used in the study, none of the participants had prior experience with or knowledge about bullet screen

prior to participation in the study. The sample was recruited at random by soliciting participants in public spaces on campus. Participants were randomly assigned to either the experimental group or the control group. Participants in the control group were asked to watch the 30-second original video, while participants in the experimental group were asked to watch the 30-second bullet screen prototype video (see Figure 1 and Figure 2, respectively).



Figure 1. Experimental Group: Bullet screen video prototype with comments appearing on the right side and move from right to left in the real time. Each line represents a different comment.



Figure 2. Control Group: Regular video (GEICO Commercial: Did You Know – Pinocchio was a bad motivational speaker.

3.1.3. Measurements

We expected that social viewing would affect viewers' moods. We also expected social viewing to affect viewers' level of engagement with the medium, what they remembered from the content, and their perception of social presence. In order to assess these reactions we used validated self-reported measures that have been used in prior studies. Mood was measured using the six-item survey from Djamasbi [9], which examine a viewer's positive and negative feelings. For engagement, we adapted a seven-item survey by

Webster et al. [35]. We adapted Cyr et al. [6] four-item survey to measure social presence. All surveys were measured on five-point scale.

We also hypothesized that engagement is likely to increase awareness of the content. In order to test this hypothesis we asked viewers to answer two questions about the appearance of the main character in the video: 1) What was the color of Pinocchio’s shirt? and 2) Did Pinocchio wear a tie or a bow tie? None of the comments used for the bullet screen prototype made a reference about the color of Pinocchio’s shirt; however, Pinocchio’s bow tie was mentioned.

3.1.4. Results

To examine the impact of bullet screen on viewing experience between the two groups we first looked at the average ratings for mood. In line with prior studies, participants’ moods were measured along the positive and negative dimensions separately [9, 24]. After averaging the three positive mood scores (glad, happy, and pleased) and three negative mood scores (annoyed, frustrated, and dissatisfied) for each participant, a t-test was used to compare possible differences between the mood of viewers in the experimental and control groups. The results, displayed in Table 1 and Figure 3 show that both groups rated their positive mood in the medium range (3.52 and 3.23 on a 5 point scale) and their negative moods in the low range (2.07 and 2.09 on a 5 point scale). These results indicate that positive mood was the dominant state in both groups [24]. However, the differences in positive and negative moods between the two groups were not significant. Thus, the results do not support H1.

Table 1. t-test, comparing the mean for positive and negative mood scores

Groups	Mean (SD): Positive mood
Control	3.52 (0.81)
Experimental	3.23(1.01)
<i>df= 35, t Stat= 0.96, p(one-tail) =0.17</i>	
Groups	Mean (SD): Negative mood
Control	2.07 (0.87)
Experimental	2.09(0.89)
<i>df= 35, t Stat= 0.04, p(one-tail) =0.48</i>	

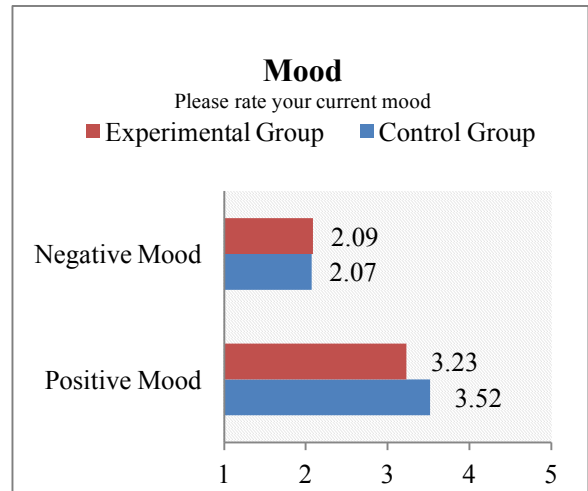


Figure 3. Mood

Next, we examined how the two groups were engaged in experiencing the video. In order to get an overall engagement score, we averaged the scores of the seven items in the engagement survey for each participant. The results of the t-test showed that average engagement scores were significantly higher in the experimental group (2.72 vs. 3.10, *p-one tail*= 0.046). The results of this t-test (Table 2) support H2. To refine this analysis we also looked at differences in individual items of the engagement scale. Our analysis showed that the experimental group scored higher than the control group on every single item (Figure 4). The differences between two groups, however, were statistically significant only in three items: engaging (*p*= 0.018), curiosity (*p*=0.048) and attention (*p*=0.009) (Table 3).

Table 2. t-test, Overall engagement

Groups	Mean (SD): Overall Score
Control	2.72 (0.56)
Experimental	3.10 (0.75)
<i>df= 35, t Stat= 1.73, p(one-tail)=0.046</i>	

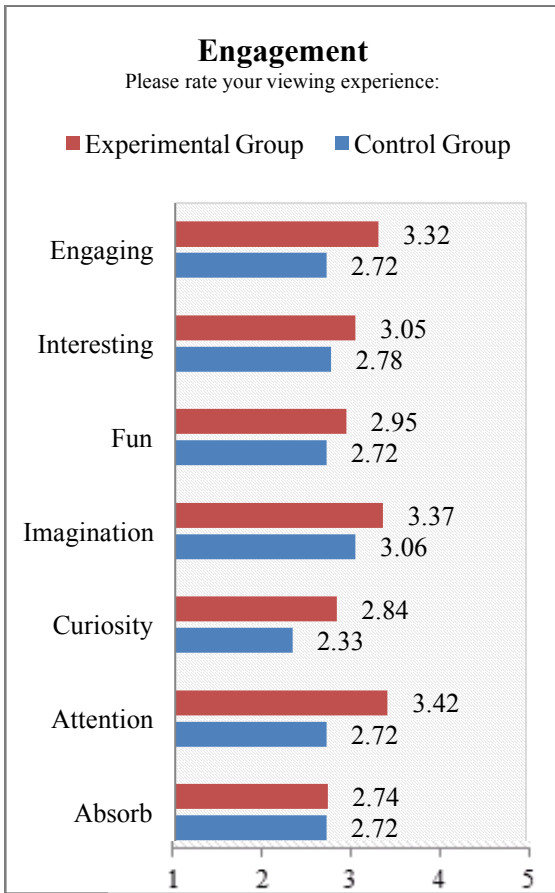


Figure 4. Perceived engagement

Table 3. t-test, seven sub-items of perceived engagement

	Mean (SD)	
	Control	Experimental
Engaging	2.72 (0.67)	3.32 (0.95)
	<i>df=35, t Stat=2.19, p(one-tail)=0.018</i>	
Interesting	2.78 (1.17)	3.05 (1.03)
	<i>df=35, t Stat=0.76, p(one-tail)=0.226</i>	
Fun	2.72 (0.75)	2.95 (1.13)
	<i>df=35, t Stat=0.71, p(one-tail)=0.241</i>	
Imagination	3.06 (1.00)	3.37 (0.96)
	<i>df=35, t Stat=0.97, p(one-tail)=0.168</i>	
Curiosity	2.33 (0.84)	2.84 (0.96)
	<i>df=35, t Stat=1.71, p(one-tail)=0.048</i>	
Attention	2.72 (0.75)	3.42 (0.96)
	<i>df=35, t Stat=2.45, p(one-tail)=0.009</i>	
Absorb	2.72 (0.67)	2.74 (0.93)
	<i>df=35, t Stat=0.05, p(one-tail)=0.478</i>	

H3 asserted that, due to increased engagement, people in the experimental group are likely to provide more accurate answers to questions about the content than their control counterparts. To test this hypothesis we counted the number of correct answers to the questions about the appearance of the main character in each video. The result of the t-test showed significantly more correct answers in the experimental group (0.78 vs. 1.42 with $p(\text{one-tail}) < 0.000$) (Table 4). This result supported H3.

Table 4. t-test, comparing the number of correct answers in each group

Groups	Mean (SD)
Control	0.78 (0.42)
Experimental	1.42 (0.61)
<i>df= 35, tStat= 3.71, p(one-tail) <0.000</i>	

Finally, we tested how the two groups felt about social presence while watching the video. We compared the overall social presence score (averages of the items in the social presence survey) between the two groups. The results of the t-test did not show significant differences between the two groups (2.71 vs. 2.79, $p(\text{one-tail})=0.405$). We also looked at individual items. The experimental group rated the items contact, sociability, and sensitivity slightly higher than the control group (3.05 vs. 2.94, 3.26 vs. 2.78, 2.47 vs. 2.44 respectively). However, average ratings for warmth were slightly lower for the experimental group than control group (2.37 vs. 2.67) (Figure 5). None of these differences were significant (Table 5). Thus, our analysis did not support H4.

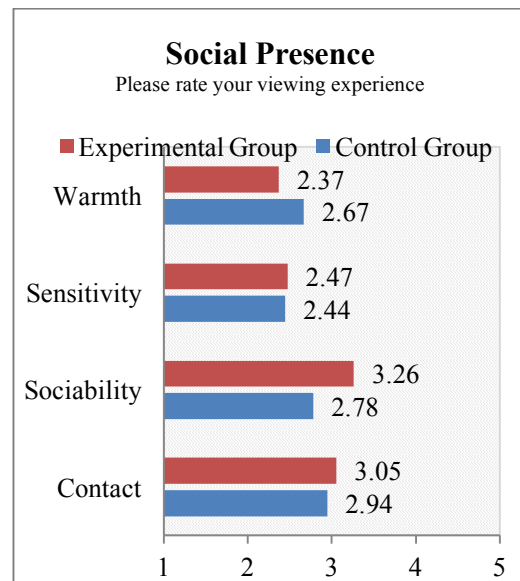


Figure 5. Average sub-items, social presence

Table 5. t-test, social presence

Groups	Mean (SD): Overall Score
Control	2.71 (1.10)
Experimental	2.79 (0.95)

df= 35, t Stat= -1.24, p(one-tail)=0.405

In summary, our analysis showed that while bullet screen was more engaging, it did not affect viewers' mood nor did it improve their perception of social presence. The lack of evidence for social presence was quite surprising given the social nature of bullet screen. Thus to better understand users' reactions we conducted a follow-up study.

3.2. Study 2

The objective of this study was to refine and extend the results of the first study. In order to capture a richer set of data we conducted a combination of unstructured and structured interviews. That is, rather than asking the participants to complete a survey the moderator asked participants to explain their general feelings toward viewing the bullet screen. The unstructured interview questions were reviewed and approved by two experts for readability and clarity, length and appropriateness for the student population. The moderator also used validated survey items from previous studies as interview questions to capture users' reactions quantitatively. This allowed the moderator to observe users' reactions to the questions as well as their responses to the questions. In this follow-up study, we focused on understanding the viewing experience of bullet screen in a different way. Rather than comparing experiences between groups of participants, we asked each participant to compare his or her experience of watching bullet screen with his or her experience of watching traditional online videos, therefore having no control group for comparison.

3.2.1. Participants and Design

A total of 17 students were recruited to participate in this study. None of the participants were familiar with bullet screen. As in Study 1, we asked our participants to view the same 30-second bullet screen prototype video. We made no changes to the video. We then used interviews to capture participants' reactions. All participants viewed the same video and all were interviewed immediately after viewing the video. As in Study 1, students were recruited at random by soliciting their participation in public spaces on campus.

3.2.2. Measurements

Study 1 did not support our expectations with respect to viewers' mood and social presence. Thus, in this study we attempted to capture these aspects differently. For example, rather than capturing users' current mood, we examined their feelings toward the bullet screen technology by having them explain their viewing experience. The responses were then quantified as the frequency of positive or negative words used to describe their experience.

In order to capture perceived social presence, we used both unstructured and structured interview questions. First, we asked users to explain in their own words whether watching bullet screen made them feel more social or more connected to others compared to their experience of watching traditional videos. We then used structured interview questions based on items from an established social presence survey, different from the survey used in Study 1. The social presence survey used in Study 1 was developed to capture social presence in regard to websites [6]. The items used in Study 2 came from a survey that was developed to measure sociability in the context of Second Life [2], an online virtual world rich with social interactions.

Finally, we measured viewing experience indirectly by asking participants to indicate their willingness to recommend bullet screen to a friend. Industry studies show a strong and positive correlation between user experience and intention to recommend [1] and thus often use this as an indirect measure of user experience [13]. This is because, people who are willing to recommend a product to a friend tend to be the same people who happen to have an outstanding experience using the product [13]. Thus, we used intention to recommend as an indirect indicator of viewing experience. Since sociability is a major aspect of bullet screen technology, we investigated to see whether there is a positive connection between sociability and the indirect measure of experience.

3.2.3. Results

We asked users to describe their viewing experience after they watched the same 30-second bullet screen prototype video that was used in Study 1. We then counted the number of positive and negative words in users' descriptions. As shown in Figure 6, participants used more positive than negative words to describe their experience of bullet screen. For example, participants used the words "cool" and "interesting" more frequently than negative words such as "overwhelmed". These results are consistent with the findings of a recent study from China suggesting that bullet screen can offer viewers an enjoyable interactive

experience [4]. The results also show that the word “distracting” was mentioned 5 times in comments. This indicates that bullet screen had also negative impact on viewing experience.

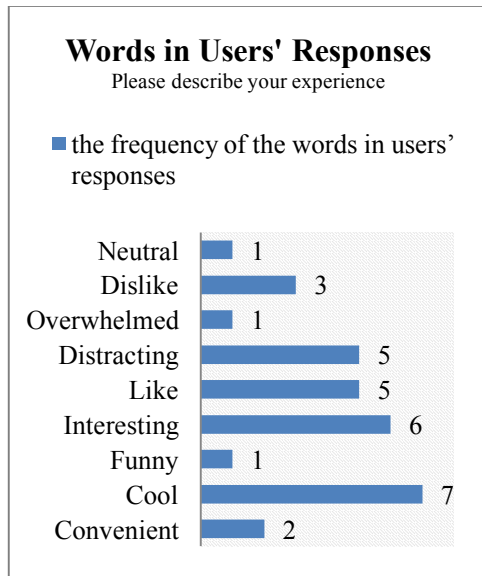


Figure 6. Feelings toward bullet screen

Next, we asked users whether they felt social or connected to other viewers watching the bullet screen video. Over 76% of the participants said they felt more social or connected to other viewers watching the bullet screen video compared to the times that they watch a traditional video online. For example, one participant expressed, “I definitely feel like if other people are making comments, it makes me more likely to make comments.” Another participant expressed, “You feel like close to people, and see how people think and comment.” Similarly, one participant mentioned, “(When I) know someone is watching my comments, it makes me feel good”.

Next, we asked participants to rate the 5 items that measured social presence [2]. The overall score calculated, an average of the rated items, was 3.15. This is larger than the overall score for social presence for the experiential group in Study 1 (2.79). This suggests that the survey items used in Study 2 may be more sensitive than the survey items in Study 1, in capturing social presence in the context of social viewing.

The ratings for the individual items “personal”, “warm”, “close”, “humanizing”, and “emotional” were all in a moderate range on a 5 point scale (3.18, 3.35, 3.24, 3.24, and 2.76 respectively) (Figure 7).

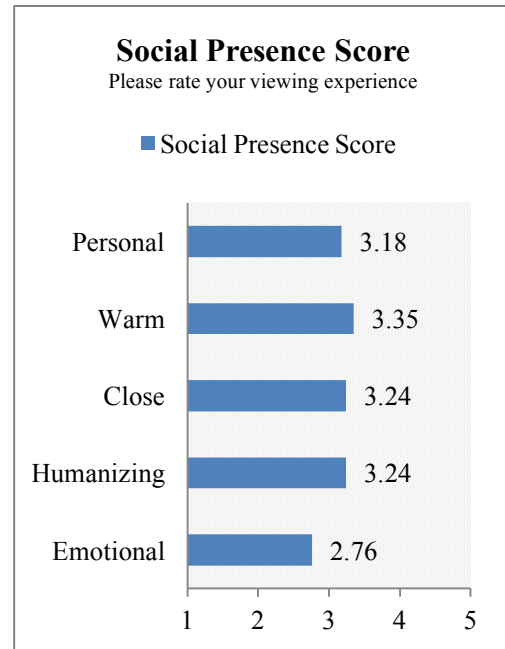


Figure 7. Study 2 social presence

We also measured experience, indirectly by capturing participants’ intention to recommend bullet screen to their friends [13]. The average rating for this item was 3.35, which is consistent with the average score for social presence. Our analysis showed that the social presence scores and intention to recommend scores were strongly correlated (0.67) [16]. Next, we looked at the correlation between intention to recommend and the individual items of social presence (Table 6). We used Evans’ suggestion for correlation strength to interpret the obtained results. According to Evans [16], correlation values between 0.60 - 0.79 are strong, and values between 0.40 - 0.59 are moderate. The correlation coefficients displayed in Table 6 show that the items humanizing/warm and intention to recommend (0.76/0.64) were strongly and positively correlated. However, there was only moderate correlation between the items personal/close/emotional and intention to recommend (0.58, 0.51 and 0.43, respectively).

Table 6. Correlation coefficient, social presence and behavior intention

		Will recommend to friends
Social Presence	Personal	0.5807
	Warm	0.6392
	Close	0.5093
	Humanizing	0.7635
	Emotional	0.4307

4. Discussion

The results of our first study showed that bullet screen had a significant impact on engagement, which was measured both subjectively with a survey and objectively via accuracy of response to questions about content. The results, however, did not provide support for the impact of bullet screen on mood and social presence. We conducted a second study to refine our understating of users' viewing behavior with respect to bullet screen. Our analysis showed that compared to traditional online videos, the majority of participants felt more connected to others when watching bullet screen. They also used more positive words than negative words to describe bullet screen, however, the word "distracting" was mentioned at least 5 times during the interviews.

The items used to measure social presence in the second study seemed more sensitive to the social viewing context compared to the items used in the first study. Despite this, social presence on average was rated in the moderate range. One possible explanation for this is that in our study participants viewed the videos passively. While participants were able to read comments written by others, they were not able to respond to them. Future studies should examine whether active participation in generating comments, (e.g., responding to comments from other viewers) can impact the ratings for social presence.

The indirect measure of experience and intention to recommend was also in a moderate range. However, there was a strong positive correlation between social presence and intention to recommend, which is a widely used industry measure for growth [13]. Thus, improving social presence seems to be a good start in improving bullet screen for companies that may look using bullet screen technology as a way to promote products and services to U.S. Generation Y consumers.

These results have important implications. First the results show that the combination of video and text is not only engaging, but it can also increase attention to the content. This in turn has significant implications for advertisers and companies that wish to increase their ROI on advertisement. Video ads are becoming an increasingly popular method of advertising. Naturally, whether people pay attention to video ads is important to both advertisers and the companies that pay advertisers to promote their products through video ads [25]. The results in our study suggest that bullet screen is likely to improve attention to video ads. By providing the ability to enrich the content with embedded text, bullet screen can provide a unique opportunity for advertisers to increase the awareness and attention to their advertisements. Further, this could be a way to engage viewers in a way that allows

for user collaboration, which may enrich the content of video ads.

For social media sites, bullet screen provides a new social communication method. Our results show a strong relationship between social presence and the industry measure of growth [13], which suggests that investing in improving the perception of social presence is likely to be a major factor contributing to the growth of bullet screen among younger generations in the U.S. market.

The fact that some viewers found bullet screen distracting is also noteworthy warranting future studies to look into ways to make the overlaid text less distracting. Because of the physiology of the human eye, we are able to see only small portions of a screen in detail [11]. Thus, overlaying text over video screens or putting things that need to be attended to in close proximity, is likely to help us see more information. However, this can also create visual clutter, resulting potentially in poorer viewing experience. This is a challenge that needs to be addressed by future studies.

5. Limitations

As with any research, our study is not without limitations. We examined only one video clip. Future studies looking at various types of video clips are needed to verify and/or extend our findings. The length of the video prototype used in our study was short, only 30 seconds. Considering the unique feature of bullet screen, as well as being new to the U.S. audience, a longer video may provide viewers more time to understand and get familiar with the technology, thus leading to a better viewing experience. We chose a 30-second clip in our study since this video format is commonly used for promotional activities. It is, however, possible that videos longer than 30-seconds are needed to form opinions on richness, mood, and social presence of bullet screen technology.

Similarly, longitudinal studies are needed to examine whether exposure to and familiarity with bullet screen can improve viewing experience. Our study used a fast-paced commercial video. Overlaying text over a slower pace video, such as a talk show, may yield different results.

In our study we did not account for individual personality differences such as introversion and extroversion. Future studies are needed to see whether such personality traits can affect users' viewing experience.

We used moderated laboratory studies to observe user reaction and behavior. Participants in our study did not seem to have any reservations about expressing their feelings toward bullet screen. Nevertheless, future

studies controlling for the possibility of social desirability are needed to increase the confidence in the generalizability of the obtained results.

In our study participants viewed the comments passively. Ability to respond to comments may change the social viewing and experience of the medium and hence impact the results observed in this study. Future studies, with live text sessions and multiple users are needed to examine these aspects, which were beyond the scope of our study.

While our sample sizes are in line with multi-step moderated laboratory user experience studies [1], future studies, with larger sample sizes are needed to confirm the results.

6. Conclusion

The results of this study provide support that viewing bullet screen was more engaging than viewing traditional online videos. Bullet screen was better than a traditional video to catch viewers' attention to content. However, the viewing experience, while pleasant to many, can also be "distracting" to some viewers as evidenced by our results.

Our results showed that the perception of social presence had a strong relationship with participants' willingness to recommend the technology to their friends. Thus, improving viewers' feeling of social presence is likely to have a significant impact on bullet screens' growth among younger U.S. users. This in turn, can have a major impact for companies that target this population with video advertisements, advertisers who develop video ads for younger U.S. users, and social media sites that provide social viewing capability for their younger U.S. viewers. Bullet screen can also increase attention to content. Further, it can not only help advertisers to design more effective promotional messages, but also help companies to increase their ROI for video ads. Bullet screen can also enable social media sites to offer their users a new communication medium.

7. References

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