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Role of Danmu Function in User Experience and Engagement:

A Double-edged Sword

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Abstract: Digital video sites currently seek new ways to build a platform to encourage user engagement and enable users to connect with one another through multiple means and channels. The widespread introduction of danmu technology has aroused concerns of academia. However, comparatively little work has been done to explicate the role of danmu function and research progress has been falling behind practical interest. In this study, we seek to investigate user experience and engagement to understand the double-side effect of danmu technology. Using S-O-R framework, we propose that danmu features, namely proximity and coherence, play essential roles in creating augmentation experience of para-social interaction and degradation experience of goal impediment and information overload. Additionally, we investigate user experience to understand user engagement in the danmu-enabled situation. We suggest that para-social interaction will elicit increased user engagement; yet goal impediment and information overload will lead to less user engagement.

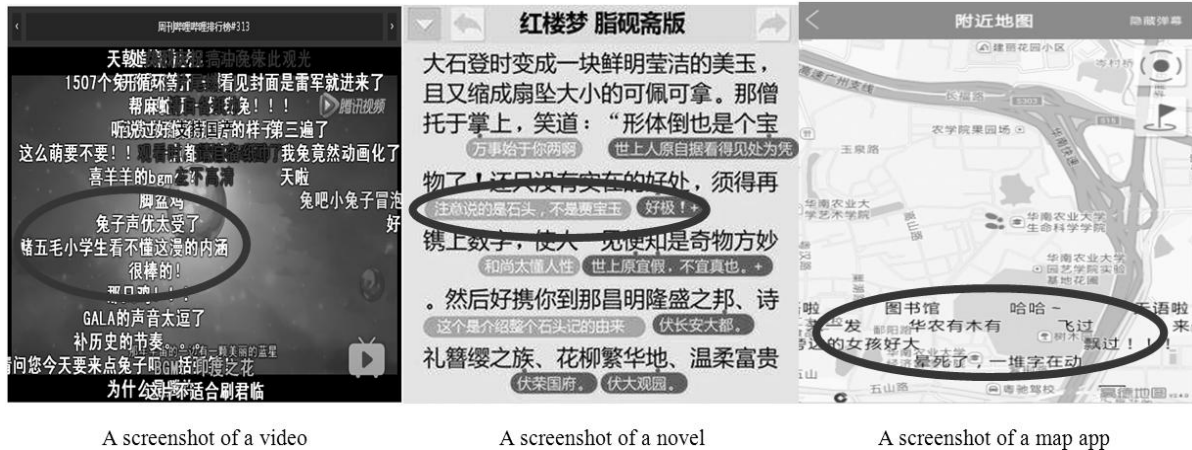
Keywords: danmu features, para-social interaction, goal impediment, information overload, user engagement

1. INTRODUCTION

With the evolution of mobile technology and portable devices, digital videos have become the ideal way to satisfy the information and entertainment needs of individuals. More than 62 percent of the global Internet users have watched streaming or downloaded video content in 2017 ^[1]. According to a report of China Internet Network Information Center (CNNIC), the number of digital video viewers has achieved 565 million in China, representing three quarters of the Internet users ^[2]. In addition, it has been estimated that nearly 299 million people in China will watch digital videos regularly via a subscription streaming service in 2018 ^[3]. In the process of booming development of video market, strategies to attract potential users and retain old users have become overwhelmingly important for platforms. The widespread implementation of Danmu function to enhance user experience on digital video platforms has aroused general concern.

Danmu has been defined as an augmented type of review with two unique characteristics ^[4]. In contrast to traditional review function, danmu comments are integrated with the reviewed objects (such as video, pictures, text, etc.) and organized by the attributes or elements of the objects rather than the order of input or popularity. In the case of video watching, danmu comments are projected onto the video screen, somewhat similar in appearance to the film subtitles. However, not quite identical with subtitles, text of danmu can slide across or float above all parts of the video screen. In addition, danmu comments are projected according to the playback time of the video that these comments were input during viewing. Currently, the application for danmu has not been limited to digital videos. Figure 1 presents three screenshots of danmu-enabled objects (i.e., a video, a novel app and a map app). Despite danmu's prevalence, some platforms just blindly follow the trend of the introduction of this technology, hardly knowing the actual role of danmu function in user experience and behaviors.

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A screenshot of a video

A screenshot of a novel

A screenshot of a map app

Figure 1. Screenshots of danmu-enabled objects

Danmu function has been referred to as part of the viewing experience [5]. Ostensibly, the directly projection of user comments onto the reviewed objects (i.e., video, text, picture etc.) might be regarded as an intrusion of viewing experience and could cause the problem of information overload. However, previous research has indicated that danmu creates a feeling of ‘virtual liveness’ [5] as well as an experience of co-viewing [4]. Furthermore, Liu et al. proposed a conceptual model to explore the impacts of danmu technology on user experience and they draw a conclusion that apart from being a play experience danmu function and its content can also be a distraction problem [6]. By and large, danmu technology does indeed exert a two-side impact on user experience and behaviors; however, so far, there are not so much existing researches examining the dual roles of danmu to clarify the relationships among danmu functions, user experience and behaviors.

Accordingly, this study aims to investigate user experience and engagement to understand the double-side effect of danmu technology. There are two theoretical significances of the present paper: first, we propose two concepts to describe danmu function, i.e., proximity and coherence. The concept of proximity is used to capture the closeness that one feels toward other users, both temporally and spatially, which reflects the ability of danmu to create a sense of ‘virtual liveness’. In addition, we use the concept of coherence to capture the perceptions of users with regard to the orderliness and consistency of contents and structures of danmu-enabled objects, which reflects the degree of integration of danmu and the reviewed object. Second, we explore the role of danmu function in user experience and engagement from two perspectives, i.e., augmentation and degradation, and provide some following studies in the theoretical basis and the managerial implication. A Stimuli-Organism-Response(S-O-R) model is used as a framework for this study to examine the relationships among danmu function, user experience and engagement (as shown in Figure 2).

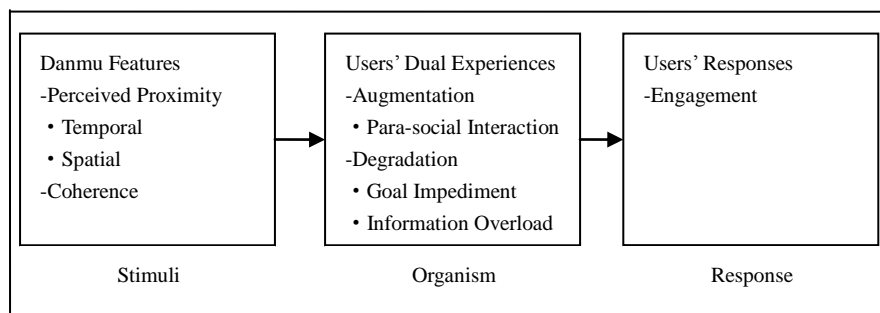


Figure 2. Theoretical framework

2. THEORETICAL BACKGROUND

2.1 Proximity and coherence as stimuli

The viewing environment afforded by danmu has an influence on users' visual experiences^[4]. There are two prominent aspects of danmu features^{[4], [5]}: one is the synchronization of danmu comments to the targeted content and the other is the direct projection of danmu comments onto the targeted content. The posting of danmu comments seems to be happening 'live' during a video viewing experience because every time the video clip is playing, danmu comments appear in the video display screen at the same point of playback time that they were submitted during viewing by their authors. Danmu comments are projected in this way so as to address the video content or respond to other comments, which makes it possible to facilitate embedded interactions among viewers^[5]. This form of commenting lends a sense that viewers can be engaged in social interactions simultaneously during viewing despite 'real' differences in time among users. Based on the above discussion of danmu, we introduce two constructs to conceptualize these unique characteristics of danmu, i.e., perceived proximity and coherence.

Perceived proximity refers to the interpersonal closeness that one feels toward others^[7]. In this article, we continue along this trail but conceptualize proximity as two-dimensional: temporal proximity and spatial proximity. In the social realm, different things may be proximally related in time or space^[8]. Temporal proximity refers here to the temporal closeness that one feels toward other users during viewing. It facilitates viewers' social experience with a sense of simultaneity and an illusion of interaction with other viewers. And the other dimension of proximity captures one person's perception of how spatially close others are. To sum up, danmu commenting can invoke a sensation that one is consuming the danmu-enabled objects (such as video, pictures, text, etc) alongside other users, which is referred as a feeling of co-experience^[4]. As more and more users contribute to the danmu comment feed, a feeling of participation may be reinforced. In a social constructivist way of thinking, perceived proximity is a perceptions product which derives from and may be strengthened by social interactions^[7]. In this study, we suggest that danmu can create for one person a sense of proximity to generate an intense perception of social visual experience.

Coherence used to be referred as the capability of virtual space to provide orderly and consistent structures, contents, and multimedia components in the space^[9]. Accordingly, we define coherence as the ease of understanding of the organization of danmu-enabled objects and postulate that coherence refers here to one person's perception of the orderliness and consistency of contents and structures of danmu and danmu-enabled objects. Previous studies found that a virtual space with well connected and unifying design components rendered better comprehension among users and made them feel more control^[9].

2.2 Para-social interaction, goal impediment and information overload as organism

The relationship between environment stimuli and users' responses is mediated by users' experience. Study has indicated that the sense of virtual liveness of watching a danmu video composes of multiple experiences^[5]. The property of danmu might be seen as the temporal congruence between the point in time of the viewing of the danmu comment by subsequent users and that of it being submitted. More specifically, adding user comments to content, i.e., videos, pictures, text, etc., enhances user experience by creating a sense of 'here and now' of viewing alongside others. Furthermore, we can think of danmu comments as supplementary information provided by other users for the danmu-enabled object, indexical not only of the object itself but also of the submitters of danmu. However, since this form of commenting presents the idea of a crowd of viewers, the text of danmu might be crowded as well and turn to be the potential for obstructing the object and preventing one person from viewing the object clearly. Additionally, we propose that, in certain circumstances, individuals

might enter an information-overload situation with too many comments presented with the danmu-enabled object.

Given the virtual liveness^[5] and pseudo-synchronicity^[4] induced by danmu, social viewing or reading experience through danmu-enabled object can be understood as para-social interaction (PSI). PSI is also called imaginary social interaction, pseudo-interaction and pseudo-friendship, which makes users not mere passive viewers but also involved and active parts of the viewing process^[10]. A PSI experience has been defined as an immediate feeling or impression derived from users' automatic mindreading activities and can provide the users with a sensation of being engaged in a real, lively social interaction with others^[11]. The present paper proposes that user experience of danmu-enabled object can be augmented through PSI.

The crowded and moving text of danmu comments, in the other way, might be seen as information noise, interrupting users' activities and causing cognitive overload. Intrusion of an interruption into a viewer's task leads to psychological reactance and results in user avoidance^[12]. In the case of danmu, the more closeness one person feels towards other users, the more likely he or she feels intrusion of other users' danmu communication into his or her viewing or reading activities. Additionally, the more one person feels the orderliness and consistency of contents and structures of danmu-enabled objects, the more likely he or she could not distinguish desired content from the unwanted, which can also result in a sense of intrusion. We identify two elements contributing to the degradation of user experience, i.e., perceived goal impediment and information overload.

Perceived goal impediment refers here to a hindrance in achieving users' goals (i.e. viewing or reading). In the field of advertising research, perceived goal impediment plays an important role in negative attitudes, aggravation, and ad avoidance^[13]. When danmu comments are regarded as a significant source of nuisance or noise, hindering user efforts to view or read the accompanying object, they can disrupt users' viewing or reading activity, distract users from the object's editorial integrity, and interfere with users' access for desired information. For instance, individuals might feel that the learning process is difficult when they are going to watch danmu-enabled computer science education videos because danmu comments distract them from the video content.

Information overload describes the state that information is afforded beyond one person's need and results in the perception of being overwhelmed^[14]. Danmu comments provide users with the illusion of viewing or reading together with others and help build an artificial atmosphere of lively communication. In this case, users are required to process the information of both the object content and danmu simultaneously, which may make users feel stressed and result in avoidance from the source of the interference.

2.3 User engagement as response

The concept "engagement" has caused a tremendous amount of disagreement and debate across industry and academia. Engagement has been referred to scholars as the state of being interested in something, involved, occupied, or as mental models, attitudes, goals, and users' activities^[15]. This study adopts a behavioral engagement perspective, building on the definition of engagement as behavioral manifestations resulting from motivational drivers^[16]. In the field of online social platform research, behavioral engagement has been referred to as active participation and word-of-mouth referral^[17]. Accordingly, we use engagement construct to capture perceptions of users with respect to active participation as well as word-of-mouth referral of danmu technology.

3. RESEARCH MODEL AND HYPOTHESES

Figure. 3 depicts the research model of this study. It shows that user engagement is determined by para-social interaction, perceived goal impediment and information overload. Proximity and coherence exert impacts on user experience. The interrelationships of the constructs are addressed as follows.

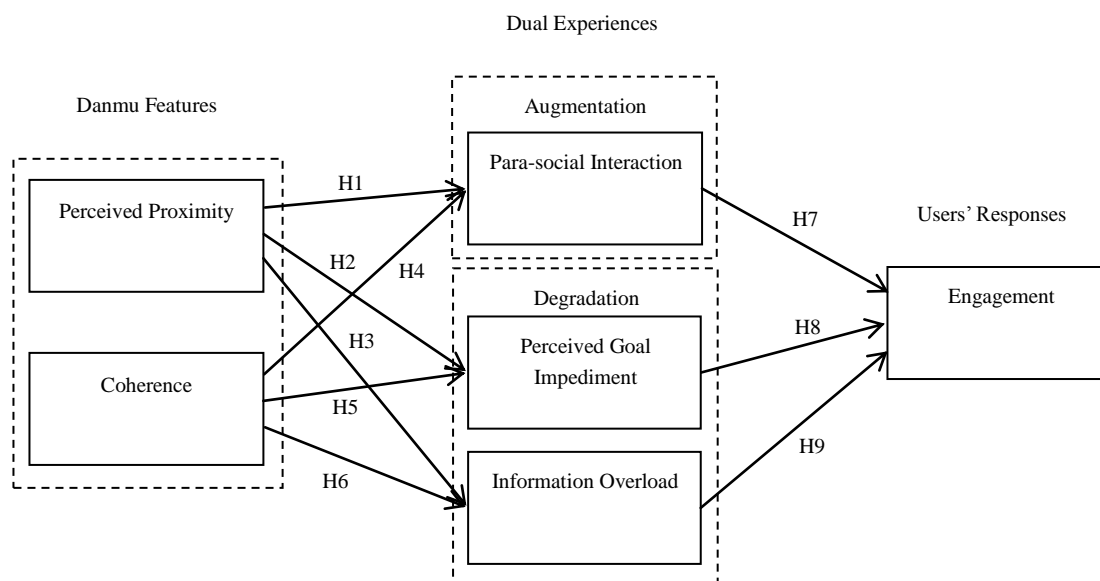


Figure 3. Research model

3.1 Effects of proximity

Previous research found that proximity plays an important role in computer-based communication due to its impacts on individuals' feeling of being observed or not by others^[18]. In addition, proximity assists in identifying para-social relationships, the degree of which also affects the development of para-social relationships^[19]. Immediacy learning course scholars have found that temporal proximity led to better learning experience resulting in more participants' engagement^[20]. Prior study also found that perceived spatial proximity contributed to coordination, shared awareness and mutual understanding^[21]. A para-social experience is accompanied by a sense of mutual awareness with the target object (e.g., a TV performer)^[11]. Thus, we suggest that perceived proximity has a positive impact on para-social interaction.

(H1) Perceived proximity is positively correlated with para-social interaction.

Proximity is used to reflect the actual physical or conceptual closeness^[19] and has been found to affect individuals' feelings and behaviors^[18]. When individuals do not feel the proximity to other users, they may consider danmu comments as a pure interruption: not only preventing them from goal attainment but also creating an information-overload experience. Once individuals have an artificial feeling that other users are in close proximity, they may start to experience para-social interactions. Prior study has claimed that social interactions provide useful information and facilitate goal attainment^[22]. Para-social interaction acts in a similar way with real social interaction despite of the non-reciprocal relationships among 'interacting parties'^[11]. Therefore, we propose that proximity would reduce user goal impediment and information overload. However, beyond a certain point, social interactions might cause information overload problem and began to deter individuals from their goal attainment^[22]. By and large, in the case of danmu-mediated communication, we suggest that proximity negatively correlate with one person's goal impediment and information overload yet with an increased marginal effect. Hence, we hypothesize:

(H2) There is a non-linear relationship between perceived proximity and perceived goal impediment, such that (a) appropriate level of proximity can mitigate perceived goal impediment (i.e., negative linear term), but (b) undesirably high level of proximity has an increased marginal effect on perceived goal impediment (i.e., positive squared term).

(H3) There is a non-linear relationship between perceived proximity and information overload, such that (a) appropriate level of proximity can mitigate information overload (i.e., negative linear term), but (b) undesirably high level of proximity has an increased marginal effect on information overload (i.e., positive squared term).

3.2 Effects of coherence

Coherence reflects one person's perceptions of the orderliness and consistency of danmu and the accompanying objects in terms of content and structure. A virtual space with well connected and unifying design components rendered better comprehension among users and made them feel more control^[9]. Coherence of danmu and the reviewed object may also facilitate better comprehensions among users and lead to shared understanding. Thus, we suggest that coherence positively affect users' perceptions of para-social interaction.

(H4) Coherence is positively correlated with para-social interaction.

On the one hand, coherence makes individuals feel control^[9], which reduces the perceptions of goal impediment and information overload. But, on the other hand, high coherence implies the high level of integration of danmu and the reviewed objects. In this situation, individuals may be overwhelmed because they have to process the wealth of information obtained from object content (i.e. videos, pictures, text, etc.) and danmu simultaneously, which may prevent them from goal attainment and exceed their ability to view or read. Thus, we hypothesize:

(H5) There is a non-linear relationship between coherence and perceived goal impediment, such that (a) appropriate level of coherence can mitigate perceived goal impediment (i.e., negative linear term), but (b) undesirably high level of coherence has an increased marginal effect on perceived goal impediment (i.e., positive squared term).

(H6) There is a non-linear relationship between coherence and information overload, such that (a) appropriate level of coherence can mitigate information overload (i.e., negative linear term), but (b) undesirably high level of coherence has an increased marginal effect on information overload (i.e., positive squared term).

3.3 Effects of dual experiences

Previous studies have found that stronger para-social interaction led to higher social norms and greater enjoyment^[11]. Accordingly, we suggest that viewers experience para-social interaction will generate more engagement. Both perceived goal impediment and information overload measure the degradation aspect of user experience. When danmu interrupts one person's goal, it may result in negative attitudes and lessen their engagement. In addition, individuals may feel stressed because the information provided by danmu-enabled objects is far beyond their abilities to view or read which could result in a retreat from the stressor (i.e., the danmu-enabled objects). Therefore, we expect:

H7: Para-social interaction is positively correlated with engagement.

H8: Perceived goal impediment is negatively correlated with engagement.

H9: Information overload is negatively correlated with engagement.

4. RESEARCH METHODOLOGY

We will conduct an online survey to test the hypotheses. Only those who had danmu-mediated experience are targeted as respondents. We plan to recruit 400 participants and they will be given monetary rewards for their participations.

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