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Author	柏, 春洋(Bai, Chunyang) 岸, 博幸(Kishi, Hiroyuki)
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Master's Thesis
Academic Year 2020

The Effect of Real-Time Audio and
Visual Interactions among Friends during
Online Streaming Live Event



Keio University
Graduate School of Media Design

Chunyang Bai

A Master's Thesis
submitted to Keio University Graduate School of Media Design
in partial fulfillment of the requirements for the degree of
Master of Media Design

Chunyang Bai

Master's Thesis Advisory Committee:

Professor Hiro Kishi	(Main Research Supervisor)
Professor Akira Kato	(Sub Research Supervisor)

Master's Thesis Review Committee:

Professor Hiro Kishi	(Chair)
Professor Akira Kato	(Co-Reviewer)
Professor Kazunori Sugiura	(Co-Reviewer)

Abstract of Master's Thesis of Academic Year 2020

The Effect of Real-Time Audio and
Visual Interactions among Friends during
Online Streaming Live Event

Category: Design

Summary

The connections among family and friends are built upon common topics and experiences. Live entertainment events, such as movies, concerts and sport events always provoke dialogue and interaction with family, friends and even strangers and thus enhance the social bonds among people.

With the global outbreak of COVID-19, most live sports events, concerts, festivals have being canceled or rescheduled. Moreover, it is possible that people's access to big events are likely to be restricted for the foreseeable future. In light of the the current situation, online streaming of live events has become a trend that draws the attention of event promoters and organizers. However, a live event is characterized by intensive interactions and emotions. This part is obviously missing in most of the live streaming.

This paper is aimed to explore the possibility of complementing part of the human interaction during online entertainment experience. With adapted application of existing communication technologies, real-time visual and auditory interaction with family and friends could be added to the online entertainment experience. Thereby, the psychological expectations of human interaction might be met, partially.

Keywords:

human interaction, online streaming, real-time visual and auditory interaction

Keio University Graduate School of Media Design

Chunyang Bai

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Chapter 1

Introduction

1.1. Background

The connections among family and friends are built upon common topics and experiences. Live entertainment events, such as live concerts, sport events always provoke dialogue and interaction with family, friends and even strangers, whether it's a discussion on a particular subject, or based on an instant emotional reaction.

As we have all witnessed, the COVID-19 pandemic had reshaped almost every dimension of our lives. Some public spaces were shuttered, while the others were offering limited access. As a result, live sports, concerts, and other live events, which usually gathered large numbers of people in one place, were canceled or rescheduled since the global outbreak of COVID-19. Against all expectations, we witnessed the first Summer Olympic Games in history ever to be postponed to the following year. Moreover, as the worldwide fight against COVID-19 is still far from declaring a victory, people's access to big events are likely to be restricted for the foreseeable future. It does not only lead to great losses of ticket-sales, but also deprive the occasion for communication and interaction from people.

During the pandemic, online streaming and on-demand video service become a major channel for entertainment [1]. events such as live concerts are been streamed online, which partially meet the expectation of the audience and relieve the financial burden of the organizing parties. Live streaming could be game-changing for these industries. With the limited capacity of stadiums and halls, traditional live events is difficult to scale up. On the on the contrary, live streaming has the potential to scale these events to unlimited capacity. In order to bridge the gap between an in-person event and the online streaming, the organizing parties have been applying a broad spectrum of technologies to make the experience more immersive and interactive. However, human interaction while watching videos online is still inadequate. It is not sufficient to fulfill the audience's need for interactions with the event, the entire audience and the persons that they want to go along with.

By nature, live events are highly emotional and interactive. It is an essential way

to strengthen the bonds between performers (artists, athletes, etc.) and their fans. It is also a tribal experience of going to a venue, singing and cheering alongside thousands of strangers. Last but not least, it is a common experience shared by friends and other close ones, with which, people can communicate through verbal and non-verbal communication and empathize their emotions. Therefore, the goal of holding live events online should not be to replicate the activity, but to recreate the emotions people feel when they go to the venue and enjoy the experience [2].

1.2. The Current Situation

1.2.1 Huge losses of ticket-sales

Live events are still under the impact of the pandemic. A huge number of concerts and sports games are canceled or rescheduled worldwide. Since the impact of COVID-19 on live events is still on-going, currently, the total amount of losses is yet to be estimated. However, it is possible to take a closer look of a concrete example, which is Tokyo Dome. According to its official website, in year 2019, Tokyo Dome hosted 65 live concert. The capacity of this stadium for a single live concert is 55,000 persons. The ticket for a regular seat is approximately 9,000 yen. Suppose that all the concerts were fully seated and count all the tickets as 9,000 yen. The ticket-sales of 2019 worth 32.175 billion yen. On the contrary, in year 2020, Tokyo dome only held three concerts (Two were held before March with normal capacity; one was held in November with a limited capacity of 19,000). As a consequence, the ticket-sales is approximately 3.61% of last year's amount.

1.2.2 Current live streaming formats

Different formats of live streaming are been applied by different promoters and organizers. Here, it will be discussed from two perspectives: (1)how it is operated financially and (2)how interaction is involved.

Financially speaking, live streaming of live events could be generally divided into three categories. First, free live streaming. Instagram, YouTube and other openly accessible platforms are used in this type of live streaming. Tickets are not necessary to watch the content, but viewers could make donations. Second,

live streaming exclusive for subscribers. This is the mode widely used in China in recent months. Subscribers to certain music apps or video streaming providers could get access to the live streaming for free, while non-subscribers will need to pay for the ticket. The live streaming or broadcast of most sports games also belongs to this type. Last, virtual concerts that sells tickets. A number of South Korean and Japanese companies are utilizing this mode.

In perspective of interaction, many live event organizers have made their attempts. The following were two typical examples:

A) Beyond Live: it is an online live concert streaming service and concert series by Beyond Live Corporation, a joint venture of South Korean entertainment companies SM Entertainment and JYP Entertainment in partnership with Naver first established in April 2020. During their live shows, real-time twitter comments are shown on the big screens at times, and there is a session where a number of viewers' real-time images are accumulated and shown as the background of the stage. (figure 1.1)¹ A fanlight that could be synchronized during the live streaming is also introduced to the viewers.



Figure 1.1 Interaction session of a Beyond Live concert

1 [Source]Interaction session of a Beyond Live concert
<https://beyondlive.smtown.com/ja/index.html>

B) NBA Virtual Fans: NBA utilizes the app named “Microsoft Teams” to project more than 300 participants live on the spectator seats during games. Participants can watch the game in real-time and are connected to the venue via a live video and audio feed, meaning that virtual attendees are not simply silent viewers — they can be seen and heard by the players, as well as by the other fans in their section, making it almost as if they were physically in the stands. (figure 1.2)²



Figure 1.2 NBA Virtual Fan Experience

The above-mentioned two examples basically recreated the interactions between performers/athletes and viewers and the interactions between individuals and the entire audience. However, the interactions among friends and the other close ones is not been included.

1.3. Research Problem

In year 2020, since the global outbreak of COVID-19, live event industry, along with cinemas and amusement parks, have all experienced a standstill for several months. Though every industry was trying their best to survive in this unexpected situation, the pandemic waves made it nearly impossible to get back to the old norms in the short term. As a result, live streaming become the only feasible alternative for many live events. It is hard to accumulate the data of how many live streaming of concerts and sports games without audience have been conducted

² [Source]NBA Virtual Fan Experience

<https://www.nba.com/heat/virtual-fans-microsoft-teams-instructions>

this year, but this trend is quite obvious.

However, As stated above, when people go to a live event, they are expecting something different from listening to recorded music or watching live streaming or TV broadcast, because a live event is real-time, emotionally intensive and overflowing with interactions. Though many promoters and organizers of live events are aware of this issue since the beginning of launching online streaming, and they have tried to apply digital technologies to compensate the viewers in the perspective of interaction, the effectiveness is quite limited.

This research, with its designated experiment, was aimed at probing one aspect of the interactions that people expect from a live event, namely the interaction between friends and other close ones, and discuss the possibility of recreating this type of interaction while people physically located in different places are watching online streaming of live events together.

1.4. Research Problem

As mentioned above, traditional live events are overflowing with interactions and emotions, among which the interactions among people participating the events together is a significant part. Compared to the existing approaches, this research is focused on how to recreate this type of interaction. The contribution of this research could be the following:

First, it could help to learn about how people value the real-time interactions with their friends and other close ones when they participate in the same live event.

Second, it could help to probe the feasibility of recreating this type of interactions remotely, since many people are physically isolated from their friends, with whom they are used to participate live events together.

Last, it could be part of the discussion of how to improve the overall experience of watching online streaming.

1.5. Thesis Structure

This thesis is divided into 6 chapters as follow:

CHAPTER 1: The introductory chapter that explains the background, research question, current situation and contribution.

CHAPTER 2: This chapter presents the literature review and related works.

CHAPTER 3: The design process of the action plan. The evaluation methods are also mentioned.

CHAPTER 4: The action observations that have been conducted and the feedback from participants

CHAPTER 5: Analysis of the results of the questionnaires and the interviews.

CHAPTER 6: The conclusion of the research and what can be further improved or discussed in the future.

Chapter 2

Literature Review

This chapter discussed the studies and existing works that were relevant to the mechanism and function of interactions happening during a live event. Four topics are involved in this chapter: 1) An overall review; 2) The interaction between friends and other close ones; 3) the interaction between individuals and the entire audience; 4) the interaction between individuals and the performers/athletes. When people experience a live event together, the paths of interactions vary widely, and sometimes it could be a combination from different counterparts. To narrow down the scope, this research generally divided the interactions into three categories: 1) the interaction between friends and other close ones; 2) the interaction between individual and the entire audience; 3) the interaction between the individual and the performers/athletes (figure 2.1). This categorization did not cover all the types of interactions, for example the interaction between the group and the performers/athletes was excluded. However, as the research was related mainly to the expectation and need for interactions from the perspective of individual participants of live events, the discussion would only be focused on the above-mentioned categories.

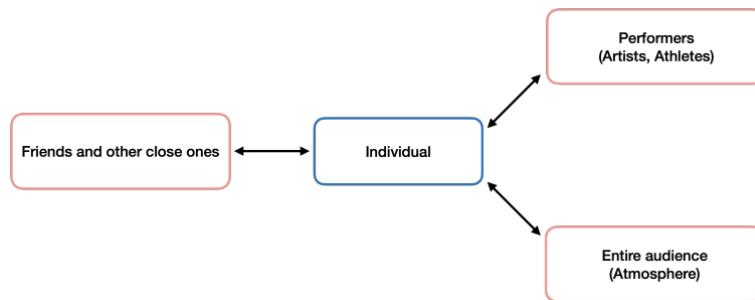


Figure 2.1 Interactions related to individual experience during a live event

2.1. Overall Review

It has been suggested that a key function of music and sports during its development and spread amongst human populations was its capacity to create and strengthen social bonds amongst interacting group members. Developed by American criminologist Travis Hirschi in the late 1960s, social bond theory is sometimes referred to as social control theory. It is the belief that socialization and the forming of personal relationships are among the most significant aspects of human development that keep us from committing crimes or other acts of social deviance. There are four basic elements in the social bond theory, namely attachment, commitment, involvement and belief. [3]

In light of the existing literature, it seems likely that physically synchronized action between people is associated with social bonding. Previous studies on human behavior and psychology suggest that firstly, performing movements simultaneously with someone else, is believed to cause some blurring of self and other via neural pathways that code for both action and perception [4]. Secondly, it has been argued that group music-making, and sports games leads to social bonding due to the release of neurohormones, specifically oxytocin. Studies showed that elevated oxytocin levels has been linked to increased trust, eye contact), face memory, generosity, empathy and the ability to infer the mental state of others [5] [6].

In the case of a live event including music and sports, people tend to sing and cheer at the same time. Body gestures, such as the wave of hands and cheer items are synchronized. Their emotions of nervousness, excitement, sadness, etc. also occurs simultaneously with what is happening in the venue and the emotions are reflected through their facial expressions and body gestures. All these interactions make people highly synchronized and consequently strengthen the social bonds among the people. As studies showed, the strengthening of social bonds also exists between the audience and the performers/athletes.

2.2. The interaction between friends and other close ones

According to researchers, when we try to synchronized with others in a music or sports live event, we tend to feel more connected and uplifted towards those people. When our own actions match those of another's, it is possible that the intrinsic and extrinsic engagement of neural action-perception networks make it difficult to distinguish between self and perceived other, thus creating at least a transient bond between the two. It help us understand what others are thinking and feeling, and to predict how they might behave [7]. This is a social skill scientists call “theory of mind,” linked to empathy.

Through a live event, friends and other close ones usually sing and cheer simultaneous, laugh and cry together, and make body movements in sync. They also could talk to each other occasionally and recall the highlights together after the event ended. All these could meet their need for communication and contribute to strengthen their social bonds with each other. However, as many people are participating online screaming event all alone, the chance to interact with each other and experience social bonds become quite limited.

2.3. Interaction between individual and the entire audience

A live event is always not limited to one-on-one interactions. With large numbers of people, it is difficult to simultaneously observe the movements of all the other participants, making self-other merging a less likely prospect. However, studies proved that rhythm and beat, which is typical for a concert or a big sport game, provide an external, predictable scaffolding that can facilitate synchrony between individuals engaging in the same experience [8].

Most live streaming events still lack this type of interaction, but the “Virtual fan experience” offered by NBA is an attempt toward this direction. In order to promote exchanges between all attendees and make sure that virtual participants feel included in the event, this element of two-way communication between the

live venue and the remote audience could be an essential part of upcoming live streaming events [9].

2.4. Interaction between individual and the performers/athletes

During a live event, the interaction between individual and the performers/athletes is also an important part. Researchers find that the audience's psychology consists of three factors, enthusiasm, motivation, and empathy. It could be commonly noticed that during a live concert, some audience tend to seek to get their greetings noticed by the performer and achieve a response. That is why fans in Japan make uchiwas (fans used as cheer items) for the concert. The situation for sports games are quite similar. It could be said that, during a live event, the individual participants tend to draw attention from the performer/athlete. It contribute to make the individual feel involved and empathized.

This type of interaction has been attempted by both the examples mentioned in Chapter 1.3. The virtual fans of NBA could get heard by the athletes during the games. The fan interaction session of Beyond Live concert also could make the fans feel that they are noticed by the performers. The purpose of these interaction designs is to get the audience feel more involved.

2.5. Summary

Though the participants of live events might have never thought about what made it so unique of going to the event in-person, they actually experienced quite intensive interactions with different counterparts. They would have the expectation of these interactions been fulfilled even if the event is held online. Yet, the current format of live streaming is not satisfactory in this perspective. Moreover, the questions of how to effectively recreate the interactions remotely is still under-researched.

Chapter 3

Research Design

This research is focused on two questions: “How people value the experience of attending a live event together with friends and other close ones?”, and “How to recreate the interactions among them though they are located at different places?”

This chapter first explains what is happening when people interact with friends and other close ones during a live event. There are many different factors involved in this activities, but this research is mainly focused on the visual and audio interactions, which are much more feasible to be stimulated online. Meanwhile, since the participants of the test are supposed to be located in different places and using different devices, some potential technical obstacles are to be expected. Therefore, how to design the test environment so as to minimize the impact is taken into consideration. To achieve the goal, the research was conducted by four steps: pre-survey, experiment, analysis of result and feedback from participants.

3.1. Concept

When people are engaged in the same activity, the interaction could get them synchronized in emotion. There is evidence that synchronization between people can influence their positive social feelings toward one another. This has been demonstrated in a number of experimental studies, involving participants walking in time with other people, dancing together, and even when people have no visual access to one another but are synchronizing with the sounds of another person [8].

Among the five senses, sight, hearing and touch are the most involved in people’s daily face-to-face interaction. We see what others are doing and response. We hear what others are saying and reply. We sometimes touch each other as a way of non-verbal communication. Among these three types of sensory interactions, visual and audio are more frequent while touch is emotionally intensive.

These type of interaction also occurs when people are participating a live event together. At times, they would look at the people around them, see them waving

their hands or cheering items, and hear each other's singing or cheering. Impromptu conversations triggered by what they are seeing and how they are feeling may also occur during this experience. As previous studies suggest, these can influence their positive social feelings and strengthen the bonds between them. However, if a person is viewing an online streaming alone, all these interactions will be deprived of.

3.2. Factors

As mentioned above, sight, hearing and touch are the most utilized senses when people interact with each other during a live event. However, compared to the other two senses, touch only occurs occasionally. Meanwhile, with existing technologies, it is not really feasible to convey the sense of touch effectively. Taking all these into consideration, In this research, the major focus is how to recreate real-time audio and visual interactions among people, when they are participating the same online event simultaneously but remotely.

Three alternative testing modes were being considered. The first one was to involve the visual element only. By using the camera of PC and smartphone to capture the facial expression and gestures of people, people can see each other's reaction.

The second one was to involve the audio element only. People could share their cheers for their favorite sport team, singers, etc., while they are watching the same content simultaneous but remotely. They may also talk to each other on topics related to the occasion or have some Impromptu conversation.

The last one was to involve both visual and audio interactions. People could see and talk to each other. This mode is the closest to the way that people interact with each other face-to-face.

Though among the above-mentioned modes, the third one involves more interaction, there is the possibility that it may result in an information overload to the viewers as they are concentrating on the content of the live streaming. Therefore, the first and second mode are taken into consideration at the early stage. A question about people's preference among these three modes was included in the pre-survey. Among all 102 response, which includes all the participants of

the participants of the test, 67.6%(69/102) answered that they would prefer to see and talk to each other at the same time. Consequently, the third mode was finally chosen as the one used in the test.

In fact, the sense of taste and smell are also involved in the daily face-to-face interactions. In the case of a live event, people sometimes may have the same food and beverage, they may smell the perfume or other scent from each other. These interactions also contribute to the synchronization in a specific occasion. However, compared to the other three senses, taste and smell are less involved. Therefore, they are not been involved in the testing stage (figure 3.1).

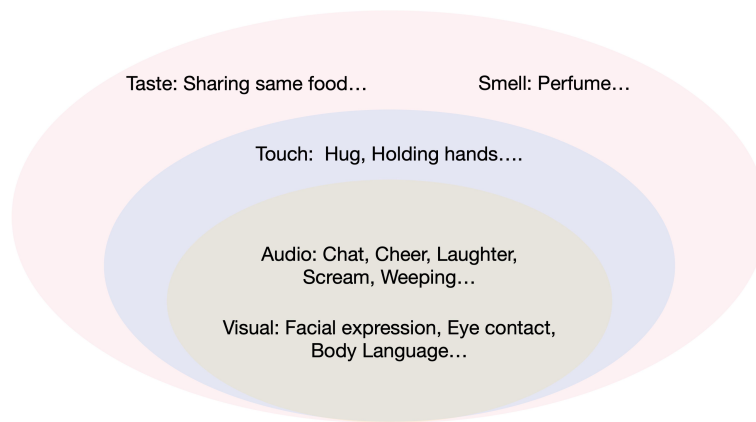


Figure 3.1 Three layers on interactions that occurs between individuals during a live event

3.3. Testing Environment

All the participants of the test were located in different places and using different devices. (A control group of 8 persons in experiment 1 was located in the same place during the experiment) This situation brought potential problem of internet lagging and echo. To minimize these impacts, all the participants' internet accessibility were checked before the testing. Meanwhile, all the participants were requested to use earphone or headset during the testing, so the audio output from each other's device would not disturb with their communication.

The effect of using cheer items together, such as fanlight, was initially planned as one part of the testing. However, some participants responded it was difficult for them to get such items at that moment. In order to make the testing environment within the same standard for every participants, this element was finally not included in the testing.

3.4. Experiment Design

As the format of live entertainment events varied a lot from each other, the interactions occurring during different events were also quite different. For example, live pop music concerts and sports games held in stadium with a large number of audience were usually highly interactive and the atmosphere was loud, while during classic music concert, opera, golf games, less interactions was expected among the participants. This research was focused on the type of live events that involved intensive interactions among all participants when held in-person.

3.4.1 Pre-survey

Before the testing, a pre-survey was conducted to look into how people value the experience of participating a live event together with friends and other close ones. The survey was sent randomly, but all the participants of the test were requested to finish it. This survey offered some general information of what people expect, in terms of interaction and social bonding, when they participate an in-person live event and what they think is missing in the current live streaming mode.

3.4.2 Experiment

The participants are chosen according to the following criteria: a) they have participated in live events before; b) in their previous experience, they would prefer to go to the events along with friends; c) the current situation restricted their participation in live event; d) in recent months, they are physically isolated from their close friends who are interested in the same type of event.

Since there could be some difference between the interactions between two individuals and the interactions among three or more than three individuals, the

test in this research only focused on the first scenario, which means that in each test group, there were only two individuals.

During the experiment, each group was assigned 10 minutes to watch a live streaming event together. The entire process was observed and recorded, and all the participants are informed of the test's aim and procedures. So as to make the the participants feel more comfortable to communicate and interact with each other during the test, they were also encouraged to get connected via the Internet in advance of the test and to continue their interaction when the observation and recording finished.

During the first experiment, which was conducted simultaneously with an online streaming of a live concert on November 3rd 2020, two control groups were also set up. Control group 1 was consist of 8 individuals. They watched the concert in a Karaoke room with projectors. The participants were able to conduct face-to-face interaction with each other. Control group 2 was consist of two individuals. They watched the concert all alone and no interaction occurred during the live streaming. Observation and video recording were also conducted with these two control groups.

3.4.3 Analysis of Result

Recordings of the experiment participants' interactions were studied and diagrams of their audio interactions were listed and compared so as to discover what was not noticed during the experiment observation and what was in common in different groups of participants. Findings through the diagrams would be discussed and possible explanations would be given.

3.4.4 Analysis of Result

Each participant was given a questionnaire after attending the test. Moreover, an interview was conducted with each of them within one day of the test. The participants shared their feeling toward the virtual interactions with their friends during the the test, their ideas of whether the interactions integrated or disturbed with the live streaming content, and their comments on the highlights of their interactions with friends during the test.

3.5. Assessment

3.5.1 Evaluation method

Both qualitative and quantitative methods are used to evaluate the testing result. For qualitative method, observations were conducted during the testing, and interviews to the participants were conducted afterwards. For the first experiment, which was conducted simultaneously with an online streaming of a live concert on November 3rd 2020, observations and interviews were also conducted with the members in the two control groups.

In terms of quantitative methods, survey and questionnaire were conducted during the research. A pre-survey was given to all the participants of the test and was also randomly sent out to other individuals. A questionnaire was sent to all the participants, except the members of the two control groups, after the testing was finished.

3.5.2 Evaluation Topic

The topics for evaluation are based on the participants' expectation to the interactions with friends or other close ones during a live event, the aspects of social bonding involved in a live event, the effectiveness of the virtual interactions.

Participants' Expectation

Each participant was asked about their previous experiences of attending live events together with friends. Questions such as how they value the experiences and what has left deep impression upon them were the main focus.

Aspects of social bonding

Among the four aspects of social bonding, namely attachment, commitment, involvement and brief, attachment and involvement are more closely related to the experience of live event participation. Part of the questionnaire and interview were designed according to these two aspects, so as to find if the virtual interaction contribute to enhance the social bonding among them.

Effectiveness of the Virtual Interactions

The aim of this research is to find if the interactions among friends and other close ones during a live event could be recreated remotely and effectively. There-

fore, after participating in the test, each participant would be asked to answer if they the test partially meet their expectation for the interactions and what is lacking in the virtual interaction.

3.6. Experiment Plan

There were two series of experiment involved in this research. The first series was conducted simultaneously with a live streaming concert on November 3rd 2020. 4 groups of participants (8 individuals), along with two control groups were involved in the process. The second series was supplementary to the first series and was conducted during November 10th to November 28th. 3 group of participants (6 individuals) participated in this process, while no control group was involved. The details about this process will be elaborated in Chapter 4.

Chapter 4

Experiment Implement

4.1. Pre-survey

As the online streaming of live event was not a major trend until this year, and promoters and organizers are still attempting different methods to enhance the interactiveness of the streaming, few works have been done to explain the viewers' expectations to interaction while a live streaming and how effective the existing methods work. In order to get the basic information, a pre-survey was conducted. The five questions in the survey are related to:

- 1) Is there any experience of going to a live event in the recent two years?
- 2) Through these experiences, do you prefer to go alone or with friends?
- 3) Is the interaction with friends during these experience important?
- 4) Is there any experience of watching online streaming of live events during the pandemic?
- 5) If you and your friend will have virtual interactions during a live event, what kind of mode do you prefer?

At last, 102 respondents answered the survey. Among them, 86.3% (88/102) replied that they had been to at least one live event during the recent two years, and they would prefer to go together with friends. 75.5%(77/102) of them regarded the interactions with friends during the live event an indispensable part of the entire experience. Meanwhile, 67.6%(69/102) answered that they would prefer to see and talk to each other at the same time if they are going to join the same live streaming together with friends.

The result of this pre-survey was used as a reference to the design of the test and the questionnaire for the test participants.

4.2. Experiment 1

4.2.1 Overview

An online streaming of a pre-recorded concert by a Japanese idol group, Arashi, was chosen as the content to be used for the test. The date of the streaming was November 3rd 2020. The concert was initially planned to be held in Japan National Stadium in May for two successive days. For each day the capacity is around 80,000 spectators. Due to the pandemic of COVID-19, the concert was finally held without audience and was streamed online on November 3rd 2020. It was accessible to every spectator with a valid virtual ticket. Though the content of the concert was recorded before November 3rd 2020, it was served to the audience as a live event streaming. All the spectators watched the concert simultaneously and there were no playback option. The choice of this concert was because this concert was phenomenal among a considerable number of fans, which means it is easier to find participants willing to participate the test. On the other hand, the online streaming of this concert was accessible worldwide and the quality of streaming was guaranteed.

4.2.2 Participant selection and other preparing work

Since the experiment was designated to test if the interactions among friends or people knowing each other well can be recreated during live events while the participants were physically isolated, the participants of the experiment were selected according to the following criteria before the experiment:

- 1) The participants were divided into group. In each group, the participants were familiar with each other, and they were interested in the content;
- 2) The participants were physically located in different places;
- 3) The participants had stable access to the Internet, video and audio input/output devices, and valid ticket for the concert.

4 groups of participants were selected to participate the experiment. Among all the groups, one group originally consisted of 4 individuals, while the other

three groups consisted of 2 individuals. In order to avoid the potential difference between people interacting in small groups and people interacting in pair. The number of participants in each group was standardized to 2. The gender composition of the participants was 7 female and 1 male. The age range was from 24 to 33 years old.

Before the experiment, all participants were required to take the pre-survey. The result showed that all 8 participants had experiences of attending a live concert with friends. Their answers to additional questions to participants showed that 7 of the participants had went to previous live concert of the artists live streaming on November 3rd 2020 (the other one only watched DVD of the artists' concert before). Participants in two of the groups had went to previous concerts of the artists together with their counterparts in the experiment.

Before the experiment, instructions were given to all participants through email. They were informed of the aim of the experiment, namely to test if the interactions among friends could be manipulated remotely. They were also informed of the duration of the experiment, which was 10 minutes for each group. The devices they would use in the experiment was also inquired.

4.2.3 Experiment environment

The content of the concert was streamed through a web page especially designed for this event, which was as the following:

<https://online.johnnys-net.jp/s/jno/page/ARAFES2020>

It could be accessed through various web browsers on Mac, PC, tablet PC, smartphone, etc. Since all the participants were located remotely, with different devices at hand, no requirement was made to standardize the browsers and devices used by the participants. However, in order to avoid the audio output of the concert interfere with the audio interactions between the participants of each group, all participants were required to use an earphone or a headset with microphone during the experiment so as to separate the sounds.

The participants were required to use Zoom, Wechat video call, and other platforms that enabled real-time visual and audio interactions for the experiment. During the experiment, the conductor of the experiment also joined the video to observe and make video recording of the participants' interactions, but the

conductor’s camera was kept off and the microphone mute so as to minimize the potential interference with the participants’ interactions.

It was initially taken into consideration that to prepare all the participants a fanlight and let them use it in the experiment so as to test if this visual element could enhance the interactions and bonds between the participants. However, due to logistic reasons, it was not feasible to equip all participants with the fanlights. After all, this element was not involved in the experiment.

As the participants reported, the choice of browsers and devices of each participants were listed as the following table 4.1:

	Device	Browser	Platform for interaction	Visual output of concert	Audio output of concert	Visual input of interaction	Audio input of interaction
Participant A (G1)	Mac book	Safari	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant B (G1)	Mac book Pro	Google Chrome	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant A (G2)	Laptop(Dell)	Google Chrome	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant B (G2)	Mac book	Google Chrome	Zoom	screen	headset	built-in camera	microphone of headset
Participant A (G3)	Mac book	Safari	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant B (G3)	Laptop(HP)	360 safe browser	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant A (G4)	Mac book and iPhone	Safari	Wechat video call	screen of Mac	earphone	built-in camera of iPhone	microphone of iPhone
Participant B (G4)	Mac book and iPhone	Google Chrome	Wechat video call	screen of Mac	earphone	built-in camera of iPhone	microphone of iPhone

Table 4.1 Devices and platforms set-up of Experiment 1 participants

For experiment Group 4, Participant B was located in China, where stable access to Zoom and other platforms could not be guaranteed. In order to set up a stable experiment for this group, Wechat video call was applied as the platform for the participants’ interactions. As a result, each of the two participants used their Macs to watch the concert and used their phones to conduct interaction.

4.2.4 Experiment procedure

During the online streaming of the concert on November 3rd 2020, experiment with the 4 groups of participants were conducted in a successive order. The participants in each group were connected via the platforms as they previously chose.

The time duration of each experiment section was 10 minutes. During the 10-minute time, the participants of each group watched the streaming together while seeing and talking to each other through the platform. During the experiment of each group, the experiment conductor was also connected through the platform so as to observe and record the interactions of the participants. As planned in the experiment environment design phase, the experiment conductor kept the

camera off and micro mute, so as to minimize the potential disturbance caused by the conductor. For Group 1 to Group 3, the recording of the interaction was done with the recording function of Zoom Mac version on the conductor's Mac. For Group 4, the recording was done with the screen recording function of the conductor's iPhone.

Though the experiment lasted 10 minutes only, the participants were required to get connected at least five minutes before the experiment started. The aim of this "warming-up" is to let the participants catch up with each other. the participants were encourage to continue their communication and interaction as long as they wanted and wrote down their feelings and emotions at any time so as to enrich their feedback.

4.2.5 Control groups

In order to examine the influence of virtual visual and audio interactions to spectators during a live streaming event, two control groups were set up for this experiment.

Control group 1 consists of 8 individuals. They participated the online streaming together in a Karaoke room located in Tokyo. Their interactions were observed throughout the live streaming and video recordings of their behavior and interaction were also taken. The live streaming was accessed through the same web page as the experiment groups. The visual output was through two projectors and the audio output was through the stereo equipment in the Karaoke room. The video recording was done with a Sony ILCE-7RM3 camera.

Meanwhile, control group 2 consists of two individuals, they watched the live streaming independently and was requested to give feedback about their feelings and thoughts toward this one-person experience. Member A of control group 2 was located in Sapporo. She accessed the live streaming through the web page same as the experiment groups and used a Mac to watch the content. Member B of control group 2 was located in Chengdu, China. She accessed the live streaming through a smartphone application named NetEase Cloud Music and used an iPhone to watch the content. Since no visual and audio interactions with others was expected, no video recording was done for control group 2.

4.2.6 Observation and analysis

From the observation during the experiment, it could be said that the virtual interactions among the participants of the 4 experiment groups enriched the participants' experience of watching the online streaming. In each group, the participants could share their excitement with each other. They talked about the favorite songs they were expecting to hear and also communicated with instant emotional reaction. During the 10-minute experiment, there were moments that they sang together with the content of the live streaming and smiled to each other. Diagrams of the verbal interaction was listed in this section.

Members of control group 1 showed intensive interaction and emotion during the observation. The members sang with the melody at times, talked to each other frequently. They also cheered simultaneously when the concert came to a highlight. They also prepared fanlights in advance, which contributed to recreate the atmosphere of a in-person live event. Diagrams of their verbal interaction was listed in this section.

On the other hand, the two members of control group 2 responded that the excitement brought by the live streaming concert was limited. They also pointed out that there were moments that they felt lonely.

4.3. Experiment 2

4.3.1 Overview

This part of experiment initially was designated to use a sport event that normally involved a large number of audience and intensive interactions as the experiment material. However, due to the pandemic, major sports games in the world were canceled or rescheduled. Therefore, no ideal material could be found during the planned experiment time. As a result, Experiment 2 finally used concert VOD and reality show as the test material, and the testing, observation and feedback were regarded as supplementary to Experiment 1.

4.3.2 Participant selection and other preparing work

Same as Experiment 1, this experiment was designated to test if the interactions among friends or people knowing each other well can be recreated while the participants were physically isolated and watching the same content simultaneously. The participants of the experiment were selected according to the following criteria before the experiment:

- 1) In each group, the participants were familiar with each other, and they were interested in the same content;
- 2) The participants were physically located in different places;
- 3) The participants had stable access to the Internet, video and audio input/output devices.

3 groups of participants were selected to participate the experiment. Each group consisted of 2 participants. The gender composition of the participants was 4 female and 2 male. The age range was from 22 to 27 years old. Before the experiment, all 6 participants were required to take the pre-survey. The result showed that all participants had experiences of attending a live event with friends.

Before the experiment, instructions were given to all participants through email. They were informed of the aim of the experiment, namely to test if the interactions among friends could be manipulated remotely. They were also informed of the duration of the experiment, which was 10 minutes for each group. The devices they would use in the experiment was also inquired.

4.3.3 Experiment environment

Different from Experiment 1, the contents used for experiment 2 were different in each group. The choice of the contents was discussed with the participants so as to ensure that the content used for the each group was a common interest of the participants. The choices of the three groups were as following:

Group 1: VOD of a pop music concert by a Taiwanese band named Mayday, which was originally streamed on May 31st 2020. The participants accessed to the VOD through the website of Tencent Video, a Chinese video streaming website.

Group 2: VOD of a pop music concert by Japanese singer Otsuka Ai, which was openly accessible on YouTube. The concert was originally staged in Tokyo with big audience in 2019.

Group 3: VOD of one episode of a Chinese reality show named Sisters Who Make Waves, which was openly accessible on YouTube. The show contained many sessions of singing and dancing in each episode.

Before the experiment was conducted, it was checked that all the contents used in this experiment were openly accessible on the Internet and there was no violation against copyright.

Following the environment setting of Experiment 1, the participants were required to use Zoom, Wechat video call, and other platforms that enabled real-time visual and audio interactions for the experiment, they were also required to use earphones or headsets to separate the potential audio interference. There was no requirement to standardize the devices used by the participants. During the experiment, the conductor of the experiment also joined the experiment section to observe and make video recording of the participants' interactions.

As the participants reported, the choice of browsers and devices of each participants were listed as the following table 4.2:

	Device	Browser	Platform for interaction	Visual output of concert	Audio output of concert	Visual input of interaction	Audio input of interaction
Participant A (G1)	Mac book	Google Chrome	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant B (G1)	Mac book	Google Chrome	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant A (G2)	Laptop(HP)	Google Chrome	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant B (G2)	Mac book Pro	Safari	Zoom	screen	Bluetooth earphone	built-in camera	microphone of earphone
Participant A (G3)	Mac book	Safari	Zoom	screen	earphone	built-in camera	microphone of earphone
Participant B (G3)	Mac book	Google Chrome	Zoom	screen	earphone	built-in camera	microphone of earphone

Table 4.2 Devices and platforms set-up of Experiment 2 participants

4.3.4 Experiment procedure

The three groups in experiment 2 did the test separately on different dates. The participants in each group were connected via Zoom, which was the platform they previously chose.

The time duration of each experiment section was 10 minutes. During the 10-minute time, the participants of each group watched the content together while seeing and talking to each other through Zoom. During the experiment of each

group, the experiment conductor was also connected through the platform so as to observe and record the interactions of the participants. In order to avoid the lagging of each participant play the content on their own devices separately, the content was played from the conductor's device through the screen sharing function of Zoom. For all the groups, the recording of the interaction was done with the recording function of Zoom Mac version on the conductor's Mac.

Same as Experiment 1, the participants were required to get connected at least five minutes before the experiment started, so as to catch up with each other. The participants were encourage to continue their communication and interaction as long as they wanted and wrote down their feelings and emotions at any time so as to enrich their feedback.

4.3.5 Observation and analysis

From the observation during the experiment, it could be seen that the remote visual and audio interactions among the participants of the 3 experiment groups enriched the participants' experience of watching the same content simultaneously. In each group, the participants talked about the favorite songs, communicated with instant emotional reaction and talk about other related topics. During the 10-minute experiment, there were moments that they sang together with the content and smiled to each other.

Chapter 5

Analysis and Evaluation

5.1. Analysis of the video recordings

The videos recorded during the test were used to analyze and discover the interactions that was missed by the researcher during the experiment observation.

As most participants used a single screen to watch the content and to have visual interaction with each other at the same time, the visual interactions were in fact constant. There did exist different moments that the participants' eye sight was focused on the streaming and that the participants were watching each other's virtual image. However, with the limitation of the experiment environment, it was not feasible to quantitatively analyze their visual interactions.

On the other hand, by nature, audio interactions between the participants in each group occurred in a sporadic pattern. Therefore, it was elaborated with diagrams in this chapter.

5.1.1 Analysis of Recordings of Experiment 1

The recording of the 4 experiment groups was studied and diagrams of their verbal interaction was listed as the following (Unit of the figures in the diagrams: second):

Group 1: The interaction recording of Group 1 covered 3 songs in the concert. The first one was from 30” to 208” ; The second one was from 233” to 375” ; The third one was from 396” to 532” . From 533 to 12’30” was an introduction talk of the artists. The interactions of the participant was listed until 600” (10 minutes). (figure 5.1)

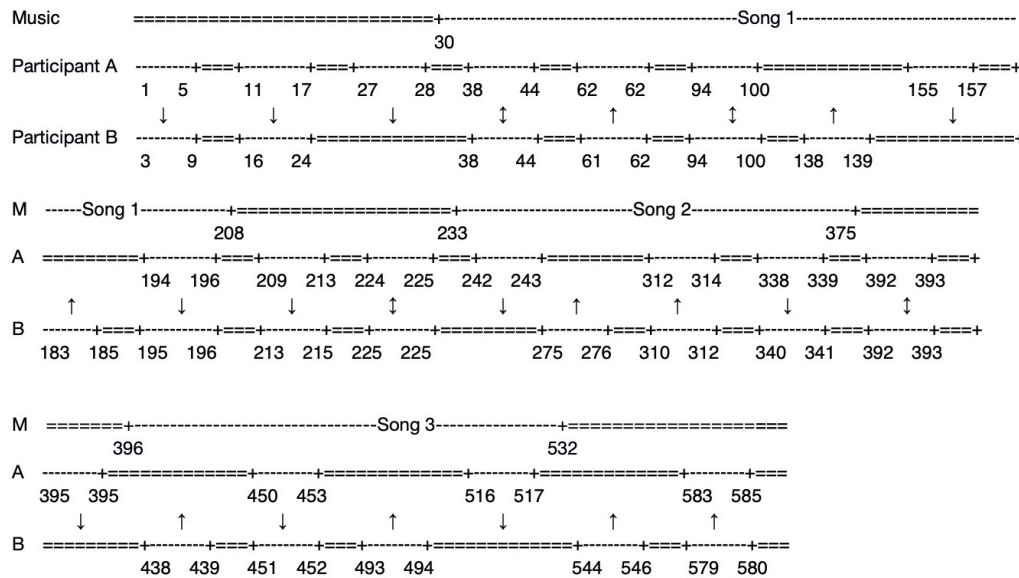


Figure 5.1 Diagram Experiment 1 Group 1

Group 2: The interaction recording of Group 2 covered 2 songs in the concert. The first one was from 8” to 191” ; The second one was from 255 to 399” ; The remaining time until 600” was a talk session. The interactions of the participant was listed until 600” (10 minutes). (figure 5.2)

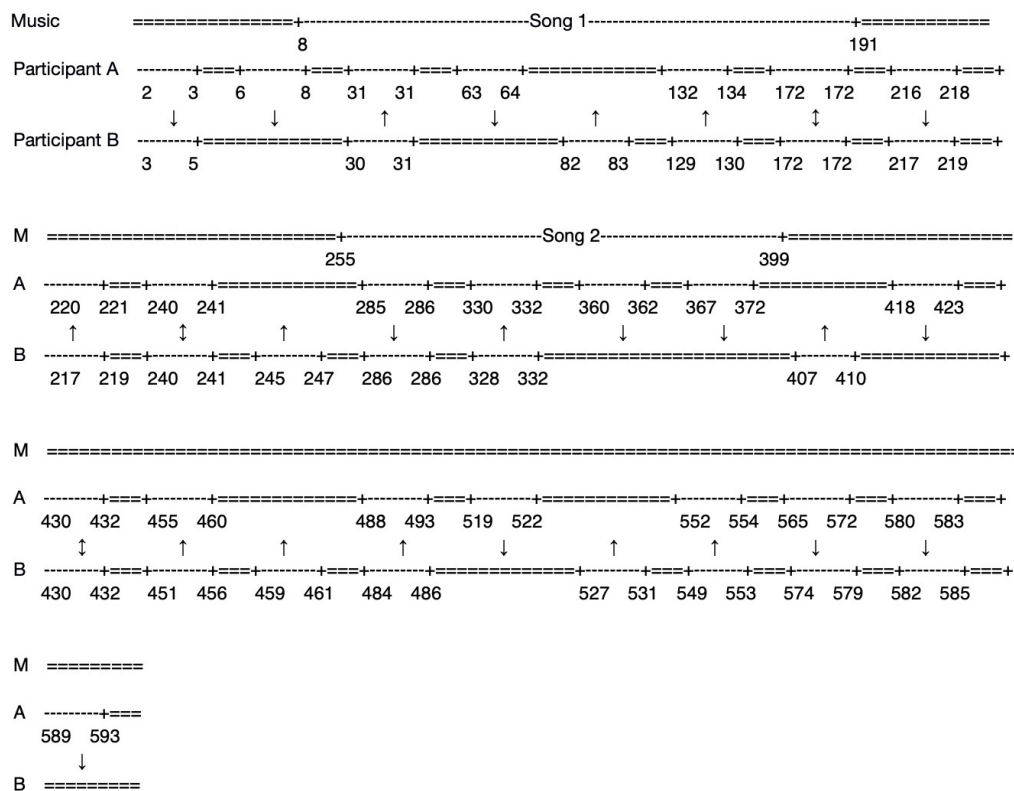


Figure 5.2 Diagram Experiment 1 Group 2

Group 3: The interaction recording of Group 3 covered 2 songs in the concert. The first one was from 33” to 384” ; The second one was from 404” to 570”. The interactions of the participant was listed until 600” (10 minutes). (figure 5.3)

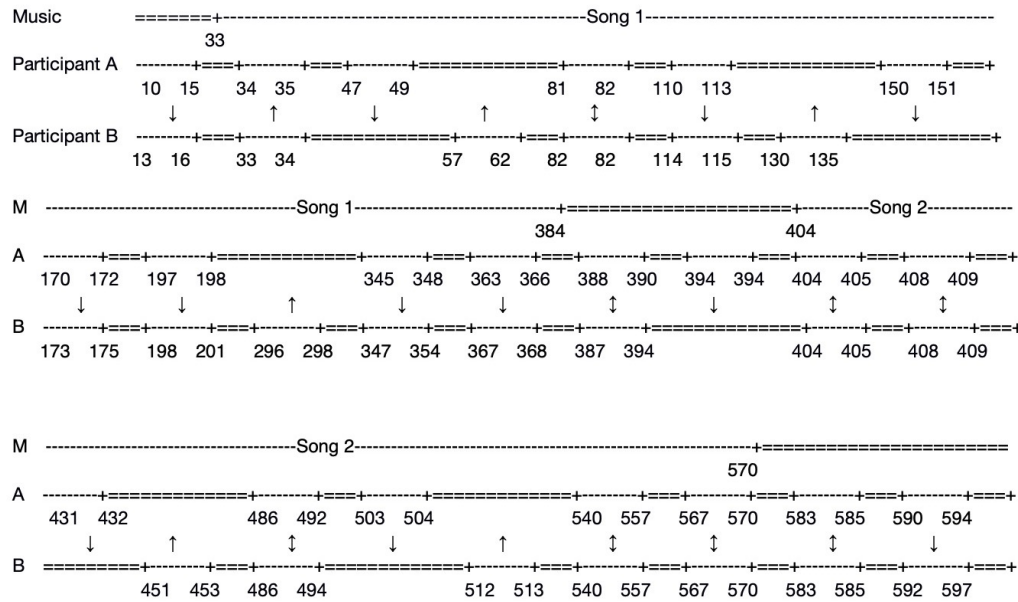


Figure 5.3 Diagram Experiment 1 Group 3

Group 4: The interaction recording of Group 4 covered 2 songs in the concert. The first one was from 46” to 210”; The second one was from 381” to 610”. The interactions of the participant was listed until 600” (10 minutes). (figure 5.4)

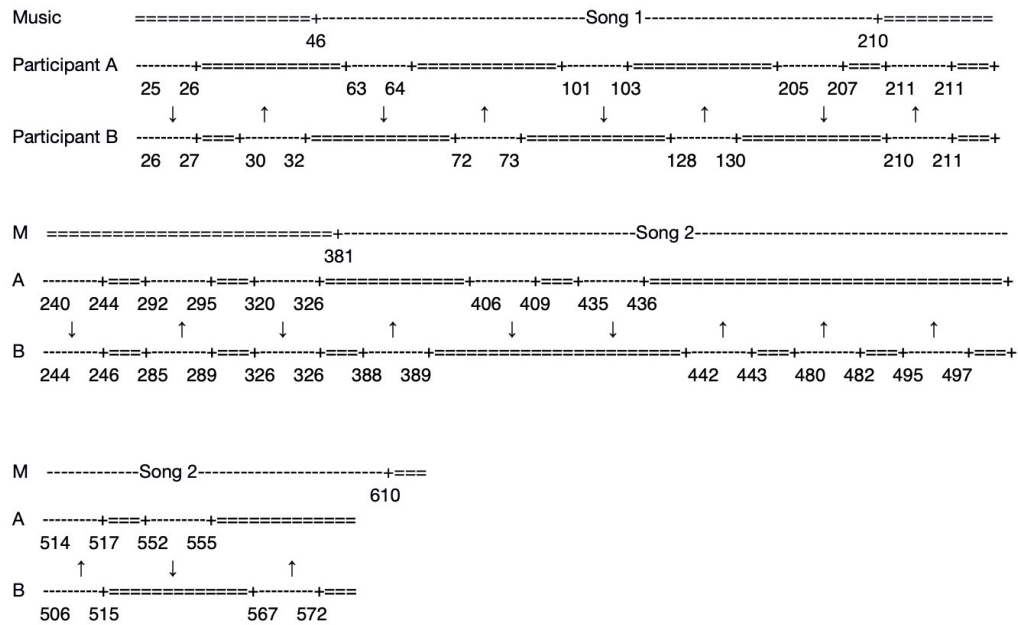


Figure 5.4 Diagram Experiment 1 Group 4

The recording of the control group 1 was studied. It was found that, cheers and shouts were the most frequent interactions among the group. Meanwhile, person to person interactions occurred mostly among participants seated close to each other. The more distant two participants were seated, the less interaction they had. Diagram of verbal interaction of 2 from the 8 participants, who were seated next to each other was listed as the following:

Control Group 1: The interaction recording of Control Group 1 covered 3 songs in the concert. The first one was from 20” to 215” ; The second one was from 286” to 430” ; The third one was from 476” to 577” . The interactions of the participant was listed until 600” (10 minutes). (figure 5.5)

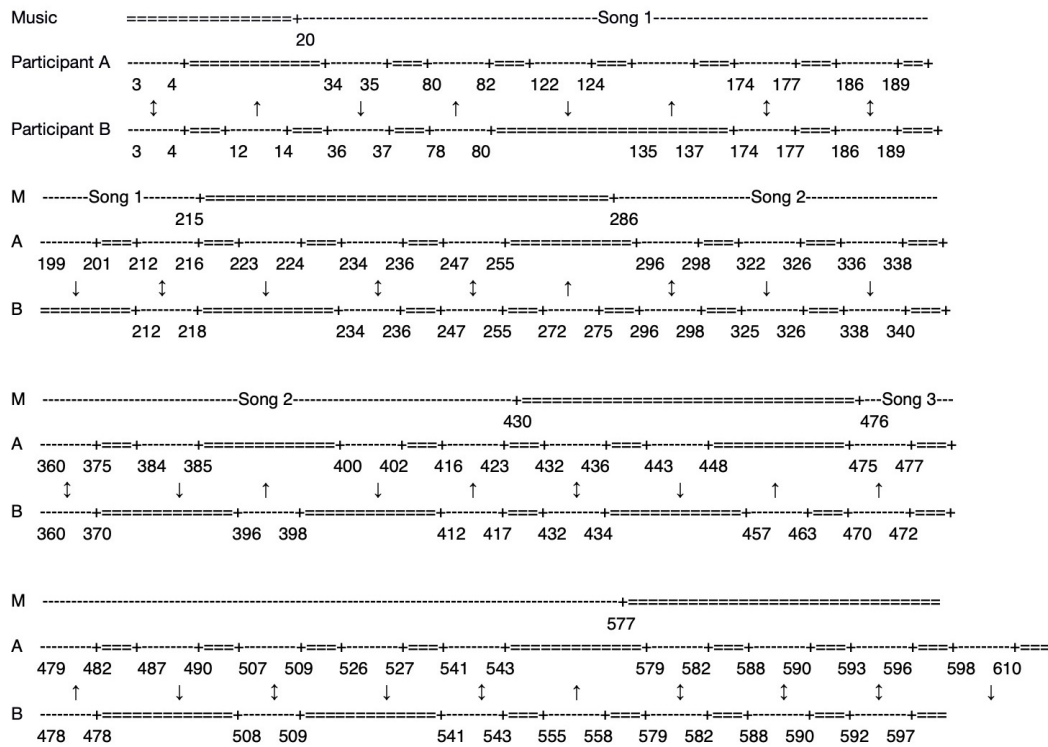


Figure 5.5 Diagram Experiment 1 Control Group 1

5.1.2 Analysis of the Result of Experiment 1

From the diagrams, it could be seen that the audio interactions between the two participants randomly occurring during the 10-minute experiment. The interactions could be categorized into 3 types:

- 1) dialogue type: One participant spoke and the other followed.
- 2) simultaneous/overlapping type: the two participants react to the content of the live streaming concert together.
- 3) comment type: one participant gave a comment or an instant reaction, while the counterpart did not respond immediately.

The diagram also suggested that while watching the same content simultaneously, the verbal interaction between the two participants in each group tended to be short and simple. The table below showed the times and duration of interactions of each participant: (table 5.1)

Participant	Times	Interactions duration with 3 sec	Interactions duration more than 4 sec
Group 1 A	18	13	5
Group 1 B	19	15	4
Group 2 A	22	16	6
Group 2 B	19	13	6
Group 3 A	21	14	7
Group 3 B	21	15	6
Group 4 A	12	10	2
Group 4 B	14	11	3
Control 1 A	30	23	7
Control 1 B	27	21	6

Table 5.1 Times and duration of interactions of Experiment 1 participants

As the table showed, short verbal interactions (within 3 seconds) conducted by the participants of Experiment groups was 73.29% of all the verbal interactions

they made during the experiments. In the two participants of Control group 1, the percentage was 77.19%.

The diagram of Experiment group 3 showed one unique feature. Simultaneous/overlapping type interactions took up 19.05% (8/42) of all the interactions conducted by the two participants. The percentage was comparatively higher than the other three groups. (Group 1: 10.81%; Group 2: 7.32%; Group 3: None). By checking with the video, it was found that the two participants sang together with the live streaming content more frequently than the other three groups. It could be suggested that there was a possibility that some individuals tended to prefer this type of interaction, or that the content of the live streaming that Group 3 watched was more attracting and stimulated more interactions. However, with the current data, it was not enough to draw conclusion on this.

The table also showed that in Experiment group 4, time times of interactions between the two participants were less than the other 3 groups, and 13 (50%) of the interactions conducted were comment type, which meant that only one of the participants gave a comment or an instant reaction while the counterpart did not respond immediately. On the contrary, in the other three groups, the percentage of comment type interaction was 21.16% (Group 1), 26.83% (Group 2), 21.3%. As mentioned above, participants in Experiment group 4 used their laptops to watch the live streaming and used their phones for interacting with each other, which was different from the set-up of the other 3 groups. This might be the reason for the difference in interaction times. However, as the 4 experiment groups did not watched the same part of the concert and the participants' interactions were related to the content the participants watched. This might have caused the difference of interaction times in Experiment group 4 as well.

5.1.3 Analysis of Recordings of Experiment 2

The recording of the 3 experiment groups was studied and diagrams of their verbal interaction was listed as the following (Unit of the figures in the diagrams: second):

Group 1: The interaction recording of Group 1 covered 3 songs in the concert. The first one was from 35” to 188”; The second one was from 204” to 440”; The third one was from 460” to 673”. The interactions of the participant was listed until 600” (10 minutes). (figure 5.6)

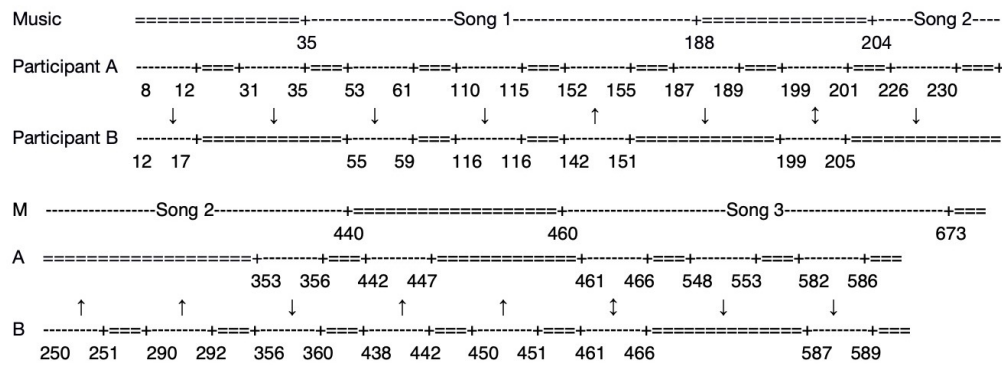


Figure 5.6 Diagram Experiment 2 Group 1

Group 2: The interaction recording of Group 2 covered 3 songs in the concert. The first one was from 25” to 237” ; The second one was from 272” to 486” ; The third one was from 517” to 720” . The interactions of the participant was listed until 600” (10 minutes). (figure 5.7)

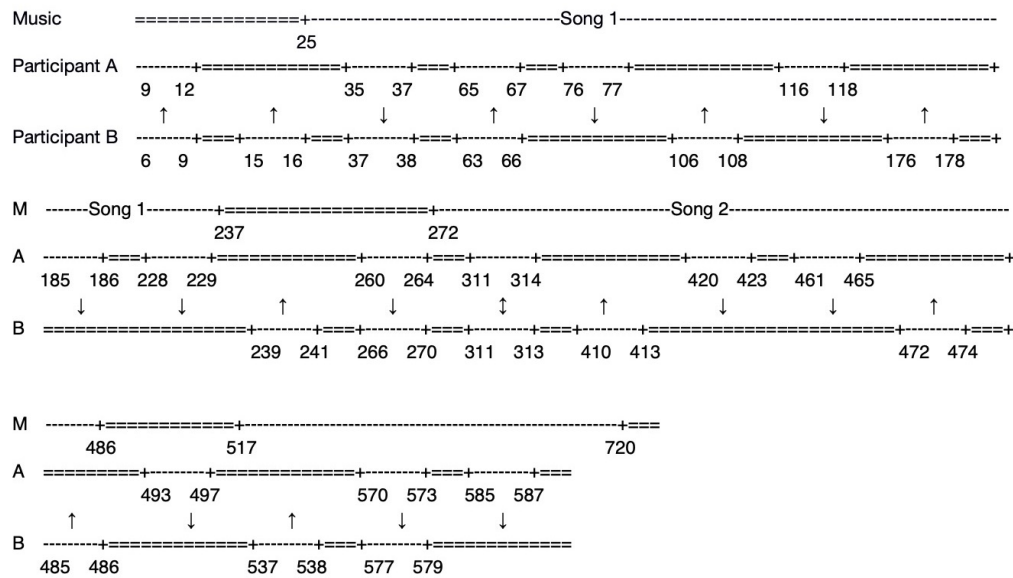


Figure 5.7 Diagram Experiment 2 Group 2

Group 3: The interaction recording of Group 3 covered 2 songs in the reality show. The first one was from 27” to 275” ; The second one was from 369” to 596” . The interactions of the participant was listed until 600” (10 minutes). (figure 5.8)

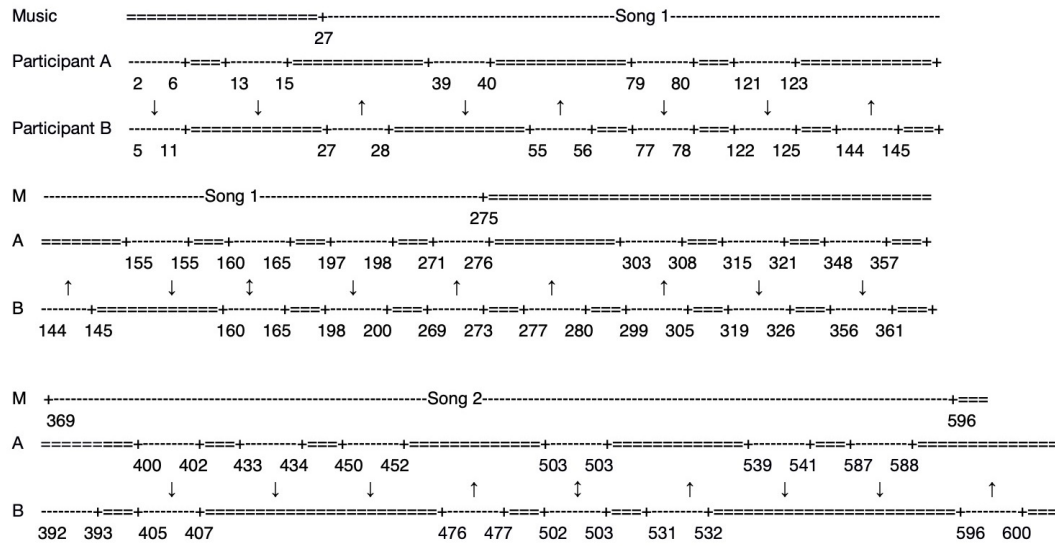


Figure 5.8 Diagram Experiment 2 Group 3

5.1.4 Analysis of the Result of Experiment 2

The diagrams suggested that the interactions conducted by the participants also occurred randomly during the experiment session, and the four types of interaction, namely dialogue type, overlapping type, comment type and simultaneous type, could be all found in the diagram.

The times and duration of interactions of each participant were as shown in the table below: (table 5.2)

Participant	Times	Interactions duration with 3 sec	Interactions duration more than 4 sec
Group 1 A	13	4	9
Group 1 B	12	5	7
Group 2 A	14	11	3
Group 2 B	14	13	1
Group 3 A	18	12	6
Group 3 B	19	12	7

Table 5.2 Times and duration of interactions of Experiment 2 participants

As the table showed, short verbal interactions (within 3 seconds) conducted by the participants was 63.33% of all the verbal interactions they made during the experiments. The percentage was still more than 50% but was lower than the result of Experiment 1. It could be seen that in Group 1 of Experiment 2, the times of long interaction (more than for 4 seconds) were more than the times of short interactions. From the table, it also could be seen that, compared to the participants of Experiment 1, Group 1 and Group 2 in Experiment 2 had less interaction times. Concerning the sample size and other related factors, within this research, there was not enough evidence to explain the reason behind the differences. However, it could be said that different types of concerts of other events might provoke different interaction frequency and pattern.

5.2. Evaluation

To evaluate the effect of the experiment, a questionnaire with 6 topics was sent to all the participants when their test was finished. An interview was also conducted with each participant.

5.2.1 Questionnaire Analysis

A questionnaire was distributed to all test participants of Action 1 and Action 2. The survey has 12 questions with 1 open question for comments. The results of the responses were as below:

- * Number of respondents: 14
- * Number of questions: 12
- * Date: November 2020

Awareness to the need for interaction:

78.6% (11/14) of the participants responded they were aware of the significance of interaction. The figure rose to 92.9% (13/14) after they participated in the test.

Bond and involvement:

All participants (14/14) agreed that they felt the bonds with their friends during the test. They also felt more involved with the live streaming event while they interacted with friends.

Relief from pressure and anxiety:

85.7 (12/14) replied that after the test, they would regard the communication and interaction during participating a online streaming concert or other virtual event together could partially relieve them from the pressure and anxiety under the current situation. 57.1% (8/14) thought this type of communication and interaction an effective way to maintain the relationship with friends.

Duration of interaction:

57.1% (8/14) answered that they continued the visual and audio interactions with their friends or used SNS as an alternative when the test was finished. Instead of watching the live streaming alone, they preferred being connected with friends.

Technical issues:

64.3% (9/14) replied that they did not experience Internet lagging, echo disruption or other major technical issues. They viewed the conditions of the test as acceptable. 14.3% (2/14) reported that lagging occurred during the test of their group. 21.45 (3/14) responded that the method used was acceptable for a test, but they did not feel comfortable with it.

Acceptance:

78.6% (11/14) answered that if time allows and the method becomes more convenient, they would like to utilize this method with friends on a frequent basis.

5.2.2 Interviews

Interviews were conducted with each participant of the test, 2 members from control group 1 and 2 from control group 2 of experiment 1 were also interviewed.

- * Interviewee: Mrs. S.H
- * Group: Group 1 in Experiment 1
- * Date: November 4, 2020

Mrs. H mentioned that this was the first time she participated in a live streaming of concert and the experience was better than her expectation.

She said that from her perspective, a live concert is not just about the performance itself, but also the expectation which became stronger and stronger as the day of the show approached, the things she did together with her friends during the entire process, the food they ate, the feeling they shared, and the memory they made during the whole journey. So she regarded that the online visual and audio interaction with a friend as a partial compensation to what was missing in a live streaming concert. She commented, “I was alone at home during the live streaming, if I watched the entire concert all by myself, I am afraid it would make me feel quite lonely.”

However, she said that for her it was still difficult to accept live streaming concert. For an in-person live concert, she would prepare uchiwa (cheer fan) and

choose her favorite dress. But for a live streaming, she did not have the motivation to do anything.

* Interviewee: Mrs. Y.H

* Group: Group 2 in Experiment 1

* Date: November 4, 2020

Mrs. H was staying in the United States this year. She said she originally planned to watch the concert all alone through the late night. She felt that the visual and audio interactions during the test shorten the distance between she and her friend and that between her and the event.

As Mrs. H introduced, as a big fan of the artists, she had participated several concerts. In year 2018, she traveled from Australia to Sapporo to join her friends to watch a concert. The concert was definitely important to her, but the common experiences with friends were also an indispensable part. Therefore, she said she enjoyed the visual and audio interaction with her friend during the testing, though it did not fulfill all her need for communication and interaction with friend through a live event.

Mrs. Y.H mentioned that the pandemic has interfered with her life from nearly all aspects. The virtual interactions during the test somehow relieved her from the current situation.

* Interviewee: Mrs. X.B

* Group: Group 3 in Experiment 1

* Date: November 4, 2020

When asked about her comment about the online video and audio interactions with her partner test participant, Mrs. B said that though it did not fully recreate what she usually experienced during a live event, it helped her to get connected with her friend during the live streaming concert.

She pointed out that without interactions and the real-time atmosphere, there would be no difference between watching a live streaming concert and playing a DVD. A live concert was always full of interactions and emotions. She enjoyed

cheering and singing together with friends during the live concerts. She would also share with them her feelings and emotions on the way back home.

She said that the online simultaneous visual and audio interactions with her friend enabled her to talk, smile and cheer with her friend. At times, she felt connected and empathized with each other.

* Interviewee: Mr. C.D

* Group: Group 1 in Experiment 2

* Date: November 25, 2020

Mr. D said that the experience of getting connected with friend through real-time visual and audio interactions while watching video brought something he had been looking for during the past few months.

As an international student in Europe, the pandemic has made him isolated from his family and friends for months. The time he spent on streaming platform increased a lot, but it did not really help him to feel relaxed. He said that the need for communication was strong, and the virtual interactions with friends while watching a video or an online streaming could serve as a good trigger to start a conversation.

However, he pointed out a point that since the sound of the video and the voice of his friend all came through the earphone, the interference was disturbing at times.

* Interviewee: Mrs. Y.G

* Group: Control Group 1 in Experiment 1

* Date: November 4, 2020

Mrs. G was among the 8 members of Control Group 1. She said that, in terms of interaction with friends, the experience of watching the live streaming together was much better than her expectation.

She recalled that during the steaming of the concert, the interactions among her and her friends were quite diverse and intensive. The fanlights and the cheers made them synchronized in behavior and emotion. They did not only watched the

concert together, but also shared stories of their memorable experiences related to the artists. From her perspective, the interactions with friends were stronger than what usually happened in an in-person event, because there were always concerns of not disrupting the other fans around.

“The fact that the big concert finally turned into a live streaming was frustrating”, she said, “but the experience of watching together with friends made it worthwhile and memorable. ”

* Interviewee: Mrs. S.L

* Group: Control Group 2 in Experiment 1

* Date: November 4, 2020

Mrs. L said that she was at work during the live streaming, so she was only able to watch the second half of the concert during her dinner time. She watched the concert alone through the screen of her cell phone. The experience was not quite exciting.

She said it was difficult for her to feel involved and the need for talking with some friends who had the same interest was strong. So she had a loose talk with a friend over SNS. The entire experience reminded her that the pandemic was still serious around the world and the time everything be back to normal was still uncertain.

As she said, the concert would not be memorable to her. 60% of the reason was that she was so busy that day and could not enjoy the whole concert at a cozy place. The left 40% was that there was no one with her so it was difficult for her to feel involved.

Chapter 6

Conclusion and Discussion

6.1. Research Summary

By observing the experiment participants interactions and analyzing the video recordings as well as collecting feedback through the participant's answers to the questionnaire and interviews, this research has come to some conclusions related to the questions raised in the first Chapter, which were how people value the interactions with friends and other close ones during a live event and probe the feasibility of recreating this type of interaction through a live streaming event.

Based on the questionnaire and interviews to the participants, the interactions among friends and other close ones was part of what they expect from attending a live event, and the experiment contributed to recreate the visual and audio interactions while the participants watched the same content simultaneously but remotely, which, as the participants stated, enhanced their bonds with friends and generated positive feelings. The analysis of the audio interaction diagrams of the participants showed that, for the participants of the experiments, the audio interactions they made were mainly featured by short duration.

6.2. Limitation of the Research

The way that the experiment was designed could be improved from some aspects, so as to probe the questions in a more systematic way. For example, the 4 groups in Experiment 1 did the experiment in a successive order. If the experiments with the 4 groups were conducted simultaneously, it could make the diagrams of the audio interactions suitable to analyze and compare the differences in interaction frequency and other factors in different group. It could also help to study the relation between the participants' interactions and the live streaming content. For example, if a certain moment in the streaming could provoke interactions in different groups. Moreover, the research chose recreating both visual and audio interactions together as the solution based on the result of the pre-survey.

However, the solution with only visual interactions and the one with only audio interactions should be studied as well and the effectiveness of these three solutions should be discussed and analyzed.

Also, the experiment in the research was not a complete simulation of the real situation. Firstly, in a real in-person live event, the number of a group of friends could be more than 2 individuals, the interaction frequency and pattern could be different from the result showed in the experiment.

Secondly, the interactions among friends and other close ones during a live event was related to the content they experienced. The experiment only covered live pop music concert. The intensity and pattern of interactions among friends in other genre of live events might be different from the result of the experiment.

Thirdly, the interactions among friends and other close ones during a live event was also influenced by the interactions between the individuals and the performers/athletes and that between the individuals and the whole audience(atmosphere). These types of interactions were excluded from the experiment of the research.

6.3. Suggestion for Future Work

As mentioned in the research limitation, the researcher suggested that experiment with other genres of live events should be conducted to probe the effectiveness of remote visual and audio interactions among friends and other close ones in different events and to study if the interaction patterns in different events vary from each other. For example, sports games that usually involved large number of spectators and intensive interactions should be further studied.

To further analyze the effect of remote visual and audio interactions among friends in a live streaming and the interaction patterns, the sample size should be scaled up and experiment with more than 2 participants in one group should be conducted. Concerning the differences in the diagrams of the audio interactions of the experiment participants, which was mentioned in Chapter 5, the researcher also suggested that similar experiment should be conducted with several groups of participants watching exactly the same content and the participants within one group should be tested with different contents, so as to make the data more comparable.

As the pandemic will continue to impact the live event industry, live streaming may serve as the major alternative to in-person event for the foreseeable future and it could be a game-changer of the industry. As new technologies would be applied to enrich the audience's interaction experience of attending online streaming event, it was worthwhile to probe the possibility of integrating remote visual and audio interactions among friends with other types of interactions that are expected for an in-person live event.

References

- [1] Pahayahay A and Khalili-Mahani N. What media helps, what media hurts: A mixed methods survey study of coping with covid-19 using the media repertoire framework and the appraisal theory of stress. *Journal of Medical Internet Research*, 22(8)(e20186), 2020.
- [2] Bas Grasmayer. So you want to be an internet dj / musician: 10 pieces of advice for the coronavirus era. *MUSIC x*, (<https://www.musicxtechxfuture.com/2020/03/16/so-you-want-to-be-an-internet-dj-musician-10-pieces-of-advice-for-the-coronavirus-era/>), 2020.
- [3] Hirschi Travis. *Causes of delinquency*. Los Angeles: University of California Press, 1969.
- [4] Katie Overy and Istvan Molnar-Szakacs. Being together in time: Musical experience and the mirror neuron system. *Music perception*, 26(5)(489-504), 2009.
- [5] Nils Lennart Wallin, Björn Merker, and Steven Brown. *The origins of music*. MIT Press, 2001.
- [6] Moïra Mikolajczak, James J Gross, Anthony Lane, Olivier Corneille, Philippe de Timary, and Olivier Luminet. Oxytocin makes people trusting, not gullible. *Psychological science*, 21(8)(1072-1074), 2010.
- [7] Kerry L Marsh, Michael J Richardson, and R C Schmidt. Social connection through joint action and interpersonal coordination. *Topics in Cognitive Science*, 1(2)(320-339), 2010.
- [8] Bronwyn Tarr, Jacques Launay, and Robin I. M. Dunbar. Music and social bonding: “self-other” merging and neurohormonal mechanisms. *Frontiers in psychology*, 5(1096), 2014.
- [9] Victoria Copans. What hybrid events can learn from the nba’s ‘virtual fan experience’. *Event Technology*, 2020.09.23.

Appendices

A. Pre-survey questionnaire

In light of the pandemic of COVID-19, live streaming has become the trend for the traditional live events, such as concerts and sports games. This research is attempted to discuss how people expect to interact with their friends and other close ones during a live event and how to bring the interactions back if people watch online streaming with friends remotely.

It would be really appreciated if you could spend several minutes to answer the following questions:

1.Is there any experience of going to a live event in the recent two years?				
Yes		No		
2.Through these experiences, do you prefer to go alone or with friends?				
Agree	Somewhat agree	Not sure	Somewhat disagree	Disagree
3.Is the interaction with friends during these experience important?				
Agree	Somewhat agree	Not sure	Somewhat disagree	Disagree
4.Is there any experience of watching online streaming of live events during the pandemic?				
Yes		No		
5.If you and your friend will have virtual interactions during a live event, what kind of mode do you prefer?				
Only with visual interactions		Only with audio interactions	With both visual and audio interactions	

B. Questionnaire to experiment participants

Thank you so much for participating the experiment related to remote visual and audio interaction with friends during live events. Please take a few minutes to answer the questions below.

1.Before the experiment, were you aware of the significance of interactions with friends during a live event?		
Agree	Not sure	Disagree
2.After the experiment, do you think the interactions with friends during a live event is important for the whole experience?		
Agree	Not sure	Disagree
3.Did you feel the bonds with your friend while participating the experiment together with each other?		
Agree	Not sure	Disagree
4.Did you feel more engaged in the live streaming while interacting with your friend?		
Agree	Not sure	Disagree
5.Do you think the interactions simulated in the experiment could help to relieve pressure and anxiety?		
Agree	Not sure	Disagree
6.Do you think the interactions simulated in the experiment could be an effective way to maintain relationship with friends?		
Agree	Not sure	Disagree
7.After the experiment, did your continued to interact with your counterpart while watching the remaining part of the live streaming?		
Yes		No
8.If your group continued the interactions, what platform was used?		
The same platform as was used in the experiment.		Some similar platform:.....
SNS messages:.....		Others:.....
9.Did you experienced any technical issues during the experiment?		
Internet lagging		Echo disruption
Other issues:.....		No issue experienced
10.Do you think the current framework is satisfactory in tern of fulfill the need to interact with friends remotely while watching the same streaming?		
Yes	Not satisfactory but acceptable for a testing	No
11.If time allows and the method becomes more convenient, do you want to communicate with your friends in this way in the future?		
Yes	Not sure	No
12.If in-person live events become accessible again, but online streaming will still be available for the same event that you want to attend, which one would you prefer mostly?		
Going to the event in-person		Watch online streaming
Depends on if the ticket is available		Not sure