Talk-Back and Talk-Together TV

-Service Concept and Possibility of User Acceptance-

視聴者発信ならびに視聴者体験共有テレビ ～サービスのコンセプトと可能性～

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Abstract Rapidly emerging IP-based broadband technologies allow multimedia communications between viewers and TV broadcasting stations as well as among viewers. Talk-back and Talk-together TV systems provide new forms of interactive broadcasting services and enhance the current experiences of TV viewing. We first defined Talk-back and Talk-together TV systems and then analyzed their possible service scenarios for extracting required system functionalities. Furthermore, we carried out a Talk-together TV system experimental study that examined user reactions to the Talk-together TV sessions on quiz and soccer programs by connecting the subject viewers with different communication media; none, text-only, audio, audiovisual, physically together. The results indicate that there are future possibilities of user acceptance for the new TV services that utilize bi-directional multimedia links among viewers.

Keywords : Talk-back TV, Talk-together TV, Broadcasting by use of telecommunication network, New service scenarios, Required functionalities, Subjective evaluation tests

1. Introduction

The traditional broadcasting system is a one-to-many system where the end viewers do not have much control about how the program is made or formed because there are only limited means or communication channels between the viewers and the broadcasting stations. In addition, the system has been very limited in supporting end users interactive services. Use of Telegong and the four buttons in digital TV broadcasting remote control are such examples. By contrast, in the radio broadcasting industry, audience can participate or give feedback by calling the radio stations over telephone and start or join a conversation in real-time. With the upcoming of the broadband technologies, a multimedia return channel from the user to the TV station can be implemented using IP network technology and such return channels open new possibilities to new television services; Talk-back TV and Talk-together TV¹⁾.

This paper discusses the service concept of Talk-back TV and Talk-together TV, analyzes the required functions and verifies the service possibility by carrying out subjective evaluation of experimental Talk-together TV sessions.

2. Background

The notion of Talk-back TV and Talk-together TV was first raised in DAVIC (Digital Audio-Visual Council)²⁾ by KPN in 1998^{3) 4)} as one of its candidate future work items. However, no further development of the notion was seen due to the closure of DAVIC in 1999. Considering the Talk-back TV and Talk-together TV would bring a new service in the broadband network environments, we have attempted to study its viability as detailed in this paper.

Talk-back TV allows the end users to feed information directly into the studio, the online content production process or the content server. The content is influenced or created based on the input of the end user (s). The system configuration for Talk-back TV is shown in **Fig.1** where the end terminals have direct access to the program provider center through the network system that is rapidly shifting to IP based.

On the other hand, Talk-together TV allows users to share the experience of enjoying the same content. It also allows users to enjoy multimedia content with friends or complete strangers in complete anonymity. **Fig.2** shows the basic system configuration for Talk-together TV. A virtual space is created and all participating terminals have access to the virtual space as a form of centralized multipoint communication⁵⁾. Within

Received Sep. 27, 2004; Revised Dec. 13, 2004; Accepted Jan. 14, 2005

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Fig.1 Talk-back TV system.

Fig.2 Talk-together TV system.

this virtual space, communications between terminals can be achieved and group discussion on specific issues can also be done. This scene could be utilized as a material for the broadcasting content. Furthermore, the end terminals may also reach other terminals directly through edge routers and achieve the effect of decentralized multipoint communication⁵⁾.

So far the use of IP network as return channels to the broadcasting station is limited to text. Use of e-mails as a feedback means is becoming daily and there has been a pioneering work on the use of Internet for exchanging text messages among event viewers⁶⁾. This can be deemed a type of Talk-together TV system. We also note a research on network architecture that would facilitate the Talk-back and Talk-together TV signal distribution by combining tree-type and mesh-type connections⁷⁾.

Since the Talk-back TV system covers the service capability of Talk-back TV system to a large extent, this paper focuses on the Talk-together TV hereafter.

3. Talk-Together TV System Scenarios

3.1 Methodology

Since Talk-together TV is a new service, we first tried to write down service scenarios on several specific application cases and compare the original service situation

Fig.3 Layers of participants.

without the use of communication network and the Talk-together TV situation⁸⁾. The objective was to identify required functionalities of the system. We took up the following cases that would be rich in information exchange among various layers of participants:

- (1) Family dinner
- (2) Casino roulette game
- (3) Horseracing
- (4) Educational program
- (5) Quiz game
- (6) Soccer game

Our analysis was on the layers of participants whose definition is given below and essential information exchanged among participants.

3.2 Layers of participants

We are interested in how people communicate and interact with other people in TV broadcasting and viewing. Based on eRENA project's model on layers of participants⁹⁾, a revised four layer model is created as in Fig.3 to match this study better.

Performers: The innermost layer describes the performers in the TV show, for example, hosts and actors. These roles typically have the fullest involvement in the show requiring the greatest commitment and the richest forms of expression.

Audience: The second layer is the audience. They are people who are participating in TV program at the place where the event is occurring. An audience member has direct contact with other audience members and performers because they are at the same place.

Inhabitants: The third layer is the inhabitants who are the on-line members of the public, connected to the

show through network. These people are able to reply back to the broadcasters either in real-time or non-real-time. The return message may be in image form or otherwise in speech or text form.

End Viewers: The outermost layer describes the viewers who experience the show through broadcast. Two kinds of end viewers have been categorized: Independent end viewers and networked end viewers with connections to other end viewers. Independent end viewers would be people who are simply watching the show without any interactions with anyone. On the other hand, the second kind would be people who are watching the show and making no interactions with the performers, audience, and inhabitants, but are interacting with other end viewers through network.

3.3 Soccer game case

As an example of the scenario analysis, we describe here the soccer game case. The space in the stadium is limited and not everyone can participate at the stadium at the same time. The Talk-together TV system solves this problem by allowing people to interact each other and with the stadium through the network.

(1) Original Scenario

The occurrence of a soccer game is announced beforehand and tickets are sold on a first-come-first-served basis. The number of tickets sold will be the number of seats in the stadium. When the people who want to buy the tickets are more than the number of seats available, people who could not get a ticket will watch the game at home or at a sports bar where there is live broadcasting of the game. This situation is shown in **Fig.4 (a)**.

(2) Talk-together TV Scenario

With the implementation of Talk-together TV system, a group of people connected each other through a server can exchange each other's comments or feelings. Some groups can also connect to the stadium and interact with the people on-site in real-time. Furthermore, as an indication of presence of the online participants, screens or displays are provided at the stadium. This way, people who are at the stadium will also know who is watching the game at the same time. Many other end viewers are independent. This situation is shown in **Fig.4 (b)**.

(3) Identifying layers of participants

This use case identifies the layers of participants as in **Table 1**.

(4) Information flow between participants within a layer and across layers of the participant

A summary is given in **Table 2**. It is noted that in this scenario, the essential information exchanged is the

(a) Original scenario

(b) Talk-together TV scenario

Fig.4 Soccer game case.

Table 1 Layers of participants in the soccer game Talk-together TV session.

Layer	Participant
Performers	Players
Audience	Audience
Inhabitants	Viewer 1, 2
Networked End Viewers	Viewer 3, 4
Independent End Viewers	Viewer 5

Table 2 Information exchanged in the soccer game Talk-together TV session.

Type	Information
Control	<ul style="list-style-type: none"> Booking of Talk-together TV session by the organizer Subscription by the participant Opening the session Logging in or out by the participant
Audio	<ul style="list-style-type: none"> Sound of the TV program Voices and surrounding sounds from all the participants
Video	<ul style="list-style-type: none"> Pictures of the TV program Picture of all the participants (mixed, switched, or combination of both methods)
Data	<ul style="list-style-type: none"> Indication of the current participants

emotions and feelings of the viewers which are often expressed through shouting, singing, and screaming in addition to words or full sentences.

3.4 Required communication functions

By assessing the scenario analysis results of six cases in Section 3.1, we derived the functions in **Table 3** as

Table 3 List of identified functionalities for the Talk-together TV session.

Phase		Functionalities
		<ul style="list-style-type: none"> • Essential (required in all the use cases) ✓ Optional (required in some use cases)
Before the Session		<ul style="list-style-type: none"> • Announcement of Talk-together TV Session • Opening the session ✓ Booking a Talk-together TV Session ✓ Registration of participants (Inhabitants) ✓ Registration of participants (End Viewers) ✓ Identification of "surrounding" participants for each viewer (Identifying people to talk with) ✓ Identification of participating or signed up members for the event
During the Session		<ul style="list-style-type: none"> • Broadcasting of audiovisual program from the broadcaster to all viewers • Registration / deregistration of participation • Presence indication of session participants • Exchanging audiovisual, audio or text information among Talk-together TV session participants ✓ Indication and collection of viewers' reaction in simple form such as thumbs-up or down ✓ Indication and collection of individual records or score and total record or score
After the Session		<ul style="list-style-type: none"> • Closing the session • Clearing down all connections among participants • Exchanging audiovisual, audio or text information among the Talk-together TV session participants

required for the Talk-together TV system. Some are marked optional with *.

4. User reactions to the experimental Talk-together TV system

4.1 Experimental Talk-together TV system

To verify the service concept of the Talk-together TV, we created an experimental Talk-together TV system that uses currently available communication media to carry out a set of subjective evaluation tests. Although there are many other psychological researches done on each tool¹⁰⁾, those studies focus on the effectiveness and efficiency of the communication tools. This study focuses on people's preferences of the media while watching television, where the television is the main source of information and the communication media are secondary source of information.

Fig.5 shows the configuration of the experimental Talk-together TV system. TV broadcasting programs are distributed by using an analog audiovisual distributor while an H.323 multipoint videoconferencing system⁵⁾ is connected to a LAN. PCs for text chat are connected to a service provider's server through the Internet.

We set up four separate terminals as shown in **Fig.6**, each of which is used by a subject viewer. Their differences are just due to equipment availability, not intentional.

Fig.5 System configuration of experimental Talk-together TV system.

4.2 Communication tools to be compared

The following five communication tools that connect separate viewers were experimented for comparison:

- (1) Alone: Each viewer watches a TV program by himself or herself, with no communication means at all with other people.
- (2) Text-based communication: Each viewer watches TV program by himself or herself but chats with other viewers using chat-room on the Internet.
- (3) Audio-only communication: Each viewer watches TV program by himself or herself but communicates with other viewers using microphone and loud speaker. This was achieved by shutting off video of the H.323 multipoint videoconferencing system.
- (4) Audio-visual communication: Each viewer watches TV program by himself or herself but communicates with other viewers using the H.323 videoconferencing system.
- (5) Together: Four viewers watch a TV program together physically at the same place.

4.3 Subjective tests

4.3.1 Purpose

We intended to obtain answers to the following questions by carrying out the set of subjective tests:

- (1) Does the notion of Talk-together TV ever have possibility of being accepted by the user?
- (2) How does the media difference of the communication channel among viewers affect the user satisfaction in the Talk-together TV system?
- (3) Can we confirm the required functionalities identified in the scenario analysis?
- (4) Are there any hints for the practical Talk-together

Fig.6 Look of the terminals.

TV system?

4.3.2 Subject viewers

There were 20 subject viewers in this study. All of them were graduate students of the same school of Waseda University, 16 were male and 4 were female at age of 20's. They were majoring in a variety of fields; information technology, multimedia arts and socio-economics. Their nationalities were also varied. Our assumption was that they formed a sample of ordinary television viewers.

An experimental study group consisting of four subject viewers carried out a set of experiments at a time. They knew each other, but the closeness among the four was not considered for the grouping.

4.3.3 TV Program contents

To ensure communication flow among participants, content was an important factor in this experiment. Quiz game and soccer game were chosen as television contents here. We assumed that all the subject viewers were commonly interested in these two contents, hence individual interests of the subject viewers were not considered for the choice of subject viewers.

Quiz games were "Who wants to be a millionaire" broadcasted by Fuji Television, while soccer games were of the Japan national team playing foreign national teams. Both were pre-recorded materials. We selected five different scenes for each type of content, hence used 10 different scenes in total. For the quiz content, a game

of particular contender running 18-20 minutes was selected as a scene. For the soccer content, a play of 10 minutes, 6 minutes before and 4 minutes after a goal, was selected as a scene.

4.3.4 Number and Order of Sessions

There were a total of 10 sessions per one experimental study group from the combination of the five communication tools and the two program contents. Combination of the tool and the content scene for each session and the presentation order of the 10 sessions were randomized for each study group.

4.3.5 Questionnaires

After each session, the subject viewers were asked to answer the questionnaire. There are three kinds of questionnaire. Questionnaire A was for sessions when subject viewers watch the program alone without any communication media. Questionnaire B was used for all other sessions. Questionnaire C addressing overall aspects was answered at the very end of the experiment. The subject viewers were required to rate each question on a continuous scale from -2 to +2. Actual questions in these three questionnaires are listed in Appendix.

4.4 Experimental results

4.4.1 Mean opinion scores and their relevance to communication tools and program contents

The mean scores of each communication tool depending on the contents are graphed in **Fig.7**. Note that

Fig.7 Summary of mean scores for each session.

Table 4 Result of two factor analysis of variance.

Significance:

** significant at 1% level, * significant at 5% level

Question # (Questionnaire)	Tool	Content	Cross term Tool x Content
1 (A & B)	**	**	
2 (A & B)	**	*	
3 (A & B)	**		
4 (A & B)	**		
5 (A)			
5 (B)	**		
6 (A) & 14 (B)	**	*	
6 (B)	**		
7 (B)	**		
8 (B)	**	*	
9 (B)	**		
10 (B)	**		
11 (B)	**		
12 (B)	**		
1 (C)	**		

"Question 5*" represents that Question 5 of Questionnaire A is different from Question 5 of Questionnaire B, "Question 6|14" represents Question 5 of Questionnaire A which is identical to Question 14 of Questionnaire B, and "Question 6 (B)" is concerned with only Questionnaire B.

Table 4 shows the result of two factor (communication tool and program content) analysis of variance for each question. We can see that the differences between the communication tools for all the questions except for 5 (A) are significant at 1% level. For the differences between the two contents, only Question 1 is significant at 1% level. Questions 2, 8, and 6|14 are significant at 5% level. It is noted that other questions are rather independent of the content. As for the interaction between the tools and contents, we cannot conclude that the

Fig.8 Results of Question 6|14 from Questionnaires A and B "As a whole, did you enjoy the TV program under this environmental setting?"

Fig.9 Results of Question 1 from Questionnaire C "Please rank the methods of TV program watching in the order of your preference from 1 to 5 where 1 being most preferable and 5 being least preferable."

interactions are significant at either 1% or 5% level for all the questions.

4.4.2 Overall evaluations

As a summary of the user reactions to the experimental Talk-together TV system, Fig.8 shows mean opinion scores for Question 6 of Questionnaire A and Question 14 of Questionnaire B "As a whole, did you enjoy the TV program under this environmental setting?"

Fig.9 shows the results for Question 1 of Questionnaire C "Please rank the methods of TV program watching in the order of your preference from 1 to 5 where 1 being most preferable and 5 being least preferable."

We can see that the communication tools were evaluated in a similar way in these two questions in the order of preference.

Looking at this ranking, it can be concluded that the subject viewers prefer communication media that has high level of richness in multimedia over communication media that has low level of richness in multimedia and watching TV alone. However, it is noted that the evalua-

tion of Audiovisual is still significantly lower than that of Together.

Also, the subject viewers preferred the quiz game content to the soccer game content in this experiment as also seen in the responses to Question 1. Since the content significantly affected the system evaluation in some questions, we need be careful about the choice of TV programs for the experiment.

4.4.3 Comments from the subject viewers and observations

Here are listed major responses of the subject viewers to Question 2 of Questionnaire C and experimenter's observations obtained during the experiments:

- (1) the subject viewers enjoyed the experience of using the Talk-together TV system.
- (2) Before the sessions started, subject viewers had been somewhat negative to needs for the system like Talk-back TV and Talk-together TV. But, after experiencing different kinds of communication tools, the subject viewers were surprised to find themselves wanting to use such systems. This result was especially obvious after the alone session.
- (3) There were some concerns with the program content since some people showed no interest in the chosen program against our expectation. Two out of 20 expressed no interest in the soccer game in response to Questionnaire C. The communication and interaction between the subject viewers were minimal in such a study group. And it is important for the subject viewers to have common interests.
- (4) If the programs are broadcasted in real-time, it is clear that the subject viewers would interact and communicate more especially for the soccer game program.
- (5) During the sessions, the subject viewers felt some discomfort and ineffectiveness towards the communication tools; difficulty of typing during program viewing for the text based system and difficulty of conversation due to the delay for audio or audiovisual systems.

In the course of setting up the experimental system and also collecting comments from the subject viewers, we noticed the following work items needing further considerations:

- (6) Audio system configuration

As there are two sources of sound, broadcasting TV and videoconferencing, and we are using open microphone - loud speakers (one for TV program, another for conversation among participants), we

need carefully set the sound level and microphone placement to avoid the TV program sounds being caught by the videoconferencing microphone and reproduced through the videoconferencing loud speaker with the videoconferencing system delay. In this experiment, the TV program analog distribution incurs no delay, hence the sound from the videoconferencing loud speaker is recognized as echoes of the TV program sound.

- (7) Video displays

In this experiment, two separate displays were used, one for the TV program, the other for the image of participants mixed at the MCU (Multipoint Control Unit). It would be more convenient if one display shows both the TV program and participants of the Talk-together TV session. The conventional TV display is limited in number of pels for displaying two type of pictures in full resolution. Use of a high resolution panel display will give us an opportunity.

4.4.4 Verification of required functionalities

According to the responses to Question 3 of Questionnaire C, we could verify that the required functionalities in Table 3, which were extracted from the scenario analysis, covers essential ones.

5. Conclusion

The results in this study indicate that being able to communicate or interact with other people while watching television would enhance people's experience of television viewing. People do have the desire to share their feelings or emotions when watching the program. From this, we can conclude that there are future possibilities and acceptance for the Talk-together TV system.

In addition, people prefer using communication media that is high in level of richness in multimedia over other communication media. The ranking from the types of tools is together, audiovisual, audio, text-based and, lastly, alone. At this point, the Talk-back TV system and Talk-together TV system are still at the early stage of research and development. There are yet many remaining issues and possible research areas such as user interface, transmission technology, quality control.

Particularly, looking at the results of the study, we recognize that there is a gap between using a multimedia tool for communication and actually being together at the same place at the same time. This indicates that there is still a need for improvement in current communication technologies and user interfaces to minimize the gap. We

observe that minimizing the round trip delay incurred by the video coding and transmission over IP networks is one of the major issues for the Talk-together system where conversation among viewers is involved.

Another remaining study item is the reaction of different category of viewers. In this study graduate students participated in the subjective experiments. Though they are deemed representative of ordinary viewers, we need to study further if this is sure. Particularly reactions to the Talk-together TV system from a group of anonymous people would be interesting since public viewing of the sports game is widely enjoyed in the "together" situation. It would be also an interesting study item to observe in a more microscopic way by what communication element the feeling of sharing the viewing experience is created.

Finally, We would like to thank the subject viewers who participated in the experimental Talk-together TV sessions as well as the reviewers of this paper who kindly provided helpful comments. We also appreciate the support of NICT (National Institute of Information and Communications Technology) for this study that was carried out as part of its R&D project "Broadcasting by use of telecommunication networks."

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[Appendix Questions in the three questionnaires]

Questionnaire A

- (1) Did you enjoy the TV program?
- (2) Were you comfortable with this way of watching TV?
- (3) Did you feel that you were watching the program together with someone else?
- (4) Did you have the desire to tell someone else your emotions or to share your emotions with someone else?
- (5) If you were able to communicate with other people, do you think it would enhance your experience of watching the TV program?
- (6) As a whole, did you enjoy the TV program under this environmental setting?

Questionnaire B

- (1) - (4) The same as (1) - (4) in Questionnaire A.
- (5) Were you able to communicate with other participants? Did you have the chance to talk to someone else?
- (6) Were you comfortable using the tool for communication?
- (7) Please evaluate the effectiveness of the communication tool.
- (8) Did interacting with other participants enhance the experience or increase the enjoyment of watching TV?
- (9) Were your emotions, thoughts, knowledge or information clearly made to your opponents?
- (10) Were you able to understand your opponents' emotions, thoughts, knowledge or information?
- (11) Did you get some responses to your expression for others?
- (12) Were you satisfied with the responses?
- (13) Please circle any activity or activities you did during the session. Please describe any other activities that are not listed. (Clap, high-fives, make body contacts with other participants, shout, scream, jump, sing, smile, laugh and others).
- (14) The same as (6) in Questionnaire A

Questionnaire C

- (1) Please rank the methods of TV program watching in the order of your preference from 1 to 5 where 1 being most preferable and 5 being least preferable.
- (2) Do you want to use the Talk-together TV system if

it is made available?

- (3) Please mark any function or functions that can improve the performance of the experimental Talk-together TV system that you have just experienced. Please describe the function if it is not indicated.
- (a) More participants (friends only)
 - (b) More participants (including strangers)
 - (c) Able to select your opponents, either friends or strangers (switching to another person immediately)
 - (d) Able to communicate and interact with the studio in real-time
 - (e) Able to communicate with professionals directly
 - (f) Able to see the status of remote participants (available, busy, away, etc.)
 - (g) Others
- (4) Please describe any comments on the Talk-together TV concept, the experimental system, the evaluation method, etc.

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