Comparison of Mental Time of Older Adults during Conversations Supported by Coimagination Method and Coimagination Method with Expedition

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Abstract

As countermeasure for preventing dementia of aging population, coimagination method has been developed. The coimagination method helps participants in utilizing brain cognitive functions of maintaining recent episodic memorization, retention and recall by the process of conversations. Hence, the risk of older adults in getting into mild cognitive impairment (MCI), which is a previous stage of dementia caused by disuse of brain cognitive functions, will decline. However, we observed situations of some older adults that recent episodic memory functions were not activated as expected. Such situations are older adults who talk about knowledge rather than episodic memories or older adults who talk about past experiences rather than recent experiences. Therefore, a novel coimagination program named coimagination method with expedition was developed to solve these situations. By adding expedition in a sightseeing area before the coimagination method, older adults have the opportunity to find topic of conversations through expedition. During conversation supported by the coimagination method, older adults are expected to recall their episodic memories in expedition and talk about it. The purpose of this research is to verify the effect of the coimagination method with expedition in older adults, by comparing mental time of older adults in the coimagination methods with and without expedition. Firstly, we estimate the mental time of older adults by analyzing their utterances during conversations supported by both coimagination methods. The past, present and future mental times of participants are enumerated in percentage. Secondly, we study the mental time travelling of participants during conversations. Finally, we study the transition points of mental time to find tendency of participants to talk about recent experiences. In this research, the analytical results validate the effectiveness of helping older adults to talk about recent episodic memories during conversation supported by the coimagination method with expedition compared to the coimagination method.

Introduction

Demographic aging shows that aging population of the world is increasing rapidly. Along with it, number of people with dementia is also increasing. The World Alzheimer Report 2015 updates that nowadays, over 46 million people worldwide living with dementia, the number is estimated to be doubled every 20 years. Therefore, by 2050, this number is anticipated to increase to 131.5 million. People living with dementia have the symptoms of decline in cognitive functions in brain, which may causes difficulties in carrying out normal daily life. Hence, prevention of dementia has become one of the challenges of society to having healthy and happy life in future.

The World Alzheimer Report 2011 shows effectiveness in improving cognitive functions and quality of life of people when interventions in early stages of dementia are started earlier. Reminiscence or life review suggests older adult to talk about their past experiences is known as an effective method to enhance psychological well-being in older adults (Bohlmeijer 2007). The coimagination method was proposed by Otake to train brain cognitive functions in order to reduce the risk of getting into mild cognitive impairment (MCI), which is a previous stage of dementia caused by disuse of cognitive functions of episodic memory, divided attention and planning (Otake 2009). During conversation supported by the coimagination method, participants talk about their experiences based on photos provided by themselves, within designated time limit and theme. In the processes such as taking photo of recent experiences and maintaining the episodic memories until the day of conversation, older adults are expected to activate their cognitive functions of episodic memory, retention of memory and recall of memories. However, we observed situations that recent episodic memory functions were not activated as expected. Such situations were classified into two as follows: (1) One that older adults were

talking about their knowledge rather than their experiences; (2) One that older adults were talking about past experiences that happened long time ago instead of recent experiences.

As a countermeasure in response to situations stated above, the coimagination method with expedition was developed by adding an expedition in a sightseeing area before the coimagination method being carried out. In this method, the participants are recommended to talk about their new experiences through expedition which is considered as recent episodic memories. This method also helps participants to find topic of conversations easily. Hence, compared with the coimagination method, the coimagination method with expedition is expected to promote participant to talk about recent experiences.

Utterance is the mean that people uses to express the thoughts. Thus, we can estimate mental time and activated memory functions of a speaker by analyzing utterances (Onoda 2015) (Otuki 2015). Mental time is the time consciousness of people over present, past and future. Episodic memory is the memory of one's experiences while semantic memory is the memory of general knowledge and information (Tulving 1993). In this research, we focus in analyzing and evaluating mental time of participants during conversations supported by the coimagination method and the coimagination method with expedition.

Related research

Mental time travelling

Mental time is conscious awareness of subjective time, for past, present and future. In 1980s, Endel Tulving (Tulving 2002) (Nyberg 2010) suggested that mental time travelling is a high-level cognitive function, uniquely for human. This brain ability is also known as Chronesthesia, allows human to travel mentally into "nonpresent" time. For examples, human mentally travels backward in time when thinking about past experiences or human mentally travels forward in time when imagining future.

Language is a tool that human use to talk about event's representation including temporal perspective of individuals. Some studies show that mental time travelling is represented in language (Ferentti 2013). For example, Reichenbach had proposed tensed utterances consist 3 "time points" which are event, speech and reference time (Reichenbach 1947). Hence, listeners can understand the representation of event talked by speakers using these three "time points". The indicators of timing is different depend on languages. For examples, in English language, tense of utterances are used; in Chinese language, adverbs such as tomorrow and next week and so on are used (Corballis 2009). In this paper, we evaluate the mental time by analyzing utterances of participants in Japanese language based on tense and keywords related to timing.

Coimagination method and coimagination method with expedition

Coimagination method is a method of group conversation based on photos, with designated time limit and theme. There are two sessions in this method. First half is a topic providing session where each participant talk about photo that they took within allocated time; second half is a question-and-answer session where each speakers and the original speakers are given chance to answer to the questions or to give comment. This method is designed to train cognitive functions of older adults and to reduce the risk of getting into mild cognitive impairment (MCI). Figure 1 shows the scene during conversation supported by the coimagination method. A group of participants are seated in a line surrounding the screen. The photos provided by participants and allocated time are displayed on the screen. The photo helps participants recalling memories, while allocated time helps participants becoming aware of time limit for talking.

Coimagination method with expedition is an innovated coimagination program (Otake 2015). In this method, before conversation supported by the coimagination method, participants have an expedition in some sightseeing area. The scene of expedition is shown in Figure 2. During expedition, participants encounter new things and take photos which are interesting. After the expedition, conversation supported by the coimagination method is carried out and participants are recommended to talk about their recent experiences during expedition.

Figure 1 Scene of Conversation Supported by Coimagination Method

Figure 2 Scene of Expedition in Asuke Old Town

Analytical Method

Conversation Data for Analysis

In this research, two conversation data were extracted from conversations supported by the coimagination method and the coimagination method with expedition. For the purpose of eliminating the possibility of mental time of individual being affected by other participants, only the utterances of topic providing session were extracted.

First data was extracted from conversation supported by the coimagination method among five older adults. They are named A, B, C, D and E. Five participants talked about the photo that they took in their daily life.

Second data was extracted from conversation supported by the coimagination method with expedition among five older adults, who are named F, G, H, I and J. Five participants explored in Asuke Old Town which is located in Aichi Prefecture, Japan before conversation supported by the coimagination method was carried out. Then, they were requested to talk about the photos that they took during expedition.

In order to compare mental time of older adults during conversations supported by the coimagination method with and without expedition, both conversations were carried out with same designated theme and same allocated time. The designated theme was "Small Discovery" and each participant was given 1 minute to talk about the provided photo. The average age of all participants is over 60s.

Analytical Procedure

Evaluation of mental time is based on conversation analysis. The conversation data were transcribed text of utterances of participants during topic providing session. We analyzed the utterances using software named iCorpus Studio (Kijima 2007), which is software for annotating time series data.

In this research, we classify the mental time into past, present and future using the time axis shown in Figure 3. Hereby, the person in the figure is an indicator of time of utterances during conversation. The coloured region represents present mental time. The duration of this region depend on photographing time of photo provided by participants on the assumption that it was taken recently. In the coimagination method, participants are requested to take photo of their recent experiences in daily life. In the coimagination method with expedition, the participants are requested to provide photo related to expedition. The utterances related to event haven't happen is classified as future.

Since the conversations were carried out in Japanese language, the classification criteria of utterances are based on grammar of Japanese language.

(1) The grammatical tense in Japanese language makes a two-way inflectional contrast between past and nonpast (O'Grady 2001). There is no distinction to represent future tense. Hereby, we classify the mental time of utterances as future with the help of words such as will or next week.

(2) We estimate the mental time of utterances using tense of verb on the assumption that tense of verb is not functioning as adjective.

(3) We estimate the mental time of utterances based on nouns in utterances which are related to time such as next week, tomorrow, some historical nouns and so on. If there are sentences without nouns and tense related to time, sentences are estimated based on the previous and next sentences.

(4) We classify the mental time of utterances about habit or description of event as present.

Based on the classification criteria shown above, we estimate the mental time of participants. In table 1, we show some examples of classification of utterances.
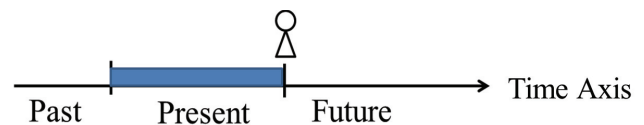

Figure 3 Time Axis during Conversation Supported by the Coimagination Method

Table 1 Example of Classification of Utterances

Utterances	Classification
Every morning, I read newspaper before going to work.	Present
Ten years ago, I met my wife during my trip to Kanazawa.	Past
Tomorrow I will attend the wedding of my daughter in Tokyo.	Future

Analytical Results of Conversation Data during Topic Providing Session

Figure 4 and Figure 5 show the percentage of estimated mental time for each participant. The percentages were calculated based on the duration of utterances reflecting mental time of past, present and future in 1 minute topic providing session. Figure 6 and Figure 7 show the mental time travelling graph that representing transition of mental time of participants during conversations.

Result of the Coimagination Method

Figure 4 shows the analytical result of conversation data of the coimagination method. Four out of five participants mentally travelled backward in time during topic providing session supported by the coimagination method. The past mental time of participant A and B exceeded 50 %.
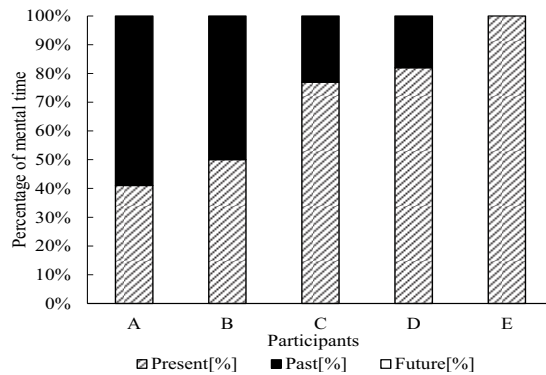

Figure 4 Percentage of Mental Time of Participants during Conversation Supported by the Coimagination Method

Result of the coimagination method with expedition

Figure 5 shows the analytical result of conversation data of the coimagination method with expedition. Although two out of five participants mentally travelled backward in time during conversation, percentages of present mental time of both participants were more than 80%.
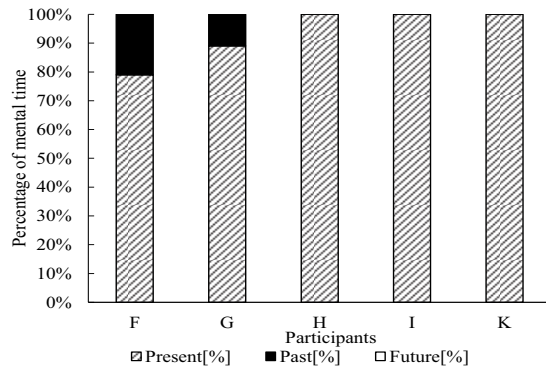

Figure 5 Percentage of Mental Time of Participants during Conversation Supported by Coimagination Method with Expedition

Mental time travelling graph of participants

We show typical time series data of mental time travelling during topic providing session of conversations. One is a data of participant A, who participated in the conversation supported by the coimagination method. Another is a data of participant F, who participated in the conversation supported by the coimagination method with expedition.

Figure 6 shows the mental time of participant A, which travelled from present to past in the middle of the talk, and remained past mental time until the end of topic providing session. Participant A mentally travelled backward in time, when she talked about her discoveries when visiting Tokyo station one year ago. She immersed in talking about her past experiences, exceeding the allocated time.

Figure 7 shows the mental time of participant F, which travelled to past in the middle of topic providing session, only continued for 10 seconds before returning to present. The utterance of participant F was mainly about comparison between past and current situation of street in Asuke Old Town. Her mental time travelled backward in time when she talked about the shop along the street in the past. Then, her mental time returned to present when she talked about present situation of the street.

In Figure 6 and Figure 7, mental times are shown as past: -1, present: 0 and future: 1.
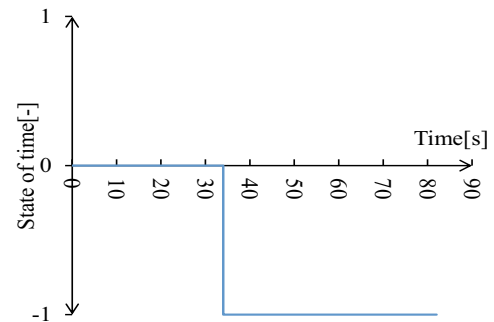

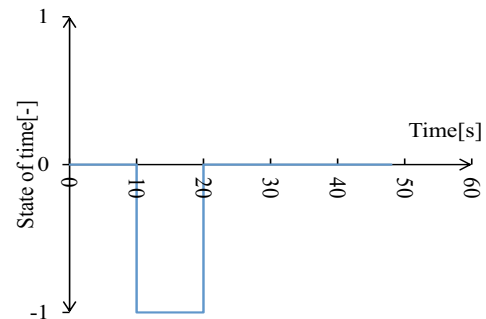*Figure 6 Mental Time Travelling of Participant A during Conversation Supported by the Coimagination Method*

Figure 7 Mental Time Travelling of Participant F during Conversation Supported by the Coimagination Method with Expedition

Transition points of mental time of participants

Six out of ten participants showed mental time travelling from present to past or past to present during topic providing session of the coimagination method with and without expedition. The participants were A, B, C, D, F and G. All of these six participants mentally travelled backward in time instead of travelling forward into future. Based on the utterances of participant, we classify the utterances in Table 2.

Table 2 Classification of Utterances which Changed Mental Time of Participants

Participant	Present to Past	Past to Present
A	Talking about past discoveries	-
B	Talking about history(past knowledge)	Aware of ending time of topic providing session
C	Talking about past experiences	Talking about present perspective about the same topic
D	Talking about past experiences	Talking about things which can be seen from the photo
F	Comparing the previous and present situation of places	Talking about experiences during expedition
G	Talking about past experiences	Talking about experiences during expedition

Discussions

In order to examine the utilization of recent episodic memory functions of older adults during conversations supported by the coimagination method and the coimagination method with expedition, the purpose of this research is to compare mental time of older adults in both conversation methods.

In both coimagination methods, we found that mental times of some participants were past. They were mentally travelling backward in time during conversations. In general, older adults have tendency to mentally travel backward in time.

By comparing percentage of mental time of participants in both conversation data, we found that overall percentage of present mental time during conversation supported by the coimagination method with expedition is higher. Hence, this shows that older adults tend to talk more about recent experiences after participating in expedition.

In conversation supported by the coimagination method, we found that some participants talk about knowledge rather than experiences. Although mental time of participant E remained present, most of his utterances was about knowledge such as way to park car or motorbike in a parking slot, which is classified as semantic memory. Mental time of participant B travelled backward in time when he talked about history, which is also classified as semantic memory. This shows that some older adults incline to talk about semantic contents in conversation supported by the coimagination method.

During conversation supported by the coimagination method with expedition, we found that two participants, participants F and G mentally return to present time when sharing their experiences during expedition by analyzing transition points of mental time of participants. This shows that expedition before the coimagination method helps older adults to talk about recent episodic memory.

We found that photo provided by participants plays an important role in maintaining or returning to present mental time. This is because photo helps participants to recall recent memory during conversation when the photo is taken recently. However, some of the participants, such as participant A, provided old photo related to the designated theme during conversation supported by the coimagination method. When she looked at the photo, she started to recall her past memories, which did not activate recent episodic memory functions. In contrast, in the coimagination method with expedition, all photos were taken recently so it helps to reduce the possibility of older adults in talking about past experiences.

During conversation supported by the coimagination method, the display of allocated time on the screen also plays a role in helping participant to return their mental time back to present mental time. Mental time of participant B returned to present when he realized the end of allocated time for topic providing session.

Based on results and discussions above, we suggest that the coimagination method with expedition helps participants to utilize recent episodic memory functions.

Conclusion

In this paper, we compared the mental time of participants during group conversations supported by the coimagination method and the coimagination method with expedition. The purpose is to support older adults thinking about present rather than past, remembering recent experiences rather than past experiences so as to activate recent episodic memory functions. Recent episodic memory function is one of the cognitive functions which declines at mild cognitive impairment and early stage of dementia. We prompt older adults to train cognitive functions through these supported group conversation.

The conclusion of this research is summarized as:

- The coimagination method with expedition helps older adults to talk about recent episodic memories compared with the coimagination method.
- Photographing time of the photos provided by participants should be recent. The photos provided by participants are displayed on the screen during conversations where the participants are supposed to talk about related episodes of the photos. The participants tend to talk about recent experiences when photographing time is recent.
- The display of allocated time on the screen is important to help returning mental time of older adults to present when they immersed in talking about past experiences or knowledges.

Future work of this research includes verifying the tendency of mental time transition due to individual differences and designing detailed criteria in estimating mental time and utilized memory functions by analyzing utterances based on theory in linguistics. In order to compare, we will carry out pairs of group conversation sessions supported by the coimagination method with and without expedition to the same participants. Then, we estimate the mental time and utilized memory functions through analyzing the utterances of participants.

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