Application of Recent Episodic Memory Function for Preparing and Presenting Topics of Group Conversation Supported by Coimagination Method

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Abstract

There is not much evaluation technique of coimagination method, which is one of the group conversation techniques have been proposed for the purpose of cognitive function training. As one of the indicator of usefulness of cognitive function training, episodic memory is usable. Therefore we have proposed an analytical method for measuring the utilization of episodic memory in coimaginaiton method. Thereafter, We conducted the experiment of group conversation base on walking around in order to give the common experience to the participants, and analyzed the results by the proposed method. In consequence, it is revealed the occurrence of past episodic memory. Furthermore, it indicates individual difference of episodic memory utilization quantitatively in terms of memory taxonomy.

1. Introduction

Japan have been facing a super aging society, along with it, the number of dementia patients has be also increasing. Prevention of dementia is a crucial issue in this super aging society consequently. The causes of dementia are divided into genetic factors and cognitive factors. To prevent dementia by reducing the cognitive factors, intellectual activities (Ball, Berch, & Helmers et al., 2000) and the development of social network (Fratigltioni, Wang, Ericsson, Maytan, & Winkled, 2000; Crooks, Lubben, Petitti, & Chiu, 2008) have been reported to be effective. It is hypothesis that the activation of three cognitive functions that decline in mild cognitive impairment (MCI) is effective for the prevention of dementia (RentZ & Weintraub, 200; Barberger-Gateau, Fabrigoule, & Rouch et al., 1999) these cognitive function include episodic memory, division of attention, and planning functions. Based in this hypothesis, Otake proposed the Coimagination Method, which is the method of prevention of dementia throughout conversation to activate these three cognitive functions (Otake,

2009). A series of trials of implementing coimagination method have been conducted at hospital and adults daycare centers (Otake et al.2012).

However, We observed the aspects which coimagination method does not function like designed. In the coimagination method, participants find topic along the theme that was given in advance with taking picture, and they perform group conversation about their topics while showing their pictures. Of course various topics is observed and Observation topics of coimagination method included the results that the series of memory memories, memory retention, and recall whether applying the memory function of memorizing recent event or not, in other word, Topic that suggested the difference in utilization of recent episodic memory were observed in he co imagination method. Such individual differences are those obtained by the observation of coimagination method and are not shown the quantitatively. Therefore, we required new analysis method to show quantitative whether recent episodic memory was active or not. Because, if we can show the utilization of recent episodic memory quantitatively, it is possible to reliably practice coimagination method in the form along the original purpose of utilizing the episodic memory function.

Describe now about Taxonomy memory. In the field of psychology, We designed analytical method in terms of taxonomy of memory In the field of taxonomy of memory, Memory is classifiable as not unit memory function but unique multiple memory functions (Tulving, 1992) as showing in diagram1. Above all, Memory that can be verbalized, which names declarative memory, can classify semantic memory and episodic memory. Tulving defined episodic memory as memory of experience decided by times and places and It can be remembered as " I remember it", while semantic memory is conceptual and abstract.

Semantic memory refers to general world knowledge and it can be remembered, as "I know it". (Tulving 1983) Obviously, there are some argument about this memory categorize by dichotomy: episodic and semantic memory [Roediger, 1984] [Seamon, 1984]. Because this classification is vague. Hence, there are no researches about estimating ratio of episodic memory from statement of conversation. While, in the field of NLP, There are some researches about indirectly interpreting the emotion from text contents automatically (Yano, Y. 2014) (Yamamoto, M. 2007) (Neviarousukaya.A 2007).

In this study, we estimate the ratio that is included episodic memory in each statement from appearance frequency of "Action", "Emotion", and "Sense" that are included in the speech in conversation show the Utilization of episodic memory quantitatively on the basis of Tulving's memory taxonomy. In this paper, we analyze the content rate of recent episodic memory in the statements according to the method of memory taxonomy in psychology. Based on these results, build a method of calculating the utilization of recent episodic memory lowering easy with age. We calculate the content rate of episodic memory in statement by applying proposed method to participant's utterance of at the time of topic description in coimagination method.
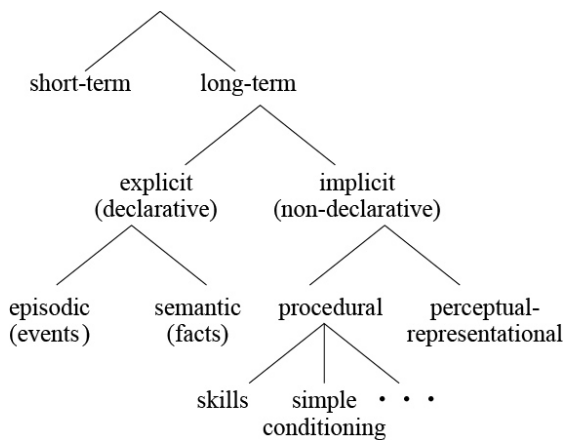

Figure. 1 Taxonomy of memory

2. Related research

2.1 Coimagination method

In this session, we further explain coimagination method, a therapeutic method for the prevention and rehabilitation of cognitive decline based on the idea of reminiscence therapeutic method (Butler 1963). Coimagination method is proposed by Otake, as psychological therapeutic method to support the memory recall skill of older adults in a systematic manner (Otake 2009; Otkae et al. 2011; Otake 2011) Unlike classical reminiscence therapies, coimagina-

tion method emphasizes the importance of memories resulting from interaction with the environment, and active participation of the older adults. The coimagination method is defined by these following rules:

1) The older adults themselves choose their own photos, illustrations, music, or real objects relevant to a predefined theme.

2) In order to ensure active participation, the older and allocated time for each older adult to describe the photos are determined. Ideally, the older adult should describe the photos within the first half of the allocate time, while the second half is used for a question and answer session involving other participants.

As mentioned above, the aim of coimagination method is to support interactive conversation and to active three cognitive functions: episodic memory, planning function and division of attention, which decline in the early stage of mild cognitive impairment (Otake 2011). In particular, we focus on the utilization of recent episodic memory in coimagination method. In the coimagination method, recent episodic memory is ideally carried out in the following steps.

1, to help memorization step by finding the new conversation topics along with theme to take a photo.

2, to help memory retention step by keeping remember the topics from the times finding topics to the time talking in the coimagination method.

3, to help recall step by recalling and explaining the conversation topics with seeing the photo.
(Otake, M. 2010). Compared to reminiscence therapeutic method, Coimagination method set the theme to induce the present or future topics of conversation. Hence the topics observed in coimagination method tend to be recent episodic memory. However, The topic suspected that is whether applying the memory function of memorizing recent event also is observed sometimes. We give an actual example at table. 1.

According with table 1, The Conversation of Ep1 almost do not include the subjective of speaker, knowledge of bridge is main contents. In the Conversation of Ep2, Contents is so retrospective hence almost no description about photo of topic. It seems that these recalling individual deference attribute the utilization of cognitive function especially recent episodic memory.

Table. 1 Example of Topic in coimagination method

Topic photo	Comments
 Ep1 Topic of Bridge	This rare bridge, which have roof, is spanning the near river. Length 7m from 5m, width 2m heights is 3m. this is small wooden bridge. On the inner side of the bridge and has become a bench, you can also rest. Car can't invade.
 Ep2 Topic of Manga	I remembered my childhood when I saw this machine. In our era, paper quality was not good, so often I tore the paper if I tried to draw some pictures. It is very nostalgic memories.

2.2 Taxonomy of Memory

Tulving define the difference of episodic memory and semantic memory (Tulving 1972). Table 2 shows the detailed deferential of Episodic memory and Semantic memory made by Tulving.

In this study, we refer this differential defined by Tulving in order to make keyword of episodic memory. According to table2, episodic memory; source is sense, memory contents are empirical furthermore, and emotion is regarded as important. Hence, we adopted action, emotion, and sense expression as keyword of episodic memory expression.

2.3 Affect Extraction from Text

Affect extraction is research to distinguish the writer's emotion from text by applying the technique of the natural language processing (NLP). There are 2 types of research about Emotion extraction in roughly divided.

First is the method of using emotion corpus to extract emotion sentence by sentence. Emotion corpus is the corpus that gave emotional information for the corpus contracted by the text such as diary and conversation text includes the emotional expression (Matsumoto, K.2005). In This approach, We calculate the appearance frequency of tag of emotion in a targeted sentence and calculate feelings

Table. 2 Deferential between Episodic memory and Semantic memory (Tulving1983)

Diagnostic feature	Episodic	Semantic
Information		
Source	Sensation Sense that meaning and purpose is not necessarily clear.	Comprehension Interpretation of the information that made by relation with the existing knowledge.
Units	Events; episodes The matter that happened in the specific situation.	Facts; Idea; concepts The matter that different by the way of the use of situation and knowledge. When knowledge is actualized.
Organization	Temporal Type of Organization such as, some episode is a point, the back or the same time in terms of time compared to other episode.	Conceptual Type of Organization that incorporate respective facts and concepts into Appropriate place in general semantic structure.
Operation		
Information of memory	Experiential A perceptual characteristic of stimulation captured directly by a sensory organ.	Symbolic A Symbol such as a natural language or other language.
Affect	More important The personal experience is often emotional	Less important It is hardly accompanied with a particular feeling
Retrieval queries	Time? Place? Form of general question is " What did you do at P Place in T?"	What? Form of general question is "What is X?"
Recollected experience	Remember past The Remembered episode is felt as personal experience belonging one's past for the person of reproduction and has a specific emotional tendency.	Actualized knowledge The activated knowledge is personal experience at the present and do not has a specific emotional tendency.
Retrieval consequences	Remember In the case of telling the information that searched from episodic memory system to other people, "Remember" is used.	Know In the case of telling the information that searched from semantic memory system to other people, "Know" is used.

level of the target sentence by using Support Vector Machine (SVM) or Naive Bayes classifier set the corpus as learning date (Yamamoto, M. 2007).

The other one is the way of using emotion dictionary to estimate the emotion by part of speech units and parse the text for calculation of emotion score. Emotional dictionary is the dictionary that gave emotion Standard to the general parts of speech such as an adjective or the verb. In This approach, we calculate emotion standard based on appearance P value of target word appearing with verb and adjective to express emotion directly (Neviarousukaya, N. 2005).

In this research, we measure utilization of the episodic memory by extraction a action, sense expression as well as emotion.

Automation is the goal of our research. Now we examine the way of using Emotion corpus to estimate the emotion from text. Altogether, It is the text classification using the corpus.

3. Generation of Experiment

3.1 Generation of Experiment

In the regular coimagination method, Participants take the photo about theme in advance and then talk about photo in coimagination method however many kind of topic are chosen depend of the interpretation of theme. Therefore, in this research we gave the same experience to participants as walking around and set the theme as the discovery in the walking around. We analyzed the date of speech at the time of one minutes topic offer.

3.2 Participants

We conducted the examination for 15 older adults.

3.3 Procedure of Experiment

We took place the one-hour town walk in exhibit space about a movie and the broadcast in Saitama. We set the theme called the discovery in the town walk in order to cause the remembered recent episodic memory. We divide the Participants into two groups. In the one-hour town work, Participants found the topic about discovery of theme with taking photo. After finished the Town work, they implemented coimagination method, the older adults described the photos for 1 minute, while the second half is used for a question and answer session involving other participants for 2 minutes. All participants positioned around the screen, which photos that candidates brought are shown, and shoot the video while the experiment.

3.4 Procedure of Analysis

We transcribed the utterances of topic describing session. In this research, we calculated the appearance frequency of remembered text from episodic memory based on the difference between semantic and episodic memory, furthermore distinguish whether recent time or paste time considering expression of time. Specifically,

(1) We distinguish statement that utterer is the subject and includes an action, emotion, and sense expression as Remembered text from episodic memory

(2) We categorize sentence considering expression of time statement from recent episodic memory and past episodic memory. We give the example about categorizing the below text.
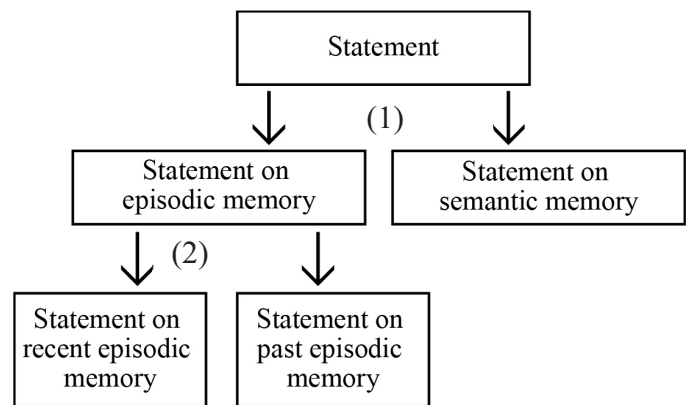
Figure. 2 Method of Analysis

Example)
Photo: Apple
Utterance of text: This is the Apple. I ate it in breakfast, and it was so delicious. In my childhood, I loved apple especially the kind of OURIN.

Action: ate,
Emotion: delicious, loved
Therefore,
"I ate it in breakfast, and it was so delicious."
"In my childhood, I loved apple especially the kind of OURIN." are defined as Remembered text from episodic memory. After that, By considering the keyword of time, in my childhood. We categorized
・ Statement on recent episodic memory
： I ate it in breakfast, and it was so delicious.
And
・ Statement on past episodic memory
： In my childhood, I loved apple especially the kind of OURIN

Finally, We calculate utilization of episodic memory by the appearance frequency of statement on episodic memory divided by the overall sentence.

3.5 Analytical Results

Firstly. Table 3 shows the Results of morphological analysis.

Table. 3 the number of each part of speech of speaking

Partici-pants	The number of noun	The number of verb	The number of adjective
A	58	25	1
B	48	19	2
C	44	23	3
D	43	18	2
E	42	25	3
F	69	22	0
G	47	24	6
H	46	22	7
I	35	21	2
J	32	20	3
K	18	11	1
L	71	24	2
M	41	23	2
N	38	20	2
O	66	25	2

Table 4 shows the number of the action, emotion, and sense expression based on the results of morpheme analysis.

Table. 4 the number of Keyword utterance of episodic memory

Partici-pants	Action	Emotion	Sense
A	11	1	0
B	5	2	0
C	4	3	0
D	7	1	0
E	6	3	1
F	5	0	0
G	10	0	0
H	7	1	0
I	8	0	0
J	5	0	0
K	4	1	0
L	1	0	1
M	9	1	0
N	9	2	0
O	6	0	0

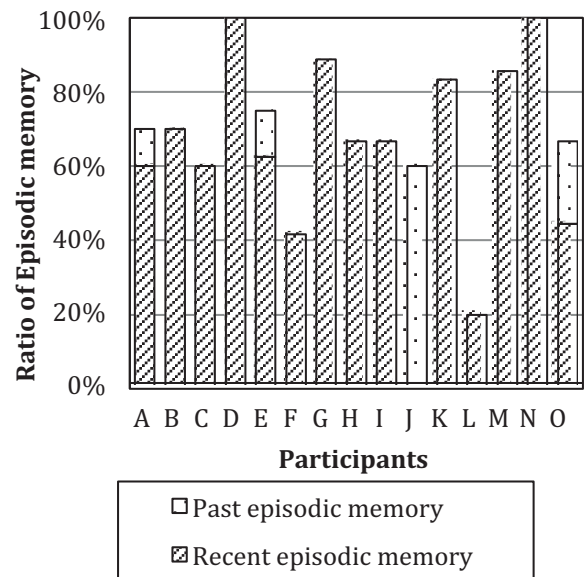Eventually, Figure 2 shows the results of analysis.

Figure. 3 Ratio of Episodic memories

According to figure 2, it can be seen that A, E, J, O have the Remembered text from past episodic memory. in particular , J has only text from past episodic memory(60%). while, on the other hand, The text from retrospective- episodic memory were not seen in B, C, E, F, G,H, I, K, L ,M, N.

The full text were classified as Remembered text from recent episodic memory in D and N. moreover, the ratio of Remembered text from past episodic memory is less than 50%.

4. Discussion

According to Figure. 3, the results of the to walk as common experience, Remembering of the past episodic memory was observed in 4 patients (A, E, J, O). In other word, the presence of people who do not recall for experience about walking town, the recall for the more past experience, were shown. Moreover, Since Individual proportion of episodic memory is between 20% and 80%，The analytical method was suggested to lead to indicator to know the utilization of episodic memory.

In conversation experiments, Utterance, which including the expression of ambiguous time definition, was seen. We classified both as recent episodic memory. However These expression also can be said expression having aspects of past episodic memory. Therefore, it seems that there is a need to clarify the time definition of recent and past episodic memory.

5. Conclusion

The purpose of this article is to reveal the utilization of function of storing "Recent event" as their own experience. Therefore, we proposed the new analytical method, from the point of view of deference of semantic memory and episodic memory. After that, we carried out the experiment of coimagination method and analyzed the results of experiments by proposed method. Consequently, It was possible to show individual differences of utilizing episodic memory quantitatively in terms of taxonomy of memory.
In the future, by confirming the reproducibility of analysis method. We increase the reliability of analysis method. Furthermore，we automate the analysis method basis of the statically method.

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