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Robot science discussion

on the onset of dissociative identity disorder (DID)

Takahiro Hoshino[1] and Junichi Takeno[2*]

Robot Science Laboratory, Computer Science, Meiji University

1-1-1 Higashi-Mita, Tama-ku, Kawasaki-shi, Kanagawa 214-8571, Japan

[1]tantakatan0324@gmail.com,[2]juntakeno@gmail.com

Abstract

This study proposes a consciousness model that simulates the onset process of the symptoms of Dissociative Identity Disorder (DID) using a conscious system constructed with Module of Nerves for Advanced Dynamics (MoNAD) consciousness modules. This paper discusses the possibility of employing the conscious system under development in order to promote a better understanding of severe human metal disorders such as Post Traumatic Stress Disorder (PTSD) and DID. We considered the symptoms of DID to be a problem of what is called "self-dispersion" in robot science, and developed a program with which we believe it will become possible to grasp the development process of DID more objectively.*t*

1 Introduction

Our research group successfully completed a self-cognition experiment using our developed Module of Nerves for Advanced Dynamics (MoNAD) consciousness modules mounted on a robot (Takeno and et al., 2005). In addition, the symptoms of Post Traumatic Stress Disorder (PTSD) have been already expressed as a consciousness model comprising neural networks (Yoshida and Takeno, 2014). With this backdrop, our present study proposes a consciousness model of MoNADs which simulates the onset process of Dissociative Identity Disorder (DID), a well known severe human mental illness.

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2 MoNAD Consciousness Module

The conscious system proposed in this paper is constructed by combining several MoNAD consciousness modules. A MoNAD is a specially structured computational model using recurrent neural

*Corresponding Author

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networks (RNN) and consists of the following sections; (a) input, (b) Primitive Representation, (c) Cognitive Representation (RL), (d) Behavioral Representation (BL), (e) output, (f) Somatic Sensation Unit (SSU). The Primitive Representation section unites three information flows (information from the external environment provided by the input section, information output from the MoNAD and immediately fed back by the SSU, and information output from the upper-layer MoNADs and input to BL to change the behavior), and sets the output of both RL and the MoNAD. Therefore, the Primitive Representation section performs both cognition or learning and behavior simultaneously. In other words, it cognizes when behaving and behaves when learning or cognizing.

3 Conscious System

Our conscious system consists of the Reason subsystem, Emotion & Feelings subsystem, Association subsystem and Episodic Memory. The Reason subsystem is a group of MoNADs that behave based on internal and external stimuli and somatic sensation information.

In our present study, we presume that the MoNADs of the Association subsystem, which unites rational thought and emotional thought, play an important role in representing personality.

4 Conscious System and Onset Process of DID

In recent years, DID and other severe human mental diseases have received considerable attention, and many doctors, psychologists and philosophers have been undertaking related research (Brown and Hart, 1998). No report has as yet been released, however, announcing that the psychological mechanism that causes PTSD or DID has been found. For this reason, we attempted to study the psychological mechanism of DID from the viewpoint of self-dispersion in a conscious system, by taking as an example the occurrence of multiple personalities.

DID is generally defined as a disease developed by a person's efforts to avoid the mental trauma of an intolerable condition or experience by "feeling that this is not happening to me" (depersonalization) or by "dissociating the feeling and memory from that event so as not to remind the person" (dissociation) (Putnam, 1989).

Also, in DID the dissociated feeling and memory develop independently to be represented as another personality (Hart, 2006). We tried to exhibit the onset process of another personality as a consciousness model in the neural network.

Figure 1 shows the fundamental structure of the conscious system using for the consciousness model. The "fundamental structure" here means that the system is composed of the Reason subsystem, Emotion & Feelings subsystem, and Association subsystem.

In the following paragraphs, we discuss the development process of multiple personalities in which self-dispersion takes place according to the information from the external environment that is input to the conscious system.

First, assume that known information is input to the conscious system in Figure 1.

1. The external information is input to MoNAD (A) of the Reason subsystem and, at the same time, the internal bodily information is transmitted to MoNADs (C) and (D) of the Emotion & Feelings subsystem. These types of input information are transmitted to Episodic Memory (B) and to MoNADs (E) and (F) that represent "pleasant" and "unpleasant" feelings.

2. The information of the Reason subsystem and Emotion & Feelings subsystem is ultimately sent to MoNAD (H) of the Association subsystem. When the input external information is “known” and indicates a “pleasant” feeling, the conscious system behaves toward external environment in such a way so as to maintain the current “pleasant” state. When the input information indicates an “unpleasant” feeling, the system transmits the information to (A) and this module behaves in such a way so that the input is changed to a “pleasant” state.

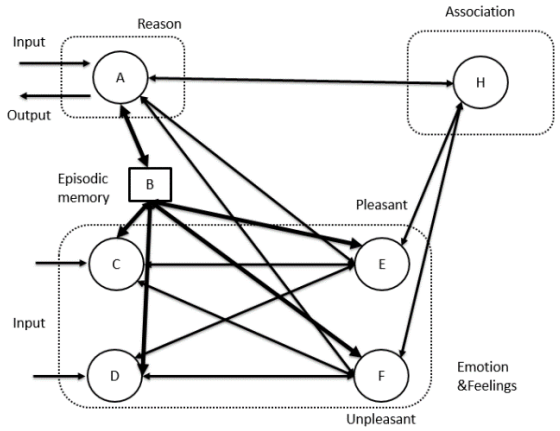

Figure 1: Fundamental structure of conscious system

In this instance, the authors think that module (H) serves as a subjective entity like the self or ego, because the information of the Reason subsystem and the information of the Emotion & Feelings subsystem are united in module (H). In other words, module (H) can be regarded as the main personality of the conscious system.

Next, we discuss the case in which unknown information is input to the conscious system.

In this case, the information flow and the handling process in the Reason subsystem and the Emotion & Feelings subsystem are the same as in the case of known information. Therefore, we only describe the change in behavior by focusing on the Association subsystem.

In Fig. 1, all the information communicated between the MoNADs is basically bidirectional, but for the convenience of explaining the information handling process, the directions are indicated with arrows.

1.When the information is transferred from the Reason subsystem and the Emotion & Feelings subsystem (Fig.2 a, b) to the Association subsystem (H), if the information input to the conscious system is unknown by (H), the conscious system creates a new MoNAD (G) in the Association subsystem. We applied the results of past research to our method for determining whether the input information is known or unknown. (Kushiro and Takeno, 2011)

2. Module (G) is a newly and automatically created MoNAD for processing the unknown information input to the conscious system. Module (G) may be compared to a new experience established within the conscious system under the control of (H).

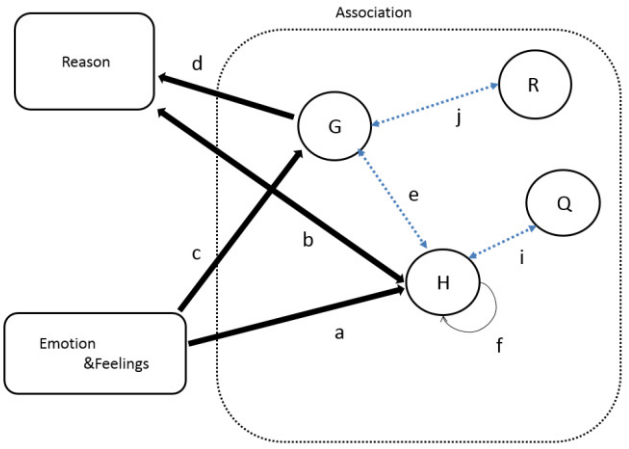

Figure 2: Handling of unknown input information in the Association MoNAD

Module (G) is a lower-layer MoNAD of (H), and connected to the Reason subsystem and the Emotion & Feelings subsystem to receive the input information through the new links (Fig.2 c, d and e).

In this way, the conscious system learns new information and behavior by adding a new MoNAD and changing unknown information into known information.

Now, we assume that the input information is accompanied by an excessively unpleasant feeling.

As stated earlier, the Association subsystem is a group of MoNADs that unite rational thought and emotional thought.

Because of this characteristic, it is likely that the excessively unpleasant feeling in comparison with past events may disrupt the balance of information processing between rational thought and emotional thought. The authors infer that this state results in the impossibility of establishing an information linkage to module (G) which the current Association subsystem (module (H), for example) should set up to handle a new experience. This inference is from robot science but, in terms of brain science, no evidence has been presented to date.

Currently, we suppose two mechanisms as the process that disrupts the balance of information processing.

When an exceptionally strong reaction is generated in the Emotion & Feelings subsystem, the following two mechanisms are conceivable:

(1) The convergence is troubled in the Association subsystem.

(2) The newly created Association subsystem attempts to establish leadership.

First, this paper examines the former mechanism.

In our program, when an excessively unpleasant feeling arises in response to the input information from the outside, in other words, when the balance is disrupted, the MoNAD in the Association subsystem enters into a state in which the output has a range of errors in comparison with past outputs. This state degrades the convergence of the MoNAD itself. Due to this degradation, the communication link between the MoNAD created as new knowledge and existing MoNADs becomes inactive.

The details of this process are as follows:

When module (G) is created as a new experience and, at the same time, the information is accompanied by an “unpleasant” state, this information is processed as shown below:

1. The information of the Emotion & Feelings subsystem is simultaneously input to module (H) and the newly created module (G). (Fig. 2 b, c)

2. Module (G) unites the information from the Reason subsystem and the information from the Emotion & Feelings subsystem under the control of (H). (Fig. 2 c, d and e)
3. At this time, however, the disruption of balance arises because module (H) receives, from the Reason subsystem and the Emotion & Feelings subsystem, a far greater amount of information than in normal communications.

In the course of this information processing, module (H) constantly checks the convergence of its own output (Fig.2 f). If there is no problem, module (H) processes the information in the same fashion as in a normal case. If a disturbance of convergence is detected, module (H) deactivates the link between (H) and (G) because the convergence may be determined to be affected by an unpleasant state in (G) from the characteristic of co-occurrence (Fig. 2 e).

As a result, module (G) becomes independent from its state of subordination to (H).

This may be compared to the mental function of a human in which pleasant and unpleasant states are used as the basis of behavior, and learning is performed so as to change the unpleasant state to a pleasant one. Once module (H) deactivates the link to (G) (Fig.2 e), it does not have to receive the unpleasant information.

This means that, in our conscious system, module (G) handles its own experience independently and module (H) does not have to cope with the experience in cooperation with (G). In other words, our conscious system has selected, by itself, a form of distributed processing.

Since link (Fig.2 e) is deactivated, depending on the information input to the conscious system, module (G) receives the information directly via link (Fig.2 c) from the Emotion & Feelings subsystem. In this case, module (G) acts as an independent personality, and therefore unites rational thought and emotional thought and outputs the results.

Hereafter, every time module (H) receives an experience with a strong unpleasant feeling, it creates a new MoNAD in the same manner, and sometimes it might deactivate the link from (H) (Fig. 2 i). The state of Q is called “parallel dissociation.” Also, module (G) belongs to this type of dissociation.

This above-mentioned dissociation is not limited to the relationship between (H) and (G). The following dissociation is also conceivable:

Module (G) may conduct the learning process as an independent personality just like (H) and create a new MoNAD (R) depending on the learning content (Fig. 2). When the learning of (R) causes an excessively unpleasant feeling, module (G) deactivates the information link from (G) to MoNAD (R) (Fig.2 j). In this case, another independent personality creates a new personality. The state of (R) is called “deepened dissociation.” For this type of dissociation, however, there is no actual case example to date.

Figure 3 shows our DID model.

The second mechanism for the balance disruption of information processing is under study (Okawa and et al. 2016).

In this model, (H) and (G) each have independent links although they unite the information of the Reason subsystem and the Emotion & Feelings subsystem. From this, we believe that our conscious system in Figure 3 can be used to explain the information handling process of DID.

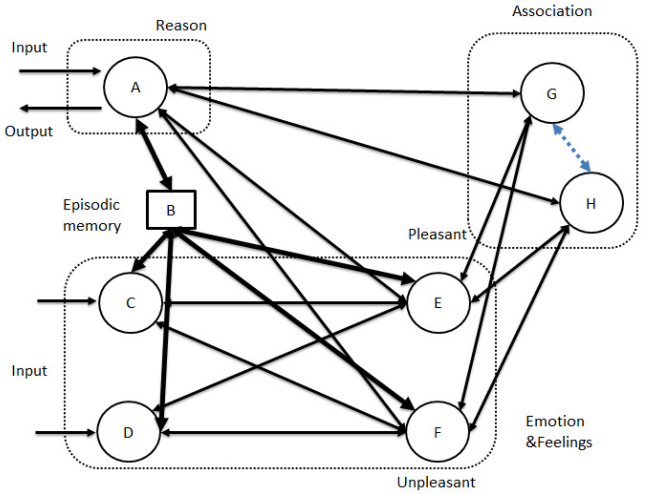

Figure 3: DID model

5 Discussion and Conclusion

In this paper, and a new proposal referred to as a "self-distributed awareness system" model for the DID of development. This self-dispersion process is a mechanism that the authors have been newly proposed. Also, the authors also constructed a consciousness model based on neural networks, and created a program for the model. This program demonstrated that the conscious system might be split into several independent processing systems due to external stimulus. This suggests the possibility of expressing a human mental disorder such as DID. This modeling have a deep connection with the ”self-cognition mechanism” (Okawa and Takeno, 2016).

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