Continual-Activation Theories of Schizophrenia and Restless Legs Syndrome

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Abstract: Two hypotheses have been put forward in this paper to theorize the causes of Schizophrenia and restless legs syndrome. The author proposes that both illnesses are caused by the activation of the continual-activation mechanisms during waking, due to the dysfunction of the continual-activation thresholds, one in the conscious subsidiary system, and the other in the non-conscious subsidiary system.

Keywords: Continual-activation theory, schizophrenia, restless legs syndrome, working memory

Introduction

Schizophrenia is the most severe of the major mental illnesses. Symptoms of schizophrenia are divided into two categories – positive and negative. Positive symptoms are characterized by paranoia, delusions, hallucination and thought disorder. In contrast, negative symptoms are characterized by apathy, lack of drive or initiative, flattened emotional response and social withdrawal. The current author believes that the positive symptoms of schizophrenia are caused by dreams intruding into the waking state. This relationship between dreaming and mental illness has, in fact, long been emphasized by many philosophers and researchers: mental illness is a "dreamer in the waking state" (Kant in Freud, 1911), "dreams a brief insanity, and insanity a long dream" (Schopenhauer in Freud, 1911), "dreaming permits each and every one of us to be quietly and safely insane every night of our lives" (Dement, 1999), "dreaming and severe mental illness are not analogous but identical" (Hobson, 2002). However, the cause of the "waking dreamer" (insanity) still remains unknown, although this relationship between schizophrenia (positive symptom) and dreaming had been first proposed more than 100 years ago.

On the other hand, restless legs syndrome (RLS) is an overwhelming urge to move the legs usually caused by uncomfortable or unpleasant sensations in the legs that may be impossible to resist, which often occurs during periods of inactivity. These sensations include creeping, itching, pulling, creepy-crawly or tugging. Although their presence is most common in the legs, these sensations may also occasionally occur in the arms and other body parts. This uncomfortable feeling can be temporarily relieved by stretching and moving the legs. The symptoms of RLS may be present all day long, making it difficult for an individual to sit motionless. Even though RLS often appears in otherwise healthy people, it is not related to psychiatric disorder. However, the cause of RLS is still unclear.

The assumptions presented in this paper intend to hypothesize theories for positive symptom schizophrenia and RLS. The new theories are a direct extension of the Zhang memory model (Zhang, 2004) and the continual-activation theory (Zhang, 2005).

Continual-Activation Theory

Jie Zhang (2004) recently presented a new human memory model. By introducing a temporary memory stage into the memory process to bridge the gap between short-term memory and the long-term memory, Zhang proposed that during our waking time, the memory formed from the working memory is not saved directly into the long-term memory; instead it is saved into a temporary memory. The function of sleep is to process, encode and transfer the data from the temporary memory to the long-term memory. Zhang suggested that, besides the central executive (a control system that mediates attention and regulation of processes) (Baddeley & Hitch, 1974), the working memory could be divided into two groups of subsidiary systems: one for processing declarative (conscious) memory and one for processing procedural (non-conscious) memory. Corresponding to the type of memory been transferred, Zhang proposed that, sleep has two different stages: NREM (non rapid eye movement) sleep for processing the declarative memory, and REM sleep for processing the procedural memory. He further suggested that there are two types of dreams. The type I dream, a thought-like dream, is the result of the memory replay when the declarative memory is transferred from the temporary memory to the long-term memory during NREM sleep. The type II dream, a more dream-like dream, mainly occurs when the procedural memory is transferred from the temporary memory to the long-term memory during REM sleep. Based on above assumptions, Zhang (2005) further hypothesizes that, in order to maintain proper brain functioning, both conscious and non-conscious subsidiary systems of working memory have to be continually activated through their life times. Zhang proposes that there is a continual-activation mechanism in each subsidiary system to carry out this task. When the level of activation of either subsidiary system descends to a certain threshold, the continual-activation mechanism in the brain will be triggered to generate a data stream from the memory stores to flow through the subsidiary system in order to maintain brain continual activation.

Continual-Activation Theory of Schizophrenia

Hypothesis: The positive symptom schizophrenia (waking dreamer syndrome – termed by the current author) is caused by impairment of the continual-activation threshold in the conscious subsidiary system of working memory.

The continual-activation theory proposes that human brain has to be continually activated through its lifetime. When the brain activation level of the conscious subsidiary system of working memory descends to a given threshold, a continual-activation mechanism will be triggered to generate a data stream from the declarative memory stores to maintain brain continual-activation. Trigging this mechanism during sleep leads to vivid dreaming (type II dream) (Zhang, 2005). The control gate is the so-called continual-activation threshold. For a normal person, this threshold can only be met during sleep when both the incoming data stream from sensors, and self-generated data stream from thinking, are reduced to a very low level. However, for people who have schizophrenia, the continual-activation threshold is impaired and raised to a higher activation level. As a result, when normal people are enjoying a nice, quiet, relaxed moment during waking, the continual-activation mechanism of schizophrenia patients will be switched on when their minds are idle (figure 1). Even though paying attention to the

sensory input can shut off the dreaming mechanism, dreaming will come back as soon as the brain quiets down again. For these people, both the reality from the sensory input, and the hallucination (dream) induced from the continual-activation mechanism, are mixed into their conscious subsidiary system of working memory. This painful experience is significantly intensified for schizophrenics, as the temporary memory is active, and all the hallucination mentation will be saved into memory while awake. In contrast, although everyone dreams every night, the dreaming sensation cannot be saved during sleep because the temporary memory is on retrieval-only mode (Zhang, 2004). For normal people, since the threshold is not impaired, hallucination (dream) can only be triggered during waking by impairing sensory input (for example: reducing sensory input by sensory isolation and hallucinogenic drugs, or jamming the sensory circuits by overloading with intense stimuli).

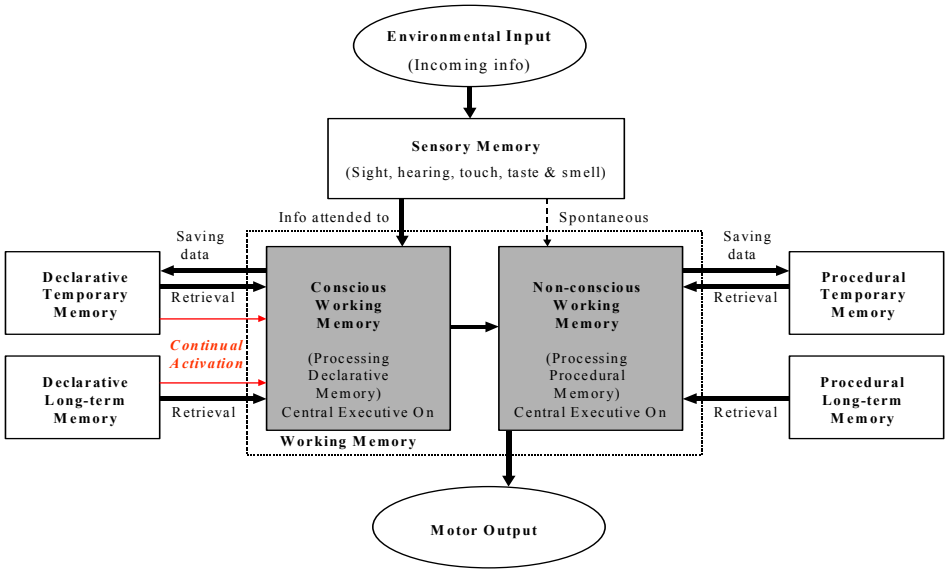

Fig. 1. **Memory model for the waking brain (with schizophrenia)**.

Continual-Activation Theory of Restless legs syndrome (RLS)

Hypothesis: The restless legs syndrome (RLS) is caused by impairment of the continual-activation threshold in the non-conscious subsidiary system of working memory.

The theory of RLS and the theory of schizophrenia are very much alike: both are caused by impairment of the continual-activation threshold. However, the RLS is due to dysfunction of the continual-activation threshold in the non-conscious subsidiary system of working memory. According to the continual-activation theory, when the activation level of the non-conscious subsidiary system of working memory descends to a given threshold, the continual-activation mechanism will be triggered to generate a data stream from the procedural memory stores to maintain the brain continual-activation. To the RLS patient, the continual-activation threshold is impaired and increased to a higher activation level. This will lead to the continual-activation mechanism being turned on when the affected individual is at rest while awake (figure 2). Since

the procedural memory data stream retrieved by the continual-activation mechanism goes against the will of the conscious brain during waking time, the RLS patient will have very unpleasant feelings and a strong urge to move the legs/body. The voluntary movement of the affected extremities can temporarily relieve this unpleasant urge because, to stretch and move the legs, the conscious subsidiary system of working memory needs to send a request to the non-conscious subsidiary system of working memory. This will generate an attended procedural memory data stream flowing through the non-conscious subsidiary system of working memory, which will shut off the continual-activation mechanism. However, because of the dysfunction of the continual-activation threshold, the continual-activation mechanism, which causes the painful sensations and urges to move legs, will be triggered again as soon as the sufferer sits or lies down again.

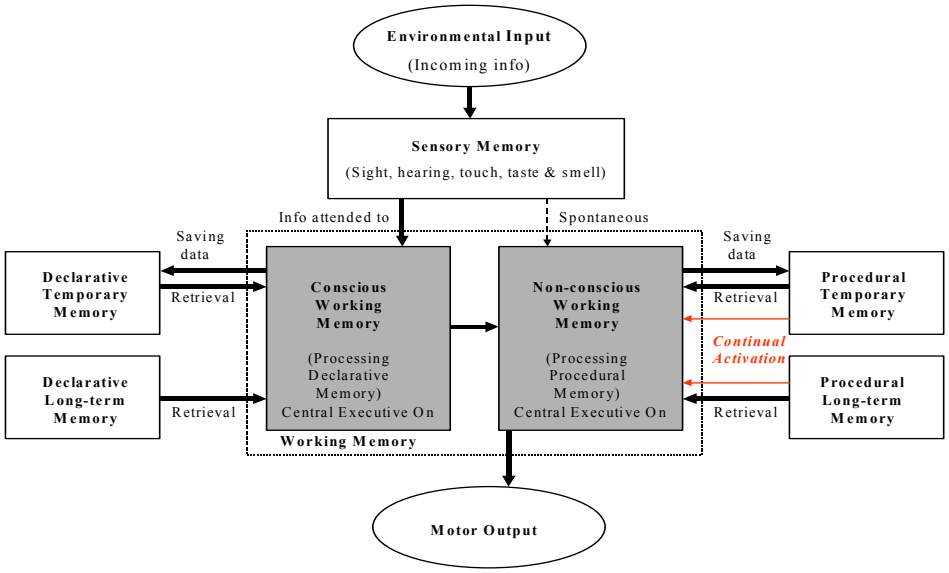

Fig. 2. **Memory model for the waking brain (with RLS)**.

Conclusion

This paper hypothesizes that both schizophrenia and restless legs syndrome (RLS) are caused by dysfunctions of the continual-activation thresholds. Schizophrenia is caused by dysfunction of the continual-activation threshold in the conscious subsidiary system of working memory, while RLS is caused by dysfunction of the continual-activation threshold in the non-conscious subsidiary system of working memory.

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