

A Case of Learning Disorder as Absence of Connection in the Cerebrum

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Abstract

A case of learning disorder in using of Chinese characters was analyzed by means of the functional blocks in the cerebrum. Using a block diagram of the kanji processing, we concluded that the absence of connections to and from the writing-sequence-generation block, or the block itself, can cause the disorder of this case.

Introduction

Learning disorder (LD) is similar to agnosia or apraxia (Gerstmann, 1927), and it is considered as the disturbance of the cerebrum (Matsumura & Hirose, ed., 2004). In the developing brain, it is known that the connections to and from the functional blocks in the cerebrum are formed after birth (Fukuda, Hara, Schankle & Tomita, 1999), and human knowledge is considered to be written on these connections thereafter according to the collision rule of Hebb. In the sense, the areas of cerebral cortex with postnatal and inherent i.e. not-yet-written connections are white board (tablula lasa) of John Locke. LD is then looked as a disorder of the white board. MRI of the reported LD child showed no abnormality. We point out that the absence of connections to and from the writing-sequence-generation block can cause LD of Chinese characters (kanjis, /kanjiz/ plural of kanji) in this case.

key words Learning disorder (LD) Chinese character (kanji) Cerebrum Functional block Connection absence

Case of 12 Year-Old Boy

A boy and his mother visited our clinic two years ago at the age of 10. His chief complaint was that he cannot write kanjis, numbers, and kana letters. He can read them, but cannot write them well. When he is ordered to write, he often hides himself. It is hard for him to copy the kanjis, written on the black board by the teacher, on his notebook. At the 5th grade, he can write kana letters and numbers a little better than before, but it is hard for him to write kanjis. He can use abacus and is entitled as 7th kyuu (grade) of the abacus association. He likes science, experiments, and gymnastics. He belongs to the club of painting and handicrafts, and made a money box and plastic models. His speaking and conversation ability has no problems, and enjoys playing with other pupils. His MRI is normal.

An Example of the Error

In Figure 1, (a) is a kanji meaning *closed*, (b) is a kanji meaning *gate*, (c) is a component of (a), and (d) is an erroneous kanji written by the case. He wrote kanji not as a

combination of (b) and (c), where (c) is inside (b) as in the correct kanji (a). In (d), component (c) is different from (c).

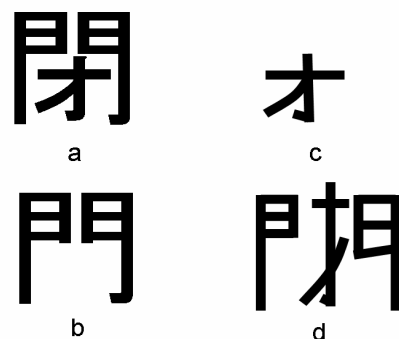


Figure 1: Kanji character "close" (a) and its mistake by the boy (d).

Also in (d), the component (b) is wrong. The kanji (d) consists of three components. According to our usual convention, he would have wrote (d) from the left one, next middle one, and finally the right one. This fact is understood that the knaji concept of *gate* cannot generate (b), concept of *close* did not generate (c) inside (b), for the writing sequence of (b) and (d) is wrong. His notebook shows many miswritten kanjis which at a glance similar to right one but their components are miswritten or lost.

Active Elements of the Cerebrum

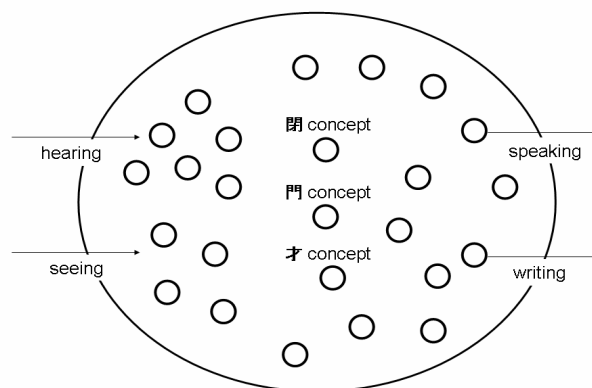


Figure 2: Mind as collection of the active elements of the cerebrum. Three kanji concepts are shown, meaning closed, gate, and talent (middle of 1-d), respectively.

Using the internal observations about mind, we concluded that active elements of the cerebrum can form the state transition of mind in the previous work (Shiida, 1985; Shiida & Watanabe, 2006). And in many textbooks, the active neurons in the cerebrum are upon the conscious processing of mind. Figure 2 shows the content of mind.

For the recognition of human face or meaningless linear figure, many active elements look to be used, but no concept of the face or the figure is activated. But a kanji is processed into a 'concept.' An activated kanji concept can generate a hand-written kanji. Because the cerebral function is localized, it is possible that the similar elements of mind locate in a part of the cerebrum. In this sense, we use the term functional block of 'kanji concepts,' which is possibly in the association areas.

Functional Blocks for Processing Kanjis

We classified 8 functional blocks of Figure 3 in the cerebrum, for conscious processing of kanjis. We learn a kanji usually by three steps. First, we learn what it means and how to read it. Next we learn how to write it, repeating to write it for many times. Third, we learn how to use it correctly in the sentences, just like learning a English word. In the first step, the *seeing* block, *visual image* block, *kanji concepts* block, *hearing* block, and *reading* block, as well as the connections between them, would be formed. At the next step, connection of the blocks *kanji concepts* --> *writing sequence generation* --> *writing* would be formed. At this stage, *writing sequence generation* block is activated using signals from *visual image* block and *kanji concepts* block. The writing sequence processing will be subdivided into generating writing sequence of easy kanjis and components and combining them into complex kanjis

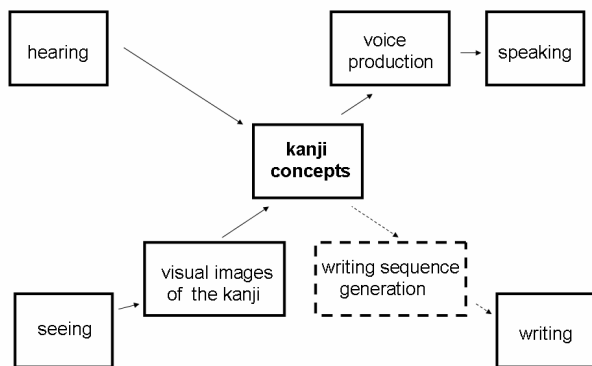


Figure 3: Block diagram of the cerebral structure for processing kanji like 関. There is a state in a block, and signals flow in on arrows. The *seeing* block is in the visual area, *hearing* block in the auditory area, *speaking* and *writing* block in the motor areas, and *writing sequence generation* block is in the pre-motor areas. *Kanji concepts* block is considered to exist in the association areas.

in a proper sequence. Third step makes connection of the *kanji concept* to the other concepts around that block, and consolidates the connections used for the processing of Figure 3.

Kanas show only meaningless voice elements like ka, ki, or ku. In the processing of a kana letter, human face, or meaningless linear figure, no concept block is concerned.

Analysis and Learning Support: Conclusions

He can read the kanjis and use his fingers skillfully in handicrafts. These two facts mean that the blocks of Figure 3 work well generally. His writing-sequence generation does not work well. It will be concluded in figure 3 that the error is in the functioning of *writing sequence generation* block. If we postulated that the block itself does exist as the normal result of MRI, its incoming or outgoing connection would be wrong. Possible bad connections and block are drawn dotted in Figure 3. For LD children, no standard educational technique is yet established. But for the severe cases of LD, use of modern technology is recommended just like in case of learning sciences (Matsumura & Hirose, ed., 2004; Miyake & Shiramizu, 2003). He did enjoy using software to combine components of the kanji. In order to encourage him in writing kanjis, we consider that use of Japanese word processor, which needs only typing keyboard by the motor area, is to be attempted. In order to operate Japanese word processor, connection from the *kanji concepts* block to the *typing* block is needed and it is not necessary to use the lacked elements in Figure 3.

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