

Study on the Critical Review of Bilingual Dual Coding Theory

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Abstract

Theory can play a vital role in language learning and teaching because under the guidance of theory, it may be clear for teachers to gain insight into why and how to implement language teaching effectively. However, it is noteworthy that theory should be appropriately chosen, or the effectiveness of language learning and teaching will be decreased, so it can be essential to study a robust theory and conduct a critical review so that teachers can judge whether and how to apply it into language learning and teaching. For researchers, especially language teachers, it is valuable to study Bilingual Dual Coding Theory, so this paper aims to have a critical review on Bilingual Dual Coding Theory from the perspective of its background, nature, research method, development, and value. The conclusion is that Bilingual Dual Coding Theory can be called a robust theory after critically reviewing aspects above, but some weaknesses need noticing, e.g., relevant research is little; it is challenging to ensure research validity and reliability due to its relative complexity. Therefore, this theory needs more exploration, thus guiding practice in a more effective way. More importantly, researchers, especially language teachers, need have a constant critical reflection on theory.

Keywords

critical review; Theory; Bilingual Dual Coding Theory.

1. Introduction

The development of language learning and teaching entails not only effective practical experience, but also strong theoretical underpinning because theory can provide a guiding role in the practice. Hence, it can be essential to study a robust theory and conduct a critical review. Currently, such an example is Bilingual Dual Coding Theory. On one hand, it caters to the trend of a growing number of bilinguals and relevant bilingual research. On the other hand, associated with cognition, it may further explore learning internal mechanism. Hence, it is worth exploring this theory. This paper aims to study and reflect it by critically reviewing its background, nature, research method, development, and value.

2. Background to the Theory

The development Bilingual Dual Coding Theory derives from dual coding theory. Dual Coding Theory (DCT) proposed by Paivio (1971) puts emphasis on the cognitive activities occur in two independent but partly interrelated symbolic systems to process two types of stimulus information: one is the image or imagery system about perceptual information and the other is the verbal system about linguistic information. Paivio and Lambert (1981) further add that the former is characterized by directly processing nonverbal objects and events while the latter is associated with linguistic stimuli and response.

Bilingual memory also provides an important theoretical support for bilingual DCT. One is Semantic Memory particularly concerned with language (Bahrick, 1974) whilst the other one is Episodic Memory associated with concrete nonverbal and verbal objects, places and time

(Macleod, 1976). The former can affect the latter based on DCT (Paivio & Desrochers, 1980). There are two contradictory views in bilingual memory. Wickelgren (1974) asserts that memory traces may increase from stimulus repetition whereas Hintzman (1986) argues that a fresh memory trace of the stimulus stems from each repetition. These two views are accepted in DCT (Paivio & Lambert, 1981). Bilingual dual coding theory also embraces these views, so bilingual memory can lay a foundation for it.

3. Nature of the Theory

Bilingual Dual Coding Theory (Bilingual DCT) proposed by Pavio and Desrochers (1980) increases an additional verbal system. It means the bilingual base is different from a single lingual base in this theory. Previously, Paradis (1978) had a similar hypothesis, namely two independent linguist memory stores could have a different connection with the identical conceptual-experiential information store. This view is in different line with Koler (1968)'s hypothesis (a single store and dual linguistic stores). Notwithstanding, Pavio and Desrochers (1980) oppose to them and propose a general hypothesis that the image system reflecting knowledge of the world and two verbal systems in bilingual are all independent but partly correlated. Hence, no matter whether a previous theory may support or question a new one, it stems from the previous theory. In this sense, theory needs constantly developing and refining.

3.1. Imagens and Logogens

In this theory, there are two key constructs: imagens and logogens. The first one refers to the representations of the image system comprising modality-specific information about the perceptual attributes of things; the second are also perceptual analogues (information represented concerned with the sequential patterns of linguistic stimuli and responses), excluding perceptual or semantic information on our knowledge of the world (Pavio & Desrochers, 1980). Similarly, Morton (1979) proposes that logogens are modality-specific entities with different sizes and longer linguistic structures while Paivio, Clark, and Lambert (1988) suggest that imagens are linked with imagery and could be implemented in recognition, memory, language, and others. Later, Heredia and Altarriba (2014) conclude that imagens are the nonverbal representational memory in contrast to logogen with verbal ones. Although logogen and imagen are different representational memory, they both serve for language learning.

3.2. Interconnected Specific Hypotheses

Central to the general assumptions above, bilingual DCT consists of three interconnected specific hypotheses: relations between image and verbal systems; relations between two verbal systems; activation of representations and connections (Pavio & Desrochers, 1980).

The first hypothesis is that the image system is functionally independent of two verbal systems, developing the main independence hypothesis of DCT. In other words, bilinguals can have cognitive behavior in a verbal way without the connection of nonverbal system. Furthermore, the verbal translation equivalents between L1 and L2 might or might not have the identical imagens. That is, Pavio et al. (1988) propose that referential connections occur between two verbal systems (V1 and V2) and the image system so connections between abstract semantic equivalents can be weaker than those between specific ones. It is also noteworthy that the image system can indirectly mediate between two languages.

The second one is bilinguals' two verbal systems are functionally independent but partly interrelated. It means that one language can be comprehended, memorized, or produced without the other's influence but they are also connected through specific access routes, e.g., associate connections. In addition, logogens play a primary bridge between two verbal systems; between-language connections are perceived to present less types different from with-in

language connections. For example, *girl-fille* (French word) is connected between languages while *girl-boy*, *girl-woman*, *girl-mother* may occur within a language. Similarly, Harbluk, Paivio, and Clark (1987) suggest that different free or same-meaning associations happening within languages outnumber those between languages.

Concerning the third one, it highlights that the stimulus situation during interaction can play a dominant role in activation, accompanied with individual structural differences of long-term memory not only in verbal but also nonverbal systems. Here, stimulus situations consist of linguistic stimuli and non-linguistic objects and other things. In practice, class stimuli can be presented by two forms such as contextual stimuli (e.g., an instruction of translating speech, description of a scene) and the focus of attention (e.g., description of objects). Briefly, individual difference and stimulus variables can cause different types of linguistic and nonlinguistic reactions.

Later, these hypotheses have aroused many researchers' attention, such as Paivio, Clark, Lambert. Concerning the strengths of bilingual DCT, Clark and Paivio, (1991) claim that concreteness, imagery, and verbal associative processes can have a guiding role in education, e.g., knowledge understanding, useful teaching instruction and individual differences and in other fields, e.g., psychology and science. However, some assumptions still need to be verified in practice. Admittedly, compared with DCT, bilingual DCT has made great progress but still deserves further exploring.

4. Research Method of the Theory

Most researchers have adopted the experimental research method (e.g., Paivio et al., 1988; Paivio & Lambert, 1981; Taura, 1998; Vaid, 1988). Experimental research method occurs in the context of an experiment (Johnson & Christensen, 2008) where one or more variables are manipulated (independent variables) and the others are constant (dependent variables) (Gass, 2015; Zimney, 1961). This theory explores two verbal systems, the image system, and their relationships so it is concerned with many variables and experimental research are more favored by researchers mentioned above.

4.1. Techniques to control the independent variables

In the previous research, there are two techniques to control the independent variables: presence or absence technique (one group with the treatment condition in contrast to the others) or type technique (different types of variables in different comparison groups) (Johnson & Christensen, 2008).

The first example is that Pritchett, Vaid and Tosun (2016) control two independent variables by accuracy of word recall without regard to language accuracy and accuracy of word recall regarding language accuracy when participants receive four different treatment conditions (e.g., figurative in both languages, figurative in English only, figurative in Russian only and nonsense). However, most of research adopts the type technique (Jared, Poh, & Paivio, 2013; Paivio, & Lambert, 1981; Steffensen, Goetz, & Cheng, 1999). For instance, Arnedt and Gentile (1986) include three independent variables (language, experience, and status) and three treatment condition (labelled pictures, translated French nouns and copied English nouns).

4.2. Validity and Reliability

Validity contains many types, e.g., internal validity, external validity, statistical validity, face, and construct validity. In terms of internal validity, it could be seen through the following ways, e.g., choose the same topic of texts (see Steffensen et al., 1999) and the same background of participants (see Pritchett et al., 2016) while external validity in some studies may be insufficient, e.g., the number of the sample (N=22) is small (Steffensen et al., 1999). Concerning

statistical validity, most of research can present it, e.g., $p < 0.001$ (see e.g., Arnedt & Gentile, 1986; Pavio & Lambert, 1981) and $p < 0.5$ (see e.g., Jared et al., 2013).

Most of research employ mixed research methods (MMR) to enhance content, face, and construct validity. They usually use a Likert-scale questionnaire with Mean, SD and Think-aloud protocols to recall the tasks but Jared et al. (2012) merely use the quantitative research method with questionnaire and Steffensen et al. (1999) use self-report. ANOVA is usually employed despite different types, e.g., 2×3 (see Arnedi & Gentile, 1986; $2 \times 2 \times 3$ (see Taura, 1998) and correlations can be reflected, e.g., English image rating and Chinese emotional response rating, $r = .72$ (see Steffensen et al., 1999). Since the difficulty of the constructs in research, multiple research methods could promote research validity, but it may increase the difficulty of data collection and data analysis. Hence, it is desirable for researcher to cooperate with other researchers.

Another point is that some studies fail to report reliability coefficients or measures (e.g., Steffensen et al., 1999; Jared, 2013). Therefore, reliability deserves noting. Moreover, apart from experimental research method, other research methods, such as case study may deeply investigate this theory in some way but it may fail to realize external validity.

5. Development of the Theory

Since the bilingual DCT was proposed by Pavio and Desrochers (1980), many studies have facilitated its development from various perspectives. For example, Pavio and Lambert (1981) conducted two experiments to explore verbal-nonverbal and bilingual dual coding in terms of their influence on recall, with French-English bilinguals as participants. These participants were presented pictures, French words and English words once and then wrote English names of pictures, translating the French words or coping the English words. Then they were required unexpectedly to recall the generated English words. The second experiment reversed this coding task. Finally, both findings revealed that in the verbal-nonverbal dual coding situations, recall ranked first, followed by translated items and copied item. Their research substantiated this theory, namely pictures or images work better to recall than an additional verbal system. Paivio et al. (1988) also supported this statement by conducting similar research.

Potter, So, Von Eckardt and Feldman (1984) expanded this theory by proposing two alternative bilingual models: the word association and the concept mediation model; an image system has a direct connection with a conceptual one in both, which in turn is associated with lexical one for a or two languages. Conversely, they failed to resolve the issue whether an image one had a stronger connection with a word in one language than the other. Jared et al. (2012) later study this issue and indicate the image system worked better, supporting the bilingual DCT.

In the 1990s, this theory was extended to the reading filed (see Goetz & Sadoski, 1996; Sadoski & Paivio, 1994). For example, Steffensen et al. (1999) investigated the nonverbal store of bilingual concerning reading imagery and emotional response to the reading text. The findings indicated that the significance of nonverbal process in reading; the verbal and nonverbal processes were similar in L1 and L2 reading. Moreover, Danan (1992) advanced this theory by exploring the effect of subtitled video programs on foreign language learning. Finally, he suggested that both reversed subtitling and bimodal input in a video program were desirable. Taura (1998) explored the effect of L2 acquisition age and the exposure to the L2 on this theory. Hence, reading, video, age and exposure were also involved in this field.

Recently, this theory has been developing, extending different scopes. For instance, Jared et al. (2013) extend it to the cultural aspect, namely culturally-biased images are named obviously faster in the culturally-congruent language than its counterpart. It also supports the theory that image system have a closer connection with one language than the other. Later, Pritchett et al. (2016) further extend this theory to the memory for idioms and indicate idioms stored in one

language-specific format in both languages can be more easily recalled than in merely one language, supporting and developing bilingual DCT.

6. Value of the Theory

To a large extent, this theory holds great value in language learning and teaching. Pictures can serve as a powerful tool in language learning and teaching (Kelly, 1969; Paivio, 1980). Bilingual DCT provides it with a theory underpinning and two vocabulary teaching methods associated with pictures or image are recommended, according to Paivio (2014).

One approach is the Keyword Method, namely learners have an interactive image between the definition of an L2 word and a familiar imageable L1 word with the same sound (Paivio, 2014). For instance, the meaning of the Chinese word “嘴” (“mouth”) can be learnt by using the keyword “water” and imagining using “mouth” to drink “water”. Then, the word “mouth” could remind the learner of “water” by the acoustic association, evoking the “mouth – water” image that mediates recall of “嘴”. This is the same with English vocabulary learning. This method may enhance the learner’s ability to memorize and stimulate his or her learning interest as well as motivation.

He recommends the other is the Pegword, or Hook Technique, namely rhyme mnemonic. Specifically, imagery and intraverbal associative associations between pegwords and new target items are both required to acquire vocabulary learning. For example, number-word pairs (“one-pen, two-bottle, three-flower, four-book, five-box...”) can be learnt by employing the rhyme to memorize a list of items with mental images of a pen, bottle and flower with images suggested by the memory targets. Likewise, it can be applied into phrase learning. In this way, on one hand, learners can easily expand the size of vocabulary but also cultivate learning interest, but both methods still need to be verified and refined.

Moreover, this theory provides a strong support for the mind-mapping approach (Bergmann & Plieninger, 2012). Mind map refers to an outline where a central image can be radiated into main categories and then lesser categories. It has also been used in language learning and teaching and empirical evidence substantiates its effectiveness of vocabulary learning (see Mei, Kun, & Hai, 2010), writing (see Lai, & Chiu, 2013) and others.

Based on the above analysis, this theory can play a significant role in language learning and teaching, but it is still necessary to constantly develop this theory. As Paivio (2014) states, the hook mnemonic research is still not sufficient. Consequently, this theory deserves further exploring.

7. Conclusion

Overall, the bilingual dual coding theory can be robust after critically reviewing aspects above. It emphasizes the significance of the image system and its relationship with two verbal systems. Based on this theory, keyword method and hook technique can be applied into practical language learning and teaching. Some empirical research also supports it. However, this new theory still has weaknesses, e.g., relevant research is little; it is challenging to ensure research validity and reliability due to its relative complexity. Therefore, this theory needs to be constantly verified and developed, so it can be more effectively applied into practice. More importantly, researchers, especially language teachers, need have a constant critical reflection on theory, thus advancing its new development and promoting practical teaching effect.

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