Chapter 1

Computer-Assisted Character Learning Using Animation and Visual Chunking

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ABSTRACT

This chapter examines the effects of computerized stroke order animation and visual chunking on character recognition and production. Through two experiments, the authors found that both computer-assisted presentation methods were effective, and their impact was comparable to or surpassed the traditional way of character learning through reading and writing. Specifically, animation was comparable to writing and more effective than reading in facilitating form recognition. Visual chunking produced better results in character production than writing when characters were presented in radical-based groups.

INTRODUCTION

It has been four decades since researchers first attempted to integrate computer-assisted language learning (CALL) in Chinese teaching, and these efforts started with the emergence of programs teaching Chinese characters (Yao, 2009). In many Chinese CALL software programs today, character or orthography learning remains a core component (e.g., Multimedia Learning Suite; Chinese Character Tutor). The design features in these programs have developed in sophistication, offering a range of possibilities such as integrating sound, verbal information, colorful or dynamic images, and interactive feedback into learning. Despite the growing availability and popularity of the learning software, only a few empirical studies (e.g., Jin, 2003; Lu, 2011; Zhu, Fung, & Wang, 2012) have examined the effectiveness of using multimedia in comparison to the traditional rote memorization of reading and writing. Such direct comparisons shall allow Chinese as a Foreign Language (CFL) practitioners to make informed decisions regarding whether and what...
types of multimedia should be used to facilitate students’ character learning. In this study we are interested in exploring whether and how different multimedia presentation modes promote Chinese orthography learning among CFL learners, and we specifically focus on two widely-used presentation modes in computer-assisted character instruction: animation and visual chunking.

**BACKGROUND**

Due to the lack of systematic grapheme-phoneme correspondence in Chinese (e.g., DeFrancis, 1989), character learning is frequently identified as one of the greatest challenges for CFL learners (Everson, 1998). Learning how to write by rote repetition can be tedious (Allen, 2008), and it was suggested that character learning should be practiced individually by learners (Wang, 1998). Z. Zhang (1998) asserted that the computer is best suited for the time-consuming task of teaching students how to write, as the multimedia is not only instructional but also entertaining. The potential effect of multimedia learning is predicted by the Dual Coding Theory (DCT) (Clark & Paivio, 1991), which claims that the association of verbal and nonverbal representations enhances learning and memory retention. Nonverbal representations are nonlinguistic objects or events including shapes, sounds, and actions such as drawing lines. In the cognitive theory of multimedia learning, Mayer (1999, 2003) builds on the DCT and suggests that multimedia enables the combination of processing through the visual channel and verbal channel, which supports long-term memory. The impact of the DCT has been tested in previous character animation studies, although not always with positive findings (e.g., Jin, 2003; c.f., Zhu & Hong, 2005; Zhu et al., 2012). In the current project, we are interested in the roles of two particular visual encoding methods enabled by multimedia: stroke sequence animation, referred to as *animation* below, and character chunk presentation, or *chunking*. We selected these two encoding methods because animation and chunking are commonly-used features in character learning software (e.g., *eStroke*) and in on-line character learning platforms (Chen et al., 2011; Chen, Chien, & Chang, 2013). These two methods also respectively address two key characteristics of Chinese character composition, namely, stroke sequence and structural regularity.

**Stroke Sequence and Animation**

Images can encode spatial transformations and help students to visualize the dynamic process of events (Clark & Paivio, 1991). Stroke sequence animation programs take advantage of continuous animation of imagery stimuli to teach characters. Traditionally, learning how to write in Chinese is conducted by imitation, with teachers illustrating how a character is to be written on the board stroke by stroke and students imitating the movement in the air (Packard et al., 2006). Such a practice focusing on stroke movement and sequence is grounded in the psychomotor basis of drawing and handwriting (Law, Ki, Chung, Ko, & Lam, 1998). For instance, research on motor aspects of graphic productions shows that there are preferred as well as very difficult directions when it comes to people’s drawing (Van Sommers, 1984), and the basic stroke types in Chinese character writing coincide with the preferred directions of drawing. While imitating a teacher’s handwriting movement in the classroom is costly in terms of various resources, stroke sequence animation programs afford a potentially viable alternative that is unrestricted by time and space.

Animated pictures can have a facilitating and enabling effect on learners, in that it helps them to construct a mental model by explicitly showing the micro-steps of those phenomena that are impossible to realize from static images (Schnottz & Rasch, 2005). For instance, in studies on teaching non-language disciplines such as geometry,
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