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LONG PAPER

Braille learning materials for Braille reading novices: experimental determination of dot code printing area for a pen-type interface read aloud function

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Abstract

This study clarifies a previously established method in which Braille reading novices obtained Braille information aurally. Therein, users touched the vicinity of the Braille with a pen-type interface characterized by a Braille-to-voice function. Two-dimensional (2D) dot codes were printed on the Braille paper, and voice information corresponding to Braille was linked to these dot codes. This study aims to establish quantitative data regarding an acceptable size for the 2D dot code printing area. Nine Braille reading sighted novices, blindfolded and without Braille reading experience, were recruited to participate in an experiment, where they were asked to identify which of the six dots in a Braille character were missing, touch the pen-type interface to a sheet layered with the dot code printing area and TRUCT Braille, and evaluate the system's effectiveness on a scale from 1 to 5. All participants correctly identified the missing dot. Participants gave the Braille-to-voice function an average effectiveness rating of 4.6/5.0, with a standard deviation of 0.7. A dot code printing area was determined to be 8 mm above and 10 mm below the midpoint between dots 2 and 5 of the Braille character, with a width of 16 mm from the midpoint of the Braille. Based on these results, design guidelines were identified for the dot code printing area to improve the success rate of obtaining voice information corresponding to the Braille with the pen-type interface equipped with the Braille-to-voice function. This has numerous potential applications in Braille education methods for Braille reading novices.

Keywords TRUCT Braille · Braille learning materials · Pen-type interface · Dot code printing area

1 Introduction

Louis Braille invented the Braille system, widely known as a code that enables individuals with visual impairments to read and write at their own pace through a tactile system of characters. The reading speed for Braille is typically one-quarter of that for visual characters [1]. Highly experienced Braille readers can read up to 200 letters per minute [2].

There are numerous methods for printing Braille, including paper-embossed and silk screen printing, where paper-embossed printing is the widely accepted Braille printing method. However, with recent progress in screen printing technology, transparent resinous ultraviolet (UV)-cured-type (TRUCT) Braille signs are becoming increasingly popular in Japan, especially when printed together with visual characters. TRUCT Braille is more rigid than paper-embossed Braille. Additionally, the forefinger of Braille readers receives sufficient stimuli from the dots to be able to read TRUCT Braille. TRUCT Braille is considered to be relatively easy to read for Braille reading novices. The

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