

Chapter 15

Easily Readable Braille Pattern for Reading Beginners and Variable Size Braille Printing System

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ABSTRACT

Braille as a means of communication for children and persons with visual impairment plays an important role in supporting their social independence. However, learning Braille is very difficult, and many persons with adventitious visual impairment who are not conversant with Braille are unable to read Braille. One likely reason behind this is that the common Braille pattern is not necessarily easy for Braille reading beginners such as persons with adventitious visual impairment. Consequently, it is necessary to quantitatively evaluate the readability of Braille patterns for Braille reading beginners and incorporate such findings in Braille design. Moreover, suitable Braille printers are also required to precisely reproduce easily readable Braille patterns. This chapter describes experiments to evaluate the effect of paper-based Braille on Braille pattern readability and introduces a variable size Braille printing system for printing Braille patterns from the experiments to be easily readable by Braille reading beginners unfamiliar with Braille reading.

INTRODUCTION

The social backdrop in Japan after the act on the elimination of discrimination against persons with disabilities was enacted in April 2016 led to a stronger expectation of further progress in reasonable accommodation and assistive technologies for children and persons with visual impairment. The progress of assistive technologies for children and persons with visual impairment represent one aspect of such

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considerations. It is known that a significant part of information that people receive from the outside world is visual. Consequently, there is an urgent need for a study on appropriate measures for children and persons with visual impairment in such a sensory organ that is responsible for receiving a considerable portion of information from the outside world. Braille is one of such technology that has been widely used for many years to support children and persons with visual impairment. Children and persons with visual impairment can read and write characters at their own pace using Braille. Therefore, as a means of communicating information, Braille plays an important role in supporting social independence in such children and persons with visual impairment.

However, mastering many techniques and appropriate education are necessary in learning Braille, making it especially difficult (Lowenfeld, Abel, & Hatlen, 1969). Accordingly, it has been pointed that many persons with adventitious visual impairment with decline in or loss of visual function due to accidents, diseases, and aging, are unable to read Braille. The authors, through deliberations with staff of social welfare organizations engaged in Braille training for persons with adventitious visual impairment, as well as schools for the blind, found that in addition to many individuals with adventitious visual impairment who are unable to read Braille, there are many people who desire to freely obtain and communicate information by learning Braille.

One reason so many persons with adventitious visual impairment cannot read Braille is that, the common Braille patterns are not necessarily designed for ease of readability in Braille reading beginners. In particular, a major hurdle in learning Braille is that the size (dot spacing and height) and spacing (cell and line spacing) of the characters are too small to read. Although specifications of Braille are defined by the Japanese Industrial Standards (JIS), it is likely that JIS compliant Braille patterns produced as it is may not be easily readable by persons with adventitious visual impairment. Accordingly, quantitatively evaluating Braille pattern for ease of readability for Braille reading beginners, and incorporating the results in Braille design are deemed necessary. Moreover, suitable Braille printers are also necessary to precisely reproduce the Braille pattern that improves readability. Some studies focused on Braille reading have been conducted from various research area (Sadato, Pascual-Leone, Grafman, Ibañez, Deiber, Dold, & Hallett, 1996; Trent, & Truan, 1997; Wright, Wormsley, & Kamei-Hannan, 2009; Jarjoura, & Karni, 2015). However, in Japan, there are insufficient studies regarding easily readable Braille patterns for Braille reading beginners such as persons with adventitious visual impairment.

This chapter describes the experiments conducted to evaluate the effect of Braille pattern on readability using Braille reading beginners who are not yet familiar with Braille as experimental participants, and a variable size Braille printing system that enables printing of easily readable Braille pattern was verified in the experiments.

This chapter is organized into five sections. The first section is an introduction of the topic dealt with in the chapter. In second section, background and motivation behind the studies that we conducted to evaluate Braille readability, and necessity of suitable Braille printers are described. The issues surrounding the topic and knowledge relate to Braille patterns and Braille printers are presented in the next section. Summary and future research directions are given in the final section.

BACKGROUND

Ever since the six-dot style code for alphabet developed by Louis Braille in 1825 was adopted for Japanese alphabets by Kuraji Ishikawa in 1890, Braille has played a significant role in Japan as a support

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