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Accuracy of articulation rate control with visual feedback in persons who do and do not stutter

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Abstract

The ability to control speech rate with real-time visual feedback was compared between people who do and do not stutter (PWS/PWNS). Nine PWS and 7 PWNS participated in the study. Fifteen sentences were read aloud after repeating a played-back sentence twice in each of 6 trials at 6 different target speeds. The 6 trials comprise a session, and there were 3 sessions (A1, B, A2) with only the second session (B) accompanied by real-time visual feedback of the subject's speech rate and the target speed. The speech rate excluding pauses or dysfluencies was significantly reduced in B and A2 from that in session A1. Although there was no difference in speech rate between B and A2, (a) there was an interaction between the target rate and the group in session B, and (b) the variability in the error of the PWS was larger than that of the PWNS in the retention session (A2). These results suggests (a) that at least some of the PWS use a different strategy in controlling their speech rate than PWNS, and (b) that some of the PWS were less accurate in retaining the learned speech rate in the previous session B with visual feedback than the PWNS, although they did use the visual feedback information and learned the speech rate, to a similar averaged accuracy during the feedback.

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1. Introduction

Fluency shaping as part of stuttering therapy usually includes reducing speaking rate, gentle voicing onset, and gentle contact (e.g. Guitar, 2013). It is, however, difficult for people who stutter (PWS) to recognize the appropriateness of their speech rate by themselves while they speak. Both of fast and slow fluent speaker groups

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uttered at approximately two thirds of their normal rate, with a large individual variance, when they were instructed to speak at 50 percent of their normal speaking rate (Tsuo, Weismer & Iqbal, 2006). In an attempt to control the speaking rate (Curlee & Perkins 1969; Ingham, Martin & Kuhl, 1974), speakers were alerted when their speaking rate became too fast. There has been research involving computer-assisted home practice systems which enable them to monitor whether their speech rate is appropriate (Webster, 1980; Euler, Gudenberg, Jung & Neumann, 2009). However, this kind of research for Japanese PWS has been scarce or unsystematic. We examined the short-term effectiveness of visual feedback on the control of reading rate with automated speech recognition technology, and compared the results with people who do not stutter (PWNS).

2. Method

2.1. Participants

Nine PWS (six men and three women whose age ranged from 22 to 36 years) and seven PWNS (six men and one woman whose age ranged from 22 to 23 years) who were all native Japanese speakers, participated in the experiment after written informed consent. This study was approved by the ethical committee of the National Rehabilitation Center for Persons with Disabilities (NRCD).

2.2. Reading material

Participants read aloud a single passage consisting of 15 sentences in each trial. The length of the sentences was 29.1 morae long on average. Each trial was preceded by a learning phase of the target speed in which a sentence that was different from any of the 15 sentences was presented auditorily.

2.3. Task

The experimental design is illustrated in Figure 1. Each participant underwent three sessions (A1, B, and A2), each consisting of six trials of a reading task. Only in the second session (session B), visual feedback of the articulation rate was presented to the participant. In each trial, participants read aloud the passage trying to keep the speech rate as accurately as the instruction phrase after repeating it twice before the reading phase. The trial was repeated six

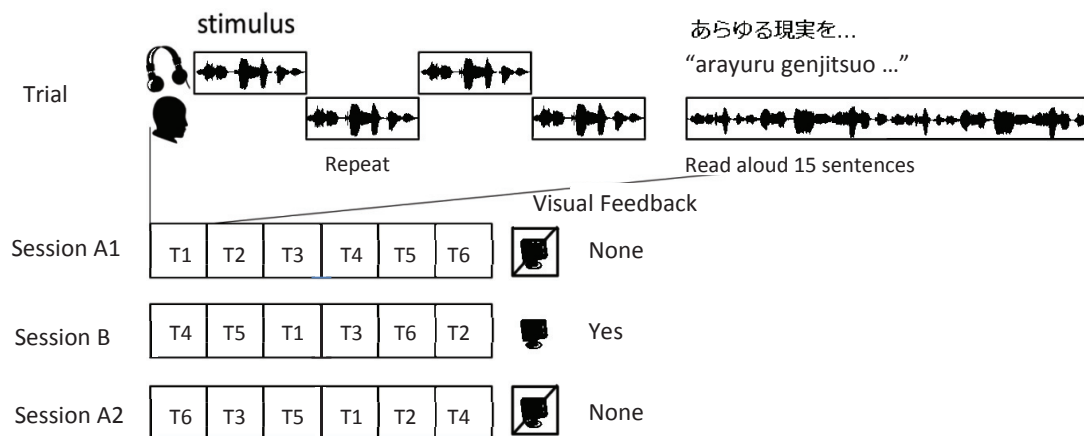


Figure 1. Experimental design

Upper panel: Each trial starts with stimulus and repetition (twice), followed by reading 15 sentences. The model speech instructed the target speech rate. Lower panel: Each session included 6 trials with different target speeds in a randomized order. Visual feedback of speech rate with a reference line showing the target speed was presented only in session B.

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