The present study investigated the role of sensory feedback (auditory, proprioception, and tactile) at the intra- and inter-gestural levels of speech motor coordination in normal and fast speech rate conditions in two groups: (1) persons who stutter (PWS) and (2) those who do not (PNS). Feedback perturbations were carried out with the use of masking noise (auditory), tendon vibration (proprioception), and nonwords that differed in the amount of required tactile lip contact (/api/ + tactile and /awi/ – tactile). Comparisons were also made between jaw-free and jaw-immobilized (with a bite-block) task conditions. It was hypothesized that if PWS depend more strongly on sensory feedback control during speech production, they would show an increase in variability of movement coordination in the combined presence of fast speech rates and feedback perturbations, in particular, when jaw motions are blocked and adaptations in the other articulators are required to achieve the task goals.

Significant feedback perturbation effects were found for both groups, but the only significant between-group effect was found at fast speech rates in the jaw-free condition, showing that control...
speakers were more perturbed at the intra-gestural level of coordi-
nation than PWS when simultaneous (auditory, proprioceptive,
and tactile) perturbations were present. The findings do not pro-
vide support for either the feedback dependency or the sensory
deficit hypotheses described in the literature to explain movement
characteristics found in fluent speech production of PWS.
© 2009 Elsevier B.V. All rights reserved.

1. Introduction

The "motor skill" view of stuttering (van Lieshout, Hulstijn, & Peters, 2004) posits that persons who
stutter (PWS) are at the lower end of a speech-motor skill continuum relative to persons who do not
stutter (PNS). According to this view, it is assumed that PNS produce speech like any other well-prac-
ticed motor task, weighted towards feedforward control that is highly automatized and based on
dynamical principles of motor control (Saltzman & Munhall, 1989; van Lieshout et al., 2004). In con-
trast, PWS are argued to be less skilled in speech production and are inclined to use a less automated
strategy that is more dependent on sensory information for the control of speech movements (Adams,
Weismer, & Kent, 1993; van Lieshout, Hulstijn, & Peters, 1996a, 1996b; van Lieshout, Peters, Stark-
weather, & Hulstijn, 1993). Within this motor skill frame work, PWS are not considered speakers with
a sensory deficit as some researchers have suggested (Archibald & De Nil, 1999; Loucks & De Nil,
2006a, 2006b). Rather it is proposed that their speech motor symptoms reflect limitations in efficiency
and agility similar to what has been reported for less skilled performances in other types of motor
tasks (Broderick & Newell, 1999; De Nil, 1999).

Others have also hypothesized that PWS might show an over-reliance on sensory feedback, but not
as a compensatory strategy to prevent stuttering due to limitations in motor skill (Max, Guenther,
Gracco, Ghosh, & Wallace, 2004). Rather, these authors claim that this over-reliance on sensory feed-
back, given the inherent delay between a motor command and its sensory consequences, may actually
result in an unstable speech motor system characterized by oscillations and resets, which at a behav-
ioral level is assumed to be reflected in disfluent speech production. It is expected that these instabil-
ities in the speech motor system would increase with increases in speech rate due to the extra
demands on temporal processing of sensory information at fast speech rates (Max et al., 2004).

Although over-reliance on sensory feedback has been implicated in stuttering both as a cause and
as a compensatory strategy, there is very little information in the stuttering literature on the exact
type of sensory information that PWS are assumed to be over-dependent on (whether its auditory,
proprioceptive, or tactile\(^1\)\), at what level it is being used for motor control, whether its use in PWS dif-
fers from that of PNS and so on. This paper is aimed at answering some of these questions.

The role of feedback in speech production is currently a hot topic of research. Broadly stated, audi-
tory and oro-sensory\(^2\) feedback arising from speech related activity is utilized to learn and control
speech movements (Guenther, 2006; Postma, 2000; Purcell & Munhall, 2006; Smith, 1992). For example,
the importance of auditory information for the control of speech movements has been demonstrated
using speech compensation and adaptation paradigms. There are studies that report of bite-block in-
duced vowel distortions and acoustic target variability in hearing impaired (Tye, Zimmermann, & Kelso,
1983) and postlingually deaf cochlear implant users when their implant was temporarily turned off
(Lane et al., 2005). Furthermore, studies have also demonstrated the significance of oro-sensory informa-
tion, independent of auditory information for the control of speech movements. For example, Tremblay,
Shiller, and Ostry (2003) used a robotic arm and applied perturbations to the jaw during speech and non-
speech tasks that had no auditory consequences (and were undetected by the speakers). After sufficient

\(^1\) The word "tactile" refers to the combined sensations of touch, pressure, and skin stretch that arise from mechanoreceptors in
the oral labia during the production of bilabial consonants.

\(^2\) The term "oro-sensory" in this paper will specifically refer to sensations mediated by mechanoreceptors (touch, pressure, and
stretch) and proprioceptors (proprioception—sensation of muscle and joint position and movement).
دریافت فوری متن کامل مقاله

<table>
<thead>
<tr>
<th>متن کامل مقاله</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ امکان دانلود نسخه تمام متن مقالات انگلیسی</td>
</tr>
<tr>
<td>✓ امکان دانلود نسخه ترجمه شده مقالات</td>
</tr>
<tr>
<td>✓ پذیرش سفارش ترجمه تخصصی</td>
</tr>
<tr>
<td>✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله</td>
</tr>
<tr>
<td>✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله</td>
</tr>
<tr>
<td>✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب</td>
</tr>
<tr>
<td>✓ دانلود فوری مقاله پس از پرداخت آنلاین</td>
</tr>
<tr>
<td>✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات</td>
</tr>
</tbody>
</table>