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Acoustic analysis of clear versus conversational speech in individuals with Parkinson disease

Alexander M. Goberman[a,*], Lawrence W. Elmer[b]

[a]*Department of Communication Disorders, Bowling Green State University, 200 Health Center Building, Bowling Green, OH 43403, USA*
[b]*Department of Neurology, Medical College of Ohio, Toledo, OH, USA*

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Abstract

A number of studies have been devoted to the examination of clear versus conversational speech in non-impaired speakers. The purpose of these previous studies has been primarily to help increase speech intelligibility for the benefit of hearing-impaired listeners. The goal of the present study was to examine differences between conversational and clear speech in individuals with Parkinson disease (PD). Twelve individuals were recorded producing conversational and clear speech. Acoustic analysis revealed that individuals with PD used some of the same clear speech strategies used by non-impaired speakers. Specifically, clear speech in PD was characterized by decreased articulation rate, increased mean fundamental frequency (F_o), and increased speaking F_oS.D. compared to conversational speech. The discussion examines the possibility that individuals with PD may have been independently applying a clear speech strategy based on their habitually increased percent pause values. Discussion also focuses on implications of the present findings to management of individuals with PD, and research implications.

Learning outcomes: As a result of this activity, the participant will be able to (1) describe the characteristics of clear speech produced by non-disordered individuals, (2) describe the acoustic characteristics of clear and conversational speech produced by individuals with Parkinson disease; and (3) describe the strategies individuals with Parkinson disease use when asked to produce clear speech.

Keywords: Parkinson; Clear speech; Conversational speech; Acoustic analysis

* Corresponding author. Tel.: +1 419 372 2518; fax: +1 419 372 8089.
E-mail address: goberma@bgnet.bgsu.edu (A.M. Goberman).

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Previous research has examined the difference between 'conversational-style' and 'clear-style' speech (e.g., Hargus Ferguson & Kewley-Port, 2002; Picheny, Durlach, & Braida, 1985, 1986, 1989). These previous clear speech studies have been primarily concerned with the effects of clear speech production on the intelligibility of speech for hearing-impaired listeners. To elicit conversational speech, instructions have been given to speak in a manner similar to ordinary conversation (Picheny et al., 1985), while clear speech has been elicited with instructions to speak as clearly and precisely as possible (Picheny et al., 1985; Schum, 1996). The current study will examine the production of clear speech, and the difference between clear and conversational speech in individuals with Parkinson disease (PD).[1]

1. Clear speech characteristics

Research has examined both the perceptual and acoustic effects of clear speech production. Overall, an increase in intelligibility has been found in clear speech compared to conversational speech (Bradlow, Kraus, & Hayes, 2003; Hargus Ferguson & Kewley-Port, 2002; Helfer, 1997; Picheny et al., 1985; Schum, 1996). This increase in intelligibility with clear speech production has been generally found to be independent of both listener factors (Bradlow et al., 2003; Picheny et al., 1985) and speaker factors (Picheny et al., 1985; Schum, 1996).

Acoustic examination of clear speech offers insight into the speech production changes that speakers make when asked to produce speech clearly. Acoustic analysis completed by Picheny et al. (1986) and Bradlow et al. (2003) have found rate and pause differences when clear speech was compared to conversational speech. Specifically, clear speech was characterized by decreased articulation rates and increased frequency and length of pauses. Uchanski, Choi, Braida, Reed, and Durlach (1996) and Krause and Braida (2002) both studied the role of rate and pause changes on the intelligibility of clear speech. Uchanski et al. (1996) concluded that speaking rate has a large effect on intelligibility, whereas Krause and Braida (2002) added that other acoustic properties also contribute to the increase in intelligibility found in clear speech production. These acoustic properties of clear speech include increased fundamental frequency (F_o), increased variability of speaking F_o, and increased intensity of certain consonants (Bradlow et al., 2003; Picheny et al., 1986). When vowel formant frequencies were examined, findings indicated that vowels were reduced in conversational speech, and vowels were produced more

[1] A number of recent publications have dropped the possessive ('s) from the eponym "Parkinson's disease," changing it to "Parkinson disease". We also opted to drop the possessive for two reasons. First, the current edition of the American Medical Association's Manual of Style (Iverson et al., 1998) states that "... in keeping with the desire to promote clarity and consistency in scientific writing, we recommend that the possessive form be omitted from eponymous terms." (p. 471) In addition to the issue of clarity, it has been stated that possessive forms of eponyms should only be used when the person who the disease is named for was actually afflicted with the disease (Haines & Olry, 2003). For example, Amyotrophic Lateral Sclerosis is sometimes called "Lou Gehrig's disease", and this is a proper use of the possessive form because Lou Gehrig was afflicted with the disease. Because James Parkinson was not known to have the disease that was named after him, we refer to this disease as "Parkinson disease."