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Speech Rate Effects on Fluency in a Preschooler with Disordered Phonology

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Abstract

Slow rate of speech, a therapy method that falls under the Demands Capacity Model of treatment, is a go to technique for treating children who stutter (Conture, 2001; Franken, 2013; Franken, Kielstra-Van der Schalk, et al., 2005; Gottwald, 2010). However, recent literature has presented the idea that this method may not be as effective when working with children who stutter and have a concomitant phonological disorder (S+DP). The purpose of the present study is to investigate in-depth the case of a four-year-old boy who stutters and who presents with disordered phonology (S+DP), and the effects of a clinician's rate of speech on facilitating his fluency. Using adjacent utterance pair methodology, this study looks at the relationship between how fast or slow the clinician's rate of speech is, and whether or not the child stutters or speaks fluently in response. The rates of the clinician's utterances were calculated in syllables per minute, and a median split comparison was performed to separate the utterances as either fast or slow. The AUP's were then separated into four groups based on clinician's rate and child response. A chi-square test for independence provided a non-significant result, suggesting that a slow rate of speech did not facilitate the fluency of this S+DP child. A noteworthy connection between the child participant's unintelligibility and fluency was also found. These findings support the idea that slow rate does not facilitate fluency in S+DP children, and that further research into this population, as well as effective methods of treatment for them, is necessary.

Key words: Speech rate, fluency, disordered phonology, Adjacent Utterance Pair, preschoolers

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Introduction

It has been reported that of school aged children who stutter, 68% exhibit at least one additional communication problem, with 24% exhibiting more than one (Blood & Seider, 1981). For instance, approximately 30-40% of children who stutter show concomitant disordered phonology (Wolk, Edwards, & Conture, 1993). From a historical perspective, Williams and Silverman (1968) were among the first to point out this co-occurrence, finding that 24% of 115 elementary school aged children who stuttered also presented with an articulation disorder. Riley and Riley (1979) found that out of 54 disfluent children (ages 3 to 11), 33% had a moderate to severe phonological disorder. At this point in time, we know that the prevalence of disordered phonology in children who stutter is greater than the 2-6% that would be expected in a normally developing population, in that stuttering children exhibit more phonological processes than their normally fluent peers (Louko, Edwards, & Conture, 1990). Finally, disordered phonology seems to be the communication disorder most commonly associated with stuttering (Arndt & Healy, 2001; Louko et al., 1990; Wolk et al., 1993; Yairi, 2007).

Some researchers have proposed that there are subgroups within children who stutter (Louko et al., 1990; Peters & Starkweather, 1990; St. Louis & Hinzman, 1988). These subgroups further break down the broad classification of stuttering with more specific criteria. Stuttering plus disordered phonology could be considered one of these subgroups. Peters and Starkweather (1990) suggested that there are two main subgroups, one with a motoric etiology and the other with linguistic etiology. Under this linguistic subgroup, various areas of interest are presented, including syntax, semantics, and phonology. It is suggested in this article that stuttering severity is linked to the severity of the deficit in these areas. Peters and Starkweather (1990) also make the claim that language skills, including phonology, in relation to stuttering seem to be relatively important. Despite this importance, the population of children who stutter and have disordered phonology (S+DP) is under-represented in the literature, particularly in the area of clinical significance and therapy approaches. Speaking clinically, determining the frequency of these subgroups, particularly those of children with concomitant disorders, is crucial because they may require different assessment and treatment strategies than children who only stutter (Arndt & Healy, 2001; Bernstein Ratner, 1995; Logan & LaSalle, 2003).

A therapy approach with good efficacy data has been the Demands-Capacity Model (DCM) - based treatment (Conture, 2001; Franken, 2013; Franken, Kielstra-Van der Schalk, & Boelens, 2005; Gottwald, 2010). This DCM model states that disfluencies occur when the environmental or communicative demands exceed the child's capacities in one or more areas of development (Arndt & Healy, 2001; Gottwald, 2010; Nippold, 2002). This DCM model also suggests that slowing rate of speech when communicating with a child who stutters would lessen the demands, and in turn provide more opportunity for the child to speak fluently.

In the DCM approach, a young child's fluency is facilitated via the caregiver's indirect modeling of a slow speech rate (Conture, 2001; Franken, 2013; Franken, Kielstra-Van der Schalk, et al., 2005; Gottwald, 2010). The popularity of this model has suggested that caregiver slow speech rate model could be a "go to" technique when treating a child who stutters. While there have been many studies on children who stutter with normally developing phonology (S+NP) and their response to a slow rate (Conture, 1990; Conture, Louko, & Edwards, 1993; Guitar & Marchinkoski, 2001), children who stutter and also have a concomitant phonological disorder (S+DP), a common occurring subgroup, have only recently begun to be been investigated in regards to their response to this slowed rate approach (LaSalle, 2015).

One study that looks at slow rate effect on the S+NP population is by Yaruss and Conture (1995). They examined the relationship between parents' and children's utterance lengths and speaking rates in conversational interactions using adjacent utterance pairs (AUPs) in 10 boys who stutter (mean age 58.5 mo.) and 10 boys who do not stutter (mean age 57.0 mo). Yaruss and Conture (1995) did not find a direct relationship between the mother's rate and child's rate, or between mother and child utterance length. They did find that the closer the speaking rates of mother and child were to each other, the more fluent the child was. The data suggested that speaking slower and closing the "dyadic gap" (i.e., the difference in rate between the caregiver and the child) does facilitate child fluency, and that slowing speech rate as a therapy approach could also be effective.

Until recently, studies done on the effect speech rates have on fluency in preschoolers who stutter have focused on the mother/child dynamic, including the previously mentioned study done by Yaruss and Conture (1995). Stephenson-Opsal and Bernstein Ratner (1988) compared the fluency level of stuttering children over the course of five sessions in two mother-child dyads at baseline and after instructions for the mothers to slow their rate of speech were given. The first child showed a 28% decrease in disfluency at the end of treatment, and the second child a 45% decrease in disfluency. These results confirm the results of Yaruss and Conture (1995), supporting the concept that slow rate of speech helps facilitate fluency in children who stutter. However, neither of these children presented with concomitant disordered phonology.

There have been only a few studies on speech rate looking at the relationship between the child and the clinician in regards to speech rate, and even fewer investigating the possibility that preschool participants who stutter and show disordered phonology are the children who do not respond as fluently to a slow clinician speech rate (Carlson & LaSalle, 2004; LaSalle, 2015). For example, Carlson & LaSalle (2004) investigated the transcripts of seven clinician-stuttering child dyads using an adjacent utterance pair (AUP) analysis, as was done by Yaruss and Conture (1995), to determine if children were more likely to speak fluently following a clinician's slower rate. Using a chi-square analysis, only two of the seven children showed significant results. One of these two children showed results in the expected direction, whereby he spoke more fluently when the clinician spoke slowly. In contrast, the child who stuttered and had a concomitant phonological disorder showed opposite results. He was more likely to stutter in response to her slow rate, despite child utterances in the fluent versus disfluent categories being essentially equivalent in length and complexity. This suggests that the fluency of the children from the stuttering plus disordered phonology (S+DP) subgroup are not affected by the slow rate of the clinician in the same way as a stuttering plus normal phonology (S+NP) child would be.

In a recent study by LaSalle (2015), six clinician child dyads comprised of graduate clinicians and children who stutter were tested for articulation rate alignment and fluency in response to a clinician's slow rate of speech. Three of the six children presented with phonological disorders (2 males, 1 female). This study also used AUP methodology with an A-B-A-B withdrawal treatment design, looking at the rate of the child in phones per second (pps) in response to the clinician's slowed rate of speech. The results showed that the 3 S+DP children did not rate align to the clinician's slowed rate, however the S+NP children did. The S+NP children also showed a greater mean baseline reduction of stuttering frequency (109.8%) than the S+DP participants (41.1%). These data align with previous results that suggest some children tend to speak more fluently when a caregiver slows their rate of speech. This also suggests that the S+DP population is among those who do not show improved fluency in response to this method.

Stuttering and phonological disorders are undoubtedly interconnected (Bloodstein, 1987; Nippold, 2002). However, this connection and its clinical implications have not yet been fully explored. A closer exploration of this could lead to a better understanding of the stuttering behaviors of S+DP children, and how these behaviors differ from those who only stutter. Similarly, exploration of this topic could lead to further understanding of how the co-occurring stutter effects phonological behaviors (Wolk et al., 1993). The knowledge gained in both of these categories could lead to more accurate assessment techniques and potentially more effective intervention strategies. Furthermore, there is some debate as to whether treatment takes longer in these children who stutter and show disordered phonology (S+DP) (Miller & Guitar, 2009; Nippold, 2002). There is agreement, however, about the need for an appropriate clinical approach for treating both disorders concomitantly, and for further investigation into how a slow rate model might be involved in that approach (Bernstein Ratner, 1995; Logan & LaSalle, 2003).

The purpose of the present study is to investigate in-depth the case of a 4 year-old boy who stutters and who presents with disordered phonology (S+DP), and the effects of a clinician's rate of speech on facilitating his fluency. It is predicted based on previous findings that this method will not facilitate the fluency of this 4-year–old S+DP child.

Methods

Research Design

This was a descriptive case study research design. The independent variable was the rate of clinician's utterances (fast, slow). The dependent variable was the child's level of speech fluency. The research question was: In a boy who stutters and shows a concomitant phonological disorder, what is the effect of a clinician's fast versus slow speech rate on his speech fluency?

Participants

One clinician-child dyad participated in this Institutional Review Board (IRB) exempt study. The clinician participant was a female graduate student at the University of Redlands assigned to work with the client as part of her clinical rotation. In order to properly follow the Demands Capacity Model of Treatment approach, the graduate clinician was instructed by her faculty supervisor to slow her rate when working with the client.

The child, participant E, was a boy aged 4;3 (years; months) who was referred to the university clinic because of parental concerns about stuttering and high levels of unintelligibility. Stuttering onset was reported by his mother as approximately age 3;3. Criteria for the selection of the client participant was that: (1) the child be of preschool age with no prior therapy, (2) have no other auditory, cognitive or developmental delays, and (3) present with both stuttering as well as disordered phonology. The client met these first two criteria based on a parent interview performed by the clinician prior to the onset of treatment. He had no prior therapy and presented with disordered phonology, rated as severe (i.e., 57% intelligibility at first session based on HAPP-3 Assessment), and stuttering, rated at a moderate level (i.e., > 3 within–word disfluencies per 100 words, mostly repetitions of /h/-initial words and non-words, such as when /h/ was repeated on words that were either unintelligible or when /h/+ vowel seemed to function as an interjection).

The qualification of stuttering was determined based on the following criteria: (a) produced 3+ within-word disfluencies or “stutter-like disfluencies” (i.e., monosyllabic whole-word repetitions, sound-syllable repetitions, audible sound prolongations, and blocks) per 100 syllables (Yaruss, 2000), and (b) child’s caregivers believed the child to be “stuttering.” Participant E’s fluency was evaluated using a 300-word sample collected using the Modified

Stocker Probe Technique (Stocker, 1980) by the graduate clinician. He averaged 11 within word disfluencies per 100 words, with a range from 5 to 17, qualifying him as a child who stutters based on the previously stated criteria.

The participant also met the diagnosis for disordered phonology based on the following criteria: (a) at least one age inappropriate phonological process present, using the operational definition provided by McReynold's & Elbert (1981) of at least four opportunities for application of the phonological process, including 20% application on these opportunities (Louko et al., 1990). The Hodson Assessment of Phonological Patterns (HAPP-3) was administered to assess Participant E's phonology. He presented with fronting, deaffrication and gliding, as well as a few occurrences of other phonological processes, qualifying his phonology as severely disordered.

Procedure

Information was gathered from 10, 50-minute therapy sessions in the Truesdail Clinic run by the graduate student clinician. These sessions were recorded on an audio/visual playback device called VBrick. Using VBrick, the 10 sessions were reviewed, and all of the child and clinician's utterances were orthographically transcribed. These orthographic transcriptions with phonetic notations where needed were then inputted into the Systematic Analysis of Language Transcript (SALT) Software (Miller, Andriacchi & Nockerts, 2011). Once a transcription of each of the ten sessions was generated, they were reviewed one by one to extract Adjacent Utterance Pairs (AUP) using methodology per Yaruss & Conture (1995), Carlson and LaSalle (2004), and LaSalle (2015).

An AUP is defined as a fluent adult utterance immediately adjacent to or followed by a perceptibly fluent child's utterance in response that is not an interruption and is at least three words in length (Yaruss & Conture, 1995). For the purpose of this study, criteria for AUPs were determined. All clinician utterances were selected that met the following criteria: (1) intelligible; (2) fluent; (3) did not include a pause >250 ms; (4) three or more words in length; and (5) immediately preceded a child utterance in a non-overlapped or non-interrupted manner. The child's utterances had to meet the following criteria in order to complete the AUP: (1) must immediately proceed a clinician's fluent utterance in a non-overlapped or non-interrupted manner; (2) did not include a pause >250 ms; and (3) three or more attempted words in length.

The VBrick video .wmv files were then converted to .wav audio files using a free Internet software called Switch (NCH Software, 1993) and were loaded into a program called Audacity (Audacity Team, 2014). Audacity allows the researcher to view a sound clip as a waveform and spectrogram, providing a visual representation of the utterances. The waveforms generated were used to acquire the exact duration in seconds of the clinician's utterances that met the requirements of an AUP using spectrographic displays. Utterance onset was operationally defined as the first peak in the waveform, and utterance offset as the last peak in the waveform. Utterance onset and offset times were decided based on two criteria: (1) all visible energy in less easily measurable phones (e.g., trailing fricatives) was captured and (2) all phones in the utterance were judged intact when the segment was played-back (LaSalle, 2015). This information was used to calculate syllables per second by dividing the duration in seconds of each clinician's utterance by the number of syllables in that utterance, which was previously collected. This number was then multiplied by 60 to convert the measurement to syllables per minute (spm).

Inter- and Intra-judge reliability

For intra-judge reliability, the standard of 100% agreement within +/- 3 ms for data re-measurement reported by Hall et al. (1999) and replicated in LaSalle (2015) was followed before submitting AUP's to statistical analyses. An undergraduate student at the University of Redlands serving as a research assistant performed the inter-judge reliability measures for the present study. Random number selecting software was used to select 36 of the 179 AUP's for review (20% of total utterances). The assistant listened to the audio recordings of the collected AUP's and orthographically transcribed the child's utterances, categorizing the utterances as either stuttered or fluent, and compared them for accuracy to the originally collected AUP's. The assistant then acquired the duration of the clinician's utterances using the same methodology as previously described. Disagreements in measurement were identified, including acoustic duration differences of the clinician's utterances in seconds that exceeded +/- 3 ms or any transcription discrepancies. Of the 36, four discrepancies were identified, achieving 90% agreement. All disagreements were re-measured. Once agreement was reached, the AUP's in question were placed back in the data set for statistical analyses.

Data Analysis

One hundred eighty-nine AUPs selected from the 10 sessions were originally selected for analysis. Child utterances that included unintelligible segments but lacked stuttering totaled 9, thus 189-9 = 180 AUPs. One more child utterance was excluded due to the presence of a between-word disfluency (i.e., a phrase repetition, revision, interjection, e.g., Conture, 2001), as opposed to the within-word disfluencies present in the remainder of his stuttered utterances, thus 180-1=179. This utterance was excluded because this type of disfluency is often considered normal and not disordered (Conture, 1990). Across all child utterances in the 179 utterances, participant E showed a mean length of utterance (MLU) of 4.57 (Range: 1 to 12 morphemes per utterance), which is within normal limits for a boy of this chronological age (4;3) (Brown, 1973). Of these 179 utterances, 61 were disfluent, and 118 were fluent.

Linguistic Analysis

A comparison of the fluent and disfluent utterances for difference in length and complexity was performed using length of the child's utterances in morphemes. To gain an accurate measure, mean length of utterance (MLU) should include calculation of utterances that are complete, intelligible, and verbal (Miller, Andriacchi, & Nockerts, 2011). Due to the amount of unintelligibility in the child's stuttered utterances, a mean length of utterances for all 61 of the utterances could not be calculated. Of the 60 disfluent utterances, only 21 (34%) were fully intelligible, that is did not include any unintelligible segments. These 21 disfluent utterances with no unintelligibility were compared to the first 21 fluent utterances using a two tailed Wilcoxon-signed- rank test with an alpha level of p=.01. A non-significant difference (p=0.121) was found between these two sets of utterances (Disfluent utterances: 5.04=MLU-m; range = 1 to 9; Fluent utterances: 3.952 = MLU-m; range = 1 to 12).

Chi-square analysis data preparation

A median split comparison was used to determine the "fast" vs. "slow" speech rate of the clinician's utterances. The median in syllables per minute (spm) of the 179 utterances was equal to 202.53 syllables per minute (spm) (range = 49.41 to 413.51 spm). If the rate of the clinician's utterance was faster than the median, it was considered "fast" (n=89). If the rate was below the clinician's median rate of speech, it was considered "slow"(n=89). The median utterance that measured 202.53 was excluded, leaving 178 AUPs for chi-square analysis. The AUP's were then classified into the following categories:

(1) Clinician fast (i.e., > 202 spm; n = 89)

(2) Clinician slow (i.e., < 202 spm; n = 89)

All 178 AUPs were then categorized as to whether the child's response was stuttered or fluent, so the following categories were formed:

(1) Child stuttered (i.e., 1+ within-word disfluency was present in the utterance)

(2) Child spoke fluently (i.e., 0 within-word disfluency was present in the utterance)

A chi-square test for no difference using a 2x2 contingency table was conducted to determine the relationship between the attributes of the variables.

Results

Statistical Analysis

Table 1 shows a 2x2 contingency table for the chi-square analysis with an alpha level of $p=0.01$, which was found to be non significant at $p = 0.26$ (two-tailed).

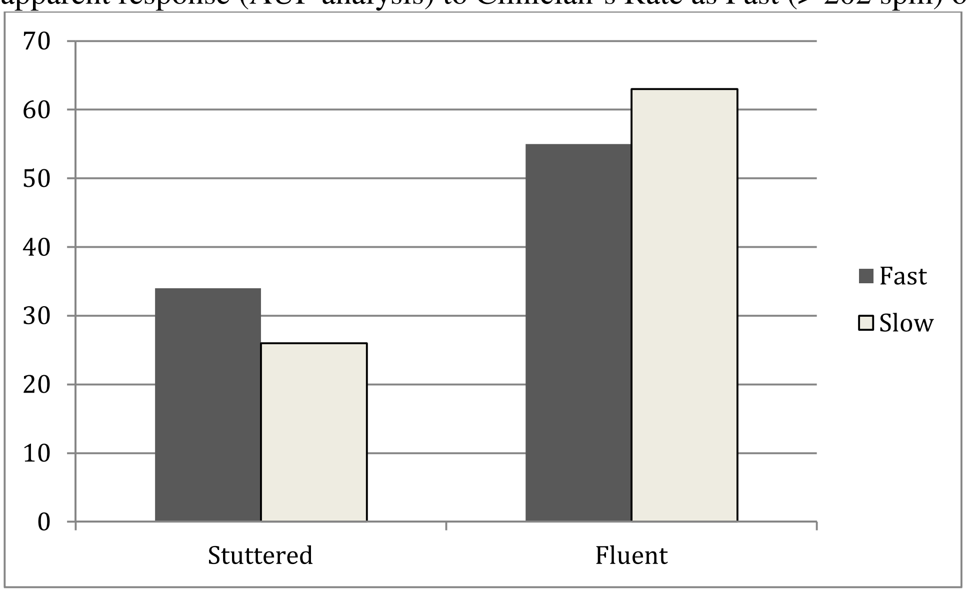
	Stuttered	Fluent	totals
Fast	34 (38%)	55 (62%)	89
Slow	26 (29%)	63 (71%)	89
Totals Totals	60	118	178

Table 1: Chi Square Test for Independence

As can be seen from Table 1, when the clinician spoke in a relatively fast rate of speech, (> 202 spm), Child E spoke fluently on 62% (55/89) of the subsequent utterances in the AUPs. When the clinician spoke in a relatively slow rate of speech, (< 202 spm), Child E spoke fluently on 71% (63/89) of the subsequent utterances. This suggests that the clinician's rate of speech had no significant effect on the fluency of this 4-year-old S+DP child based on non-significant p value of p=0.26.

As illustrated in Figure 1, 53% of the child's fluent utterances (63/118) were preceded by the clinician speaking slowly; however almost equally as many (47% or 55/118) were preceded by the clinician speaking quickly (> 202 spm). A similar effect was observed with the child's stuttered utterances. Of the child's stuttered utterances, 57% (34/60) were preceded by a fast clinician rate, but 43% were preceded by a the clinician speaking slowly (26/60). These data suggest that the rate of speech has little effect on the fluency of the child.

Figure 1: Number of child's utterances out of 178 AUPs that were either Stuttered or Fluent in apparent response (AUP analysis) to Clinician's Rate as Fast (> 202 spm) or Slow (< 202 spm).



Discussion

The focus of the present study was the effect that a clinician's rate of speech has on the fluency of child who stutters and presents with a speech sound disorder or disordered phonology (i.e., an S+DP child). The main finding was that there was no difference in the fluency of an S+DP child with moderate severity stuttering and severe disordered phonology, contingent on the clinician's fast versus slow rate of speech. There was no difference in the length of utterance in morphemes between his stuttered versus fluent utterances. These findings suggest that an S+DP child's fluency does not improve when a clinician uses a slow rate of speech as the sole method of therapy.

These findings are consistent with the findings of LaSalle (2015). LaSalle investigated six clinician-child dyads (3 S+NP, 3 S+DP) and found that rate entrainment, as well as improved fluency, did in fact occur in the 3 S+NP participants. The S+DP group did not rate entrain, and two of the S+DP children did not show an increase in their fluency in response to a clinicians slow rate of speech. The only S+DP participant who did show increased fluency, participant FE, was female. The other two S+DP participants were male. From baseline, FE showed a 321.4% decrease of stuttering frequency. In contrast to this, the S+DP boys showed 25.9% and 28.9% decreases respectfully. All of the S+NP boys showed greater than a 90% stutter reduction from baseline.

It is interesting to note that both children in the LaSalle (2015) study who did not respond to slow rate in treatment were male and S+DP, similar to the participant in the present study. These findings suggest that S+DP boys do not respond as fluently to a slow rate mode as do S+DP girls and, by inference, S+NP girls. It suggests the question of how does an S+DP boy respond to a slow rate model as compared to S+DP and S+NP girls? It is widely accepted that there is higher incidence and prevalence of stuttering among males than females and that males are less likely to spontaneously recover than females (Ambrose, Yairi, & Cox, 1993; Bloodstein & Bernstein Ratner, 2008; Yairi, Ambrose, Paden, & Throneburg, 1996; Yairi 2007). The findings of the present study combined with the results of LaSalle (2015) suggest that the confounding factors of the phonological disorder may not be as inhibiting in fluency recovery for females as it is for males.

The Anticipatory Struggle Hypothesis

The direct relationship between Participant E's unintelligibility and his stuttering, that is the fact that 34% of his disfluent utterances were too unintelligible to submit to mean length of utterance (MLU-morpheme) analysis, was a serendipitous and yet important aspect of the findings of the present study. In a post-hoc analysis, this seemingly direct relationship wherein increased unintelligibility equals increased stuttering was measured. Previously excluded utterances were placed back into the corpus for analysis. The number of his fluent utterances with unintelligible speech units was then compared to the number of stuttered utterances also with unintelligible speech units on various levels of frequency. Of the original 127 fluent utterances, only 9 included unintelligible speech units (7%). In comparison, of the 61 stuttered utterances, almost two-thirds (41/61 = 66%) included one or more unintelligible speech units.

One explanation that could be offered for this connection between participant E's stuttering and unintelligibility is the anticipatory struggle hypothesis (Bloodstein, 1972). This theory generally states that stuttering results due to the child's belief that speaking is difficult. Many forms of this hypothesis exist, but the main idea across them all is that the series of events that leads to stuttering is as follows: (1) the suggestion of imminent difficulty of speech, (2) the anticipation of failure, (3) being overcome by the need to avoid this failure, (4) abnormal motor planning of voluntary articulation, (5) production characterized by tension ad fragmentation, interfering with normal speech processes (Bloodstein & Bernstein Ratner, 2008).

In relation to the present study, the difficulty anticipated by participant E is his unintelligibility. It was reported by his mother that he does not seem to be aware of his disfluencies, but is aware that people do not understand him. Therefore, when participant E's unintelligibility is high, and he is aware he is not being understood, the anticipation of this causes him to stutter. It has been proposed that events of stuttering are caused when a child's strong need to be heard and understood meets with a feeling of opposition, usually triggered by listener behavior (Perkins, 1992). This suggests that participant E's stuttering could stem from his knowledge that the clinician does not understand his attempts, and the frustration this knowledge causes.

It is also interesting to note the participant E's temperament and the effect it could have on improved fluency in correlation with the anticipatory struggle hypothesis. Temperament is possibly best defined as "an inborn style of behaving" (Kagan, Reznick & Snidman, 1987, as cited in Guitar, 2014, p. 37). During initial evaluation, participant E's mother was asked by the clinician to complete the *Temperament Scale* (Neville & Johnson, 1998). She reported him to have a high energy level, moderately frustrated reactions, moderate to high dramatic intensity, and to be moderately sensitive. It was hypothesized by Guitar (2014) that if a child who stutters has a more challenging and/or more sensitive temperament, this may contribute to his/her vulnerability in regards to the onset and development of stuttering. Also, children who stutter have a tendency to be more easily aroused in response to a stimulus (Guitar, 2014; Seery, Watkins, Mangelsdorf, & Shigeto, 2007).

In the case of participant E, his moderately sensitive temperament could make him more sensitive to stuttering in response to his unintelligibility. The response participant E receives in conversation of frequently not being understood could serve as the stimuli to which his sensitive temperament makes him more easily aroused. This arousal would then lead to his stutter, which could also serve as an explanation for why his more unintelligible utterances are more frequently stuttered. There is not enough research on the interaction between temperament and the onset of stuttering or its persistence (Seery, Watkins, et al., 2007), but taking a closer look at this relationship, particularly in stuttering subgroups such as S+DP, could be beneficial.

Spontaneous Speech and Unintelligibility

The clinician noted during initial evaluation that the participant E's stuttering was most present on responses to open-ended questions requiring complex language (i.e., describe or tell a story about a toy). These are opportunities for the child to speak spontaneously, providing more opportunity for him to be unintelligible than if he was repeating carrier phrases provided by the clinician. Participant E appears to avoid these opportunities if possible. When asked questions such as "What is that?" he frequently responded with some variation of "I don't know" and looked for the clinician to provide the answer for him to then repeat. Out of the 189 original AUP's collected in this study, he responded this way 23 times (12%).

This could be because participant E is anticipating the difficulty of speech and is avoiding being misunderstood. When participant E did attempt a spontaneous response, he was highly unintelligible and stuttered. It appears that most of his stuttered and most unintelligible utterances are in response to open ended questions, as opposed to in response to carrier phrase prompts, which would be expected based on what we know about childhood stuttering (Bloodstein & Bernstein Ratner, 2008).

Clinical Implications of the Results

The results of the present study suggest that if a clinician were to slow his/her speech rate when working with an S+DP child, there may be some theoretical benefits not explored in the present study, but not facilitated fluency. Thus the solitary use of a slow rate model with S+DP children does not appear to have an evidence base for clinical practice. Other methods of the

DCM approach to therapy need to be explored. Logan and LaSalle (2002), for example, offer strategies for prioritizing which disorder to treat most aggressively in children with concomitant disorders. These strategies involve the clinician asking themselves questions about severity, effects on daily living, and likelihood of the impairment responding to treatment. Logan and LaSalle (2002) also provide a breakdown of how the severity of each impairment will affect approach to treatment.

In the case of participant E, an active approach was being taken toward treating his disordered phonology. Concurrently, the passive approach of slowing rate of speech was being implemented to address his stuttering. The demands of the direct approach to phonology could be overshadowing the effectiveness of the slow rate, leading the method to have little effect on facilitating fluency. It could be beneficial, especially in the case of S+DP children, to prioritize impairments as suggested by Logan and LaSalle (2002). As language therapy and fluency therapy usually both require long term intervention, the worry that one impairment can not go unaddressed while the other is focused on could be valid (Bernstein Ratner, 1995). In response to this, clinicians also could alternate focuses during treatment by switching back and forth between activities that address one impairment or the other (Bernstein Ratner, 1995; Logan & LaSalle, 2002). No matter what the treatment approach being used, lowering the demands on the S+DP child in more ways than what is provided by a clinician slow rate alone appears necessary.

Limitations and Future Directions

The first major limitation of this study is the case study design. However, studying one case in depth can be beneficial. Case studies serve as their own control, and provide in-depth analysis of a single individual with very thorough results (Schiavetti, Metz, & Orkiloff, 2011). Case studies allow researchers to analyze interactions between factors and provide explanations for change and growth (Shaughnessy, Zechmeister, & Zechmeister, 2009). This type of research is important in topics with limited research such as treating the S+DP population. The development of pilot data will help inform future researchers investigating this topic. However, the results are not easily generalized to the population. The statistical data and results of the study are important for instigating future research and enhancing interest in this area, but on their own there is still much room for elaboration. Implementing this methodology with a larger number of clinician-child dyads could present more clear and reliable data.

In future research, it would be beneficial to recruit both S+DP participants, as well as participants who stutter but have normally developing phonology (S+NP). Studies of this nature in the past have shown a difference in response between these groups, but none have been looking for this difference specifically. Using the same methodology on both groups could provide a beneficial comparison about the effects a slow rate of speech has on both types of children. It also could be of interest in future research to recruit S+DP and S+NP girl participants. Researchers have shown differences in fluency between males and females who stutter as related to clinicians' slow rate models (LaSalle, 2015; Zebrowski, Weiss, Savelkoul, & Hammer, 1996).

The second major limitation is the variability of the clinician's rate of speech. Although it was suggested to the clinician throughout the duration of treatment to slow her rate of speech in therapy, she was not trained to be consistent in how slow or fast she was speaking. This provided an uneven data set with variable rates and responses. There was a wide gap between her slow and fast utterances, with some significantly below the median and some significantly above it. Training the clinician's participating in future research to slow their rate a consistent amount, and speak at fast rate within consistent limits could provide more robust data. Also, a limitation of the methods for data collection was the AUP criteria for clinician's utterances eliminated some spontaneous utterances produced by participant E. These utterances are more frequently stuttered, so including them could have increased the number of stuttered utterances in the corpus and made the number of utterances in each category a bit more even, potentially resulting in clearer results. Looking at these utterances also could have provided further information on the connection between participant E's unintelligibility and stutter. A larger amount of data could have enhanced the linguistic comparison of the two groups as well. For future research, lowering the required number of words in the preceding clinician's utterance could provide a larger sample size.

It also could be of interest to look at the clinician's rate of speech as well as the child's rate of speech in intended phones as opposed to actual phones produced. The suggestion has been made that S+DP children have a slower rate of speech as baseline than their S+NP peers, however this information could be artifact based on the deleted phones that result from their phonological disorder (LaSalle, 2015). Looking at intended phones could provide a more accurate representation of the S+DP child's speaking rate, and elaborate on the idea of rate entrainment in the S+DP subgroup.

Lastly, it may be beneficial to expand on the current methodology linguistically, and explore the characteristics and complexity of the stuttered words. For children who stutter and exhibit language impairment, words that are more phonologically complex are more likely stuttered (Wolk & LaSalle, 2014). In the case of participant E, almost 2/3 of his stuttered utterances were also unintelligible. It could be of interest to more carefully examine the words being stuttered, and the relationship they have to the child's phonological deficits, including how his own speech rate might be measured in terms of possible rate alignment or entrainment (cf., LaSalle, 2015). Another possibility is that words with phonological processes present could be more frequently stuttered upon than words without.

Conclusions

In conclusion, a slow speech rate model showed no significant effect on the fluency of this preschool aged S+DP child. This data supports the findings of Carlson & LaSalle (2004) and LaSalle (2015), suggesting that slow rate in therapy with S+DP child may not be as effective as previously assumed. Future research needs to be done on this population with larger sample sizes to further expand our knowledge of this topic. Future research also could benefit from comparing this population directly to children of the same age who stutter but do not have disordered phonology. Closely comparing these two population's fluency in response to slow rate could provide greater validity to the claim that this slow rate does in fact not benefit the fluency of S+DP children as it has been expected, or at least not that of male S+DP children. It is hoped that the data and interpretations presented here will spark interest in this topic, because clinical methods should differ depending on the clinical profile of the child who stutters. Also, perhaps the methodology used in the present study can be used and/or altered in future research on the efficacy of various treatment approaches with the S+DP population. More information on these childhood stuttering and phonology treatment approaches could inspire changes in therapy methods, and lead to exploring better ways to provide therapy to children who fall into this subgroup of children who both stutter and present with speech sound disorders or disordered phonology.

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