# Parent-Child Interaction after Treatment of Stuttering: a Comparison between the Lidcombe Program and the Demands and Capacities Model-based Treatment

L. C. Oonk (3252108)

Supervisor:

Dr. M.C. Franken

Erasmus Medical Center, Sophia Children's Hospital

Department of Otorhinolaryngology, Speech and Hearing Center

Rotterdam

Reviewer:

Prof. Dr. Ph. Dejonckere

University of Utrecht

Faculty of Health Sciences

Clinical Language Speech and Hearing Sciences

***Abstract***

The change in four parent-child interaction variables was evaluated after three months of therapy, with either the Demands and Capacities Model based treatment or the Lidcombe Program. Results indicate that parents do not change their articulation rate, mean length of utterance, type token ratio and percentage of positive statements after three months of therapy. Furthermore, none of the parental variables proved significantly as a predictor of the child's fluency. The only significant predictor of the child's fluency was the factor time (pre- or post therapy).

***Key words***: *stuttering, treatment, children, Demands and Capacities Model, Lidcombe Program, parental variables*

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# Parent-Child Interaction after Treatment of Stuttering: A Comparison between the Lidcombe Program and the Demands and Capacities Model-based Treatment

*Leonoor C. Oonk*

## Summary

**Purpose:** To evaluate the change in a number of verbal parent-child interaction variables after three months of stuttering therapy, with either the Demands and Capacities Model (DCM) based treatment or the Lidcombe Program (LP) and to investigate the relationship between the parental change and the change in the child's fluency.

**Method:** Participants were fifteen parents and children treated with the DCM-based treatment and fifteen with the LP. Data were based on 20 minutes parent-child video recordings pre-therapy and after three months of therapy. The fluency scores of the child were based on three 10 to 15 minutes audiotapes, recorded in three different situations outside the clinic. Variables measured were: parental Articulation Rate (pAR), parental Mean Length of Utterance (pMLU), parental Type Token Ratio (pTTR) and the percentage of parental Positive Statements (%pPS).

**Results:** The scores of the parental variables under investigation did not change significantly after 3 months of therapy, neither after DCM-based treatment nor after the LP. Furthermore, none of the parental variables proved significant as a predictor of the child's fluency. The only significant predictor of the child's fluency was the factor time (pre- or post therapy).

**Conclusions:** No evidence is found that parents change their verbal interaction behaviours after DCM-based treatment or after treatment with the LP. However, children do achieve significantly more fluency after three months of therapy, but the role of the parental variables as a treatment factor remains unclear.

**Key Words:** stuttering, treatment, children, Demands and Capacities Model, Lidcombe Program, parental variables

## INTRODUCTION

Many programs for the treatment of young stuttering children presume that communicative and linguistic factors in the environment influence fluency in young children. Examples of treatment programs for pre-school stuttering that are based on this assumption are the Demands and Capacities Model based treatment (DCM) (Starkweather & Given-Ackerman, 1997; Starkweather & Gottwald, 1993; Starkweather, Gottwald & Halfond, 1990), Parent Child Interaction therapy (Millard, Nicholas & Cook, 2008) and Family focused treatment (e.g. Bernstein, 1992; Gregory, 2003; Guitar, 2006; Richels & Conture, 2007; Riley & Riley,

1979; Yaruss, Coleman & Hammer, 2006). In the Netherlands, the DCM-based treatment is commonly used as a framework for intervention (Bezemer, Bouwen & Winkelman, 2006; Franken, Kielstra-van der Schalk & Boelens, 2005). Stuttering according to the DCM is seen as a multi-factorial problem. Therefore, treatment in the early stages of development focuses on different parameters. The assumption is that stuttering occurs when children's capacities for fluency are stressed by demands related to speaking. The therapy that emerges from this model aims at decreasing demands and increasing capacities. Demands and capacities are categorized as motoric, emotional, linguistic and cognitive. With young children, the focus is primarily on reducing the demands from the environment. Parents are trained to make changes, particularly in verbal interactions such as reducing their rate of speech, diminishing the number of questions, lessening the number of interruptions and creating an unstrained turn-taking behaviour (Franken, Kielsta-Van der Schalk & Boelens, 2005; Onslow, Packman & Harrison, 2003; Starkweather & Given-Ackerman, 1997). Thus changes in verbal interaction patterns are an essential part of this treatment approach.

The DCM-based treatment has received little study and outcome data are relatively scarce, even though this treatment is widely recommended and practiced. The multi-factorial assumption makes effect studies complex, since every child has a different set of factors that needs to be attended to in therapy. Therapy is client centered and differs from child to child.

The influence of modifications of parents' communication behaviours on the child's fluency has been investigated in a few studies ( e.g., Bernstein Ratner, 2004, Guitar & Marchinkoski, 2001; Savelkoul, Zebrowski, Feldstein & Cole-Harding, 2007; Starkweather & Gottwald, 1993; Zackheim & Conture, 2003). Empirical findings indicate that slowing parental speech rate and altering turn-taking patterns, facilitates fluency in young stuttering children. (e.g., Cardman & Ryan, 2007; Guitar & Marchinkoski, 2001; Jones & Ryan, 2001; Kelly, 1994 ; Kelly & Conture, 1992, Wood & Ryan, 2000; Zebrowski, Weiss, Savelkoul & Hammer, 1996). Furthermore, longer sentences and more complex language appear to provoke dysfluency and stuttering (Logan & Conture, 1997; Zackheim & Conture, 2003). Rommel (2000), in a longitudinal study among young stuttering children and their mothers, found that with 5 year old children, the more complex sentences and the more differentiated the vocabulary of the mother, the higher the prospects for a chronic course of stuttering in the child. Concerning the emotional domain of the DCM, there is some evidence that stuttering children experience and display more negative affect than children without stuttering (Eggers, De Nil & Van den Bergh, 2009; Embrechts & Ebben, 1999; Kasprisin-Burelli, Egolf & Shames, 1972). Also, they appear to take longer to recover to their fluency speech baselines following emotional upsets (Karass et al. 2006; Zebrowski, 2007).

There is obviously a need for more data on the effects of the DCM-based treatment. Also, there is a need to establish whether the treatment goals set for the parents are achieved.

Parents are trained to make modifications in certain verbal interaction patterns when communicating with their stuttering child, but do they achieve these changes?

Not all programs for the treatment of young stuttering children set objectives for parents to make changes in their interactive patterns. One example is found in the Lidcombe Program (LP). The LP is a behavioural treatment, which focuses directly on the stuttering behaviour (Onslow, Packman & Harrison, 2003). The treatment is based on principles of operant conditioning, praising the child for passages of fluent speech and 'punishing' for stuttered speech. The fundamental 'treatment agent' of the program is assumed to be the parental verbal response-contingent stimulation. Parents are trained to use and implement these verbal contingencies, first in structured play sessions, later in everyday situations. Stutter-free speech is praised frequently and stutters are corrected occasionally: the ratio for feedback on fluency to comments about stuttering should be at least 5 : 1. In the LP the parents are not explicitly instructed to change aspects of their communicative interactions with their children, as in the DCM-based treatment, but only to implement the verbal contingencies.
The effect of the LP treatment has been researched over a period of time and shows favourable outcomes (Harris et al., 2002; Jones et al., 2005; Jones et al., 2008; Onslow, Packman & Harrison, 2003).

In a pilot study, Franken, Kielsta-Van der Schalk and Boelens (2005) compared the effect of LP with the DCM-based treatment. Thirty preschool-age stuttering children were randomly assigned to one of the two programs. After 12 weeks of therapy, no differences in the effect between the experimental groups were found.
Although this study by Franken et al. reported only preliminary results, it is interesting that two programs, based on entirely different principles should equally reduce stuttering in young children. This notion is not new and is also found for totally different treatment approaches in other fields such as treatment programs in clinical psychology (Bernstein Ratner, 2005). Why this is so, is a difficult but important question. Both LP and DCM-based treatment consist of many components. It may be possible that the two therapy programs are equally effective because of treatment components that are similar in both treatments, such as the individual attention to the child and special playtime for mother and child. (Franken et al, 2005). It could be that these non-specific components are responsible for the therapy effects. Another possibility is that components that are not themselves targeted do however change as a result of the therapy procedure. The question arises whether the implementation of the verbal contingencies does in fact change the verbal parent-child interaction on certain modalities, although the LP does not intend to change verbal parent-child interaction in contrast with the DCM-based treatment. This possibility was assessed in a retrospective study by Bonelli, Dixon and Bernstein Ratner (2000). Tape-recorded interactions of nine mother-child pairs

who received LP treatment, were analyzed pre- and post treatment. The language complexity of the mothers did not change, but the maternal speech rate increased in the post-treatment samples and the mothers decreased the proportion of their utterances that contained a request for information. This study provides only descriptive results, but suggests that certain changes in the maternal verbal interaction may occur, that would not be theoretically predicted (Bonelli et al, 2000).

The purpose of this present study was to evaluate the change in a number of verbal parent-child interaction variables after three months of therapy, with either the DCM-based treatment or the LP. A second purpose of this study was to obtain more knowledge about the contribution of our specific parent-child interaction variables to fluency changes in the child. Four dependent variables were selected based on the different domains of the DCM-based treatment: parental Articulation Rate (pAR), parental Mean Length of Utterance (pMLU), parental Type Token Ratio (pTTR) and the percentage of parental Positive Statements (%pPS). These variables are an explicit objective for change in the DCM-based treatment but not in the LP treatment. Our hypothesis therefore was that parents who received DCM-based treatment will show a change in the four variables mentioned in the sense that pAR, pMLU and pTTR will decrease and the %pPS will increase. Parents who received LP will not show a similar change. However, an increase in the %pPS after LP treatment could be possible. Parents are taught to react with agreement to fluent utterances. This could perhaps expand in the sense that parents will make overall more positive statements and agreements in interactions with their child. Although not specifically targeted upon in the LP, a possible increase in positive statements might influence the self image and self acceptance of the child.

Our specific research questions were: (1) Do parents participating in either the DCM-based treatment or the LP alter their verbal interaction patterns on the four specified variables (pAR, pMLU, pTTR, %pPS) after three months of therapy? (2) What is the relationship between the change of the parental verbal interaction variables under investigation and the change in the child's fluency?

## METHOD

*Design*

The present retrospective study is based on a pre-post program-comparison group design. Data were analyzed in a two factorial split-plot design with one within-subject factor, time (fixed factor), with two levels ( pre-therapy (T1) and after 3 months of therapy (T2)) and one between-subject factor the 'group' (fixed factor), with two levels (DCM and LP). In addition a multiple regression analysis was carried out.

*Sampling*

Preliminary power calculations were conducted to establish the sample size. Outcomes indicated that a sample size of 15 subjects within each treatment group would have a reasonable probability (i.e. between 0,8-0,9) of detecting a clinically relevant change in the variables under investigation. A change in the variables after three months of therapy of between 0,75 and 1 SD was considered to be a clinically relevant change for all variables under investigation. An estimation of the mean value of the dependent variables and their standard deviation was based on data in the literature (e.g.: Guitar, 2006; Jansen, 1985; Miles & Bernstein Ratner, 2001; Quené, 2007).

*Subjects*

Subjects were children and their parents participating in a randomised controlled trial (RCT) to compare the cost-effectiveness of the LP and the DCM-based treatment, currently in progress in the Netherlands (Koedoot, Franken & Stolk). Inclusion criteria for participation in the RCT are shown in table 1. The informed consent also contained parental permission to make further analyses on the collected data.

| ***INCLUSION CRITERIA*** |
|---|
| 1. pre-school child, younger than 6;3 years of age; |
| 2. time since onset of stuttering at least six months; |
| 3. severity of stuttering, as rated by parents and therapist, at least 'mild' on the scale for stuttering severity developed by Yairi and Ambrose (1992, 1999; in Franken et al. 2005); |
| 4. SSI-score >11; |
| 5. stuttering frequency at least 3% syllables stuttered (%SS) during initial assessment; |
| 6. no diagnosed emotional, behavioural, learning, or neurological disorders; |
| 7. parent responsible for treatment is fluent in Dutch; |
| 8. informed consent of the parents; |

*table 1: inclusion criteria RCT Koedoot, Franken & Stolk (ip).*

As a standard procedure in this RCT, video recordings are made of parent-child interactions pre-treatment (T1) and after three months of treatment (T2). These videotapes were used for the analyses in the present study. A random sample was drawn of 50 children and their parents who had received at least six treatment sessions at T2.

Exclusion criteria were:

- T1 and T2 recordings contained interactions of the child with a different parent
- video recordings that contained fewer than 22 minutes of interaction or that were not clearly audible.

From the original sample of 50 children and parents, the first 30 recordings meeting the inclusion criteria, and containing 15 who were treated with DCM-based therapy and 15 with LP, were used for analysis. Three participating parents were fathers, and all others were mothers.

*Transcription procedures*

The parent-child videotapes, obtained from the RCT of Koedoot et al. (see above) contained one 15 minute period of structured interaction: parent and child making (a) jigsaw puzzle(s), and one 15 minute period of unstructured interaction (free-play). Ten minutes of each interaction were orthographically transcribed, twenty minutes in total for each parent and child. Not all tapes contained the full 30 minutes of interaction. From recordings that were sufficiently long, the first 2 to 5 minutes were excluded to allow for a 'warming-up' period.

All persons involved in analyzing the tapes were blinded for the moment of measurement of the recordings (T1 or T2) and the type of treatment (LP or DCM treatment). Only after completion of the analyses, was this information revealed.

Orthographic transcriptions were made using the format required for analysis with the Computerized Language Analysis (CLAN) program (MacWhinney, 2000).

An utterance was defined as: "An auditory completed unit of speech in spoken language, characterized by a completed intonation and generally bounded by silence" (Beheydt 1983, in: Gillis & De Houwer 2000).

Ten undergraduate students in speech therapy and the first author, who is a senior clinician, made the transcriptions. The author double-checked all transcriptions for accuracy. In case of a disagreement the author made the final decision.

*Articulation Rate Measures*

In order to assess the pAR, ten clearly audible and fluent utterances of the parent in the structured interaction were selected: one 6-syllable, two 7-syllable, two 8-syllable, two 9-syllable and one 10-syllable utterances. By doing so a fair comparison between T1 and T2 treatment is possible. A similar procedure was chosen by Kloth et al (1995).

The computerized software Audacity (open source software) was used to determine the AR in syllables per second. Cursors were placed at the beginning and end of each utterance, that was identified by means of the visualized waveforms. The simultaneous playback of the audio signal facilitated the identification of the onset and offset of the periodic waveform. The software automatically calculated durational measures of the waveforms between the cursors in milliseconds. AR was calculated by dividing duration by the number of syllables. The mean of the utterance durations across the ten sampled utterances was then computed for each subject.

*Language Measures*

The pMLU was measured in words per utterance. MLU in words and morphemes are highly correlated in the Dutch language (Beheydt, 1983: in Gillis & De Houwer, 2000). The mean number of utterances used to compute the pMLU at T1 was 242 (range 115 - 319) and at T2 the mean was 224 (range 122-317).

The pTTR was calculated by dividing the number of different words by the total number of words. The CLAN program automatically calculated the pMLU and the pTTR of the 20 minutes sample.

*Measuring parental Positive Statements*

Parental utterances that were considered positives statements were marked in the transcripts, using CLAN conventions. A protocol was written to define a positive statement. This protocol is shown in table 2.

**When is the response of the parent considered a positive statement?**

**If the parent:**

- gives a verbal response which reflects or shows acceptance of the child's apparent feelings in a calm manner; "*I see you are angry now", or: "I know you would like to receive a letter too".*
- gives a verbal comment that reflects the action of the child ; *"I see that you are trying to fit it in".*
- gives a verbal response indicating that the child's message is received; *"ok",* Or: repeats what the child has just said; *CHI: "We also have this one!". MOT: "Do we also have this one?""*
- gives a verbal response that encourages the child ; *"I believe you will be able to build a very high tower".*
- gives a verbal comment that encourages the self-esteem of the child; *"You must be very proud of yourself."*
- gives the child a compliment or gives explicit positive feedback on the child's behaviour.

(References: Franken & Putker, 2008;, Kaspirin-Burelli, Egolf & Shames, 1992; Kloth et al, 1998.)

*Table 2: protocol of positive statements used in the present study*

The author and one trained undergraduate speech therapy student marked the positive statements in the transcripts, while simultaneously playing the videotape. The first tape was scored by both judges in order to get the same understanding and interpretation of the protocol. After agreement of the protocol was reached, the remaining tapes were judged separately. After an interval of three weeks, one random tape was scored independently by both judges to assess the interjudge agreement. Agreement was derived by counting the percentage of utterances that both judges identified as either a positive statement or non-

positive statement. The interjudge agreement calculated with the Cohen Kappa resulted in a coefficient of 0,67 which is considered a reasonable agreement (Howitt & Cramer, 2005; Rietveld & Hout, 1993). To improve interjudge agreement an analysis of the different interpretations was made and discussed. After one week another random tape was scored by both judges. Interjudge agreement on the pPS determined by the kappa-procedure was now 0,83 which is considered a strong agreement. All previously scored tapes were re-scored in order to be consistent with the latest interpretation of the protocol.
The intrajudge agreement, obtained by re-scoring the same tape after two weeks was strong with a Cohen Kappa of 0,90 and 0,94 for judge 1 and 2.
The CLAN program automatically counted the number of utterances marked as positive and divided this by the total number of utterances to yield a percentage.

*Fluency measures*

The fluency of the child was expressed as the number of syllables stuttered divided by the total amount of syllables (%SS). The scores were based on three 10 to 15 minute audio tapes, recorded in three different situations outside the clinic: (1) at home with the parent; (2) at home with someone other than the parent; (3) outside the home with someone other than the parent. The data were collected and provided by the researchers carrying out the RCT of Koedoot et al. (see above). All samples were scored by two independent and blinded senior SLP-students. Both students followed a nine hour training in identifying and measuring stuttered and fluent syllables with the use of an electronic button press counter. For all samples the interrater agreement was at least 80%. Intrarater reliability was obtained on 5% of the samples and also was at least 80%.

## RESULTS

*Descriptive Information*

Table 3 shows the mean group scores and the standard deviation (SD) for the two different therapy groups pre-therapy and after 3 months of therapy. At first glance these data show little change in the mean group values of the four variables**.** Beforehand, a change of the mean scores of .75 to 1 SD was considered to be clinically relevant. This was not found for any of the variables under investigation. However, we did see a decrease in SD of the variables MLU and AR in the DCM group.

| THERAPY | | pMLU 1 | pMLU 2 | pTTR 1 | pTTR 2 | pAR 1 | pAR 2 | %pPS 1 | %pPS 2 |
|---|---|---|---|---|---|---|---|---|---|
| **DCM** (N = 15) | M | 4,717 | 4,625 | ,247 | ,262 | 5,097 | 4,920 | ,318 | ,323 |
| | *SD* | *,908* | *,467* | *,044* | *,050* | *,694* | *,470* | *,084* | *,093* |
| **LP** (N = 15) | M | 4,551 | 4,750 | ,244 | ,253 | 5,276 | 5,339 | ,363 | ,377 |
| | *SD* | *,715* | *,825* | *,041* | *,036* | *,706* | *,634* | *,108* | *,098* |
| **Total** (N = 30) | M | 4,634 | 4,688 | ,245 | ,257 | 5,187 | 5,130 | ,341 | ,350 |
| | *SD* | *,808* | *,662* | *,041* | *,043* | *,694* | *,588* | *,098* | *,098* |

*Table 3: Means and standard deviation (SD) of the 4 dependent variables pre-treatment (pMLU1, pTTR1, pAR1 and %pPS1) and after 3 months of therapy (pMLU2, pTTR2, pAR2, %pPS2). pMLU = parental Mean Length of Utterance, pTTR = parental Type Token Ratio, pAR = parental Articulation Rate, %pPS = percentage of parental Positive Statements.*

Figures 1,2,3 and 4 show the scatter plots of the two treatment groups, DCM and LP, pre-therapy (pMLU1, pAR1, pTTR1, %pPS1) and after three months of therapy (pMLU2, pAR2, pTTR2, %pPS2), for all four variables under investigation. The line drawn is ' y= x'. A point above the line indicates an increase of the value in question, a point below a decrease.

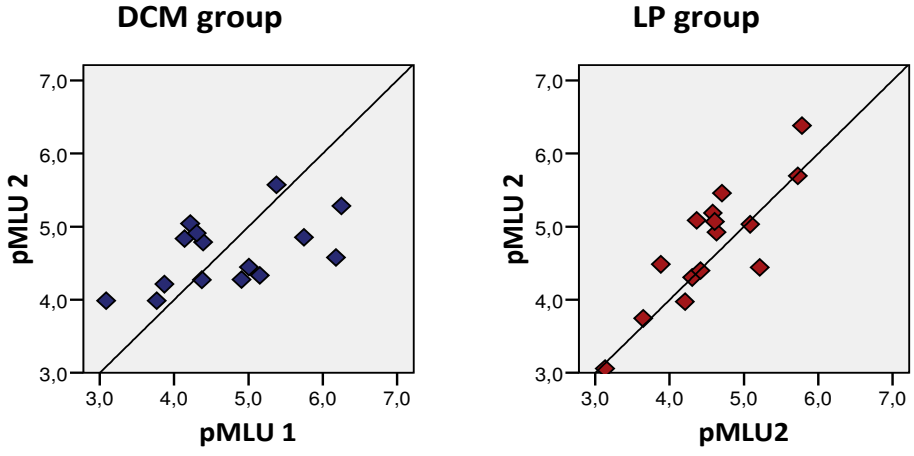


*Figure 1: Scatter plot of the parental Mean Length of Utterance pre-treatment (pMLU1) and after 3 months of treatment (pMLU2 ) with the line 'y=x' DCM group N=15; LP group N=15.*

For the variable pMLU (figure 1) some parents increased their score, some parents decreased their score and some showed no change. In the DCM group however, six out of seven parents with a high pMLU pre-therapy, had decreased their pMLU at T2. On the other hand, the parents of the DCM group with a low initial pMLU showed a slight increase at T2. This trend was not apparent in the LP group. The earlier mentioned decrease in SD in the pMLU of the DCM group can be seen in the scatter plot as well: the values are less spread out after treatment than in the LP group.

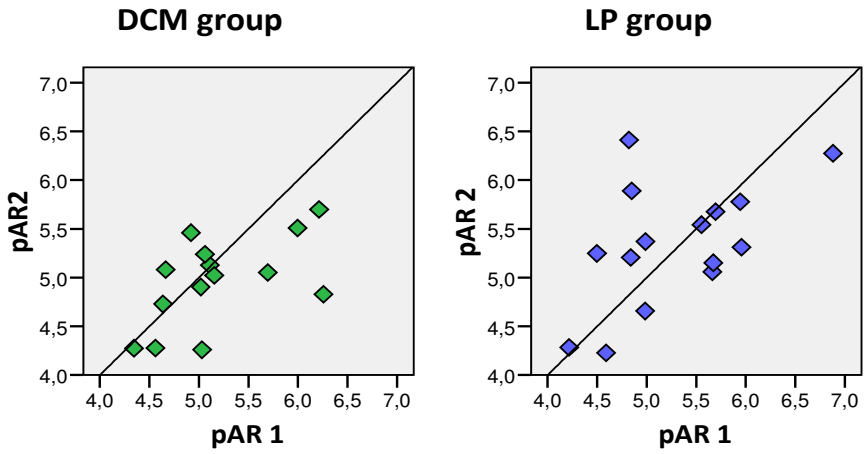


*Figure 2: Scatter plot of the parental Articulation Rate pre-treatment (pAR1) and after 3 months of treatment (pAR2) with the line 'y=x' . DCM group N=15; LP group N=15.*

For the pAR (figure 2) we also see a decrease at T2 for the parents with a high rate at T1, but this trend can be seen in both types of treatment, and is less pronounced than in the pMLU cases. This feature may very well be the result of a regression towards the mean.
The spread has decreased at T2 in the DCM group, and not so in the LP group.

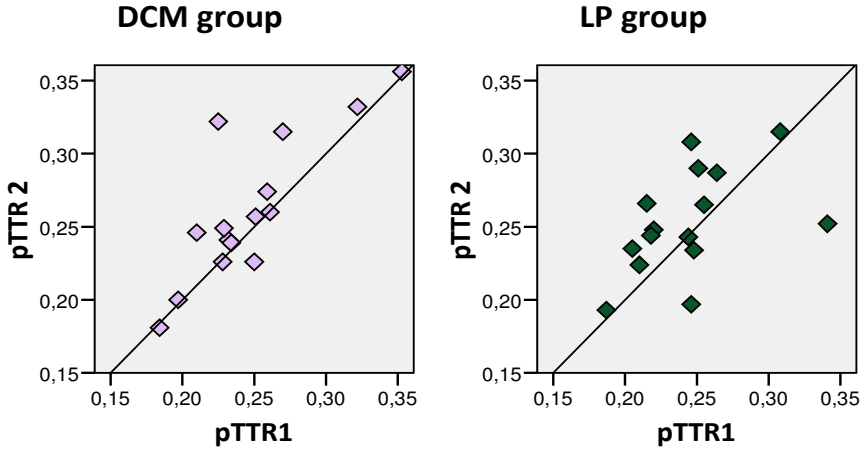


*Figure 3: Scatter plot of the parental Type Token Ratio pre-treatment (pTTR1) and after 3 months of treatment (pTTR2) with the line 'y=x' . DCM group N=15; LP group N=15.*

Figure 3 shows that the pTTR of the majority of the parents stays the same or increases at T2**.** Only four parents have a lower pTTR at T2, one in the DCM group and three in the LP group.

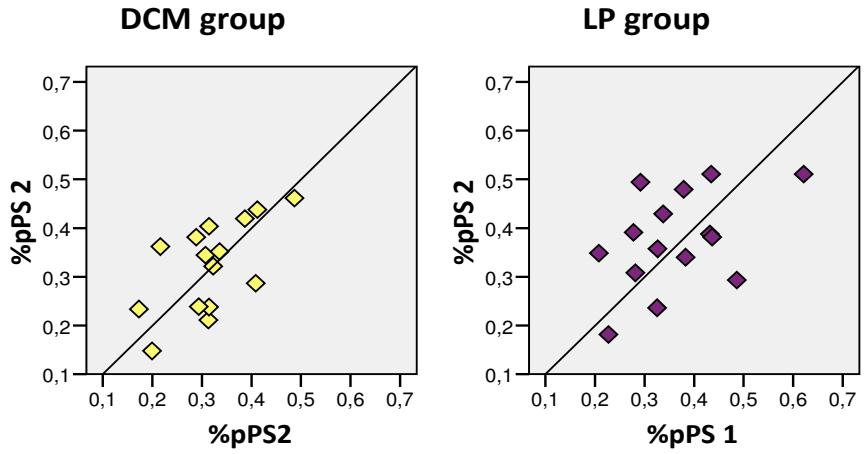


*Figure 4: Scatter plot of the % parental Positive Statements pre-treatment (%pPS1) and after 3 months of treatment (%pPS2) with the line 'y=x' . DCM group N=15; LP group N=15.*

For the %pPS (figure 4) no patterns of change are apparent in either the DCM group or the LP group. Some parents have an increase, some a decrease and some stay the same.

*Research question 1*

*Do parents participating in either the DCM-based treatment or the LP alter their verbal interaction patterns on the four specified variables after three months of therapy?*

An analysis of variance was carried out on the data with the GLM Repeated measures procedure of SPSS. Thirty cases were included in the analysis. There was one within-subject factor, time (fixed factor), with two levels: pre-therapy (T1) and after 3 months of therapy (T2); and one between-subject factor namely the treatment factor (fixed factor), with two levels: DCM (group I) and LP (group II).

The ANOVA yielded no significant effect for time at the 5% level for the pMLU : $F_{(1, 28)} = .221$, $p = .642$; for the pAR: $F_{(1, 28)} = .271$, $p = .607$; for the pTTR: $F_{(1, 28)} = 3{,}895$, $p = .058$ and for the %pPS: $F_{(1, 28)} = .292$, $p = .593$. These results indicate that the scores of the parental variables pMLU, pAR, pTTR and %pPS did not change significantly after 3 months of therapy. There was an almost significant effect for time on pTTR ($p = .058$) on the two-tailed ANOVA. However, the mean pTTR of the group *increased*, while our hypothesis had expected a *decrease*.

No significant interaction for the factors ' time x type of therapy' was found at the 5% level: for pMLU: $F_{(1, 28)} = 1.635$, $p = .212$; for pAR: $F_{(1, 28)} = 1.199$, $p = .283$; for pTTR: $F_{(1, 28)} = 0{,}172$, $p = .682$ and for pPS: $F_{(1, 28)} = .070$, $p = .794$, indicating that the change of the parental variables did not significantly differ between the DCM and the LP group. Also for the between-subject factor 'group' no significant results at the 5% level were found (for pMLU:

$F_{(1,28)} = .007$, $p = .934$; for pAR: $F_{(1,28)} = 2.159$, $p = .153$; for pTTR: $F_{(1,28)} = .156$, $p = .696$; for pPS: $F_{(1,28)} = 2{,}616$, $p = .117$), indicating that no significant differences in any of the variables under investigation were found between both therapy groups.

Since the ANOVAs failed to show any significant effect, no post-hoc comparisons were run on the group data.

*Research Question 2*

*What is the relationship between the change of the parental verbal interaction variables under investigation and the change of the child's fluency?*

A multiple regression analysis was conducted to assess the relative contributions of the specified parental communicative behaviour on the fluency of the child.

Because not all fluency data of the children were available in time, a sample of 28 parents and children was used for this analysis: 14 parents and children treated with DCM-based therapy and 14 with the LP.

The correlation matrix of the factors pMLU, pTTR and pAR at T1 was computed. Correlations were relatively low (Pearson's $r < .42$ ) therefore multicollinearity poses no apparent threat to the analysis.

A multiple regression analysis was performed, with the percentage of stuttered syllables of the child (%SS) as the dependent variable and the factors pMLU, pTTR, pAR , %pPS , Time (T1/T2 ) and the child-specific factor as the independent variables. Figure 5 depicts the multiple regression model.

$$\%SS_{it} = \alpha_i + \beta_1 pQ_{it} + \beta_1 pX_{it} + \beta_2 pY_{it} + \beta_3 pZ_{it} + \varepsilon_{it}$$

where:

%SS = fluency of the child in % syllables stuttered

t = time ( 1 = pre therapy; 2 = after 3 months of therapy)

$\alpha$ = child-specific intercept

*pQ/pX/pY/pZ* = parental variables

ε = residual error term

i = index number of the child

*Figure 5: multiple regression model*

First, a standard regression analysis was conducted with all independent variables included in the model. Results revealed that none of the parental variables under investigation had a significant relationship with the child's fluency (see table 4). The only factor showing a significant relationship with the child's fluency on the 5% level, was the factor 'time' ($p = .013$) in the sense that there was a significant decrease of stuttering after three months of therapy.

*Table 4: Outcome Multiple regression analysis with all independent factors entered into the model*

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | pMLU | ,324 | ,921 | ,273 | ,351 | ,729 |
| | pTTR | 6,389 | 19,393 | ,289 | ,392 | ,745 |
| | pAR | -,246 | 1,257 | -,228 | -,195 | ,847 |
| | %pPS | -9,636 | 7,303 | -,592 | -1,319 | ,200 |
| | Time | -1,985 | ,738 | -,250 | -2,689 | ,013 |

*-Dependent Variable: %SS*
*-Independent variables pMLU = parental Mean Length of Utterance, pTTR = parental Type Token Ratio, pAR= parental Articulation Rate, %pPS= % parental Positive Statement and the child specific factor ( results not shown in this table). Time is marked as significant at the 5% level*

Next, all parental variables were entered into the model in isolation, controlling for the factor 'time' and the child-specific factor. This procedure could not identify any of our parental variables as a significant predictor for the fluency of the child. 'Time' however, yielded significant results in all of these analyses. So, apart from the child-specific factor, 'time' was the only significant predictor for the %SS accounting for 6% of the variance (adjusted $r^2$ ).

## DISCUSSION

The first purpose of the present study was to evaluate the change in a number of verbal parent-child interaction variables after three months of therapy, with either the DCM-based treatment or the LP. Our hypothesis, based on therapy objectives, was that parents who participated in the DCM-based treatment would show a decrease in pMLU, pAR and pTTR and an increase in the %pPS. Parents who participated in the LP were not expected to change although we speculated on a possible increase of the %pPS after treatment with the LP. The initial findings do not support our hypothesis. There was no statistically significant decrease in the MLU, AR, TTR nor a significant increase in %PS of the parents, after three months of therapy with either DCM or LP.

The findings concerning the LP treatment group are consistent with the study of Bonelli et al. (2000), where language complexity of the mothers after LP treatment did not change. However, a slight increase in the articulation rate of the mothers after therapy was found.

The findings concerning the DCM treatment group are quite surprising. DCM-based therapy teaches parents among others, to speak more slowly, to use shorter sentences and less complex language and to be positive and supportive towards the child, yet this study shows no evidence of any change in the parental behaviour, on four parental variables. This was in spite of the fact that our sample size was such that a clinically relevant difference had a reasonable probability of being detected. Studies of, among others, Bernstein Ratner (1992), Guitar & Marchinkoski (2001) and Zebrowski et al. (1996) showed that parents are capable of

reducing their speech rate and their MLU when explicitly instructed to do so. The main difference between these studies and the present one is the timing of the instruction. In the former, parents received the instruction to speak more slowly or to use short sentences immediately prior to the recorded sessions. In our study however, these instructions were part of the therapy, which took place during a three months period. The instruction was not explicitly repeated immediately prior to the recorded sessions. Without such reminders, most parents seem to talk like they always did, at least on the variables measured. This suggests that the therapeutic intervention has not achieved its stated goals.

It could be argued that not all parents who received DCM-based treatment were coached to change all of the measured variables. DCM-based treatment is a client-centered approach and every case has a different set of factors needing attention in therapy. Some parents might already have been using simple language at the start of therapy, so reducing the pMLU and pTTR for instance, might not have been an objective for their therapy. This might have influenced the results of the group. The observation that in the DCM treatment group the parents with the highest pMLU showed a decrease, together with a decreased spread in the pMLU and pAR might support this assumption. Based on the present data this supposition however is quite speculative and needs further investigation.

One important treatment goal of a DCM-based treatment is to slow down the speech of the parents. In general, all DCM therapists will try to set 'slowing down the speech of the parents' as an objective for therapy with almost all parents. Still, we did not find a change in the pAR after three months of therapy. An explanation could be found in the study of Jones & Ryan (2001). They reported in a single case study, that the mother spontaneously returned to her base speaking rate after a session in which slowing down had been exercised, stating that she did not like to talk slowly. Only with a considerable amount of intensive training could this mother achieve the desired goal. In the current study, the training given by the various therapists was possibly not intensive enough to maintain an effect. Another explanation could be that besides the articulation rate as a measure to compute the rate of the parental speech, other measurements are required. Speech can also be slowed down by making more pauses, without slowing down the actual articulation rate. According to Jones & Ryan (2001) it is easier to teach paused speech and paused speech becomes normal speech very naturally. In the present study we did not measure these pauses. However, slowing down the actual articulation rate is considered an effective way to enhance the child's' fluency and the majority of therapists will use this as a strategy in therapy (Jones & Ryan, 2001; Starkweather & Gives-Ackerman, 1997).

Although we did not measure a change in any of the parental variables after three months of therapy, this does not necessarily mean that parents did not change their speech pattern at any point during the therapy process. For instance, it is very well possible that at the beginning of the therapy process, parental changes were apparent but faded over time, as the child's

fluency improved. We agree with Zebrowski et al. (1996) that the nature of the complex relationship between parent and child speech and language behaviours, is not fully reflected in data collected at one or two isolated points in time. To obtain a more detailed insight in the process of possible parental change, frequent recordings could be taken and analyzed, for instance on a weekly basis.

A second objective of this study was to obtain more knowledge about the relationship between the change of the parent's verbal interaction variables under investigation and the change in the child's fluency. Our outcomes indicate that the only factor identified as a significant predictor for the fluency of the child is the factor 'time' in the sense that there is a significant decrease of stuttering frequency after three months of therapy. The parental variables pAR, pMLU, pTTR and %pPS yielded no significant values as predictors of the child's fluency.

As our sample size is quite small for this kind of analysis, the results have to be considered with care. Despite the small sample size however, the factor 'time' yielded significant results, so children did improve their fluency after three months of therapy. The present study provides no insight into whether this is truly the effect of the treatment provided, or of the process of natural recovery.

Similar studies have been done by Guitar et al. (1992) and Starkweather and Gottwald (1993). Both studies reported significant correlations between the speaking rate of at least one of the parents and the child's stuttering frequency, however, these conclusions are under debate (Ingham, 2005; Jones & Ryan, 2001). Guitar et al. (1992) conducted a single-subject retrospective study of interactions between parents and their 5-year old stuttering daughter. The only parent variable which significantly correlated with the child's stuttering frequency was the mother's speaking rate ($r$ = .70). The father's speaking rate showed no significant relationship with the child's stuttering although the father managed to slow down his speaking rate considerably. The child's stuttering frequency scores were based on a sample of 10 minutes taken in the clinic. The variability in stuttering, a well-known feature of childhood stuttering, was not taken into account (Ingham, 2005). In a pilot study with 14 young stuttering children and their parents, Starkweather and Gottwald (1993) examined relationships between several environmental variables and the child's fluency at intake before intervention and at discharge. They found a significant positive correlation ($r$ = .47) between the change in the child's fluency level during treatment and the changes in the parent's speech rate. However, the statistical base on which this significance was computed is seriously questioned as the required adjustments of the degrees of freedom and the $p$-level were not applied (Jones & Ryan, 2001).

In the present study we found no evidence of a relationship between the change of the parental variables and the stuttering frequency of the child. This finding does not deny such a relationship, but neither does it support it.

## CONCLUSIONS

The present study finds no evidence that parents change their verbal interaction behaviours on the variables measured, after DCM-based treatment or after treatment with the LP. However, children do achieve significantly more fluency after three months of therapy, but the role of the parental variables as a treatment factor remains unclear.

The question which treatment components contribute to the positive effects of therapy for young stuttering children remains to be answered.

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