# Structural generalization after treatment based on different oppositions approaches

## Generalização estrutural a partir do tratamento por diferentes modelos de oposições

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## ABSTRACT

This study had the aim to analyze structural generalization (to untreated words, to other word positions, across and within sound classes) in three different models of contrastive approach, based on the severity of phonological disorder. The sample comprised nine subjects with phonological disorders with ages between 4 years and 2 months and 6 years and 6 months. All subjects were assessed before and after phonological therapy. Three groups with three subjects each were established for treatment; each group had one subject with severe, moderate-severe and mild-moderate disorder, and each was treated by a different model – Minimal Oppositions, Maximal Oppositions/Empty Set, and Multiple Oppositions. Statistical analysis compared therapeutic models and the severity of phonological disorders, using the types of generalization. It was verified the occurrence of different types of generalization across all groups, however, there was no statistical difference between them. All three models of intervention favored the occurrence of structural generalization in the three different severities of disorders, demonstrating that contrastive approach models are effective in the treatment of phonological disorders.

**Keywords:** Speech; Speech disorders; Generalization, response; Speech therapy/methods; Child

## INTRODUCTION

The treatment of phonological disorders using a phonological basis brought many benefits to speech-language therapists, because, besides taking into consideration the phonological system of the child to select the target-sound, it also aims generalization, making therapy more effective[1-4].

There are different therapeutic models that employ phonological basis, but they differ on the theoretical principles of the approach. Some of them are: Maximal Opposition[2], Minimal Opposition[4], Multiple Oppositions[5], Modified Maximal Opposition[6].

In the Maximal Opposition approach[2] the selection of the target-sounds is based on the phonemic mistakes of the

child concerning the target. The child is taught to contrast the sounds that are not correctly used in her phonological system with those that are. In comparison to Minimal Pairs, this approach does not contrast the error sound (or mistake) with the target-sound, instead contrasting the error sound with a sound the child produces correctly, taking into consideration the distinctive features of the contrast. The contrast should be maximally distinct from the error sound[2].

In 1991, Gierut applied another intervention method, mentioned in a previous study called Empty Set[2]. In this approach the child is taught to contrast two new sounds (both are absent in the phonological system) with maximal feature distinction. This model is a variation of the Maximal Opposition approach.

Some studies in Brazil[7-10] use the Maximal Opposition approach, but what is observed is that the treatment was based on the Empty Set, although the authors do not mention that name.

The Multiple Oppositions approach[5] is a specific approach for the treatment of children that collapse multiple phonemes. The model is recommended for children with a severe disorder, because they usually replace many phonemes of the adult system for only one sound. The method involves the selection of sounds which are substituted by the same error phoneme.

The Modified Maximal Opposition[6] model was based on a study[4], however, with modifications in the therapeutic procedures.

In this survey the following models were chosen: Minimal

Opposition based on a study[4], contrasting two new sounds which differ in one or two distinctive features of non-major class distinctions; Maximal Opposition/Empty Set[2,4], contrasting two new sounds (Empty Set) or one new sound and one present in the phonological system of the child (Maximal Opposition), differing in three or more distinctive features of major class, and Multiple Oppositions[5].

Some therapeutic approaches have currently been compared in order to analyze their effectiveness and efficiency, such that there are several researches[5,7,8,11]. All of them consider the severity of the phonological disorders for treatment delimitation and for monitoring the evolution of the subjects.

Current researches[7,9,10] have also been emphasizing the many types of generalization approaching different therapeutic models. Generalization can be defined as an extension of what was learned. In a more limited sense generalization occurs to untreated words and to other word positions occurs, and in a wider sense, when it occurs within and across sound classes[1]. However, it is observed that there are no studies that analyze generalizations with different oppositions models (Maximal, Minimal, Multiple), in different severities of phonological disorders.

Considering the importance of generalization in the therapeutic process, this research had the aim to analyze structural generalization (to untreated words, to other word position, within and across sound class) in three different models of contrastive approach, considering the severity of the phonological disorder.

## CLINICAL CASES PRESENTATION

This study was developed after the project was registered and approved by the Ethics Committee of the Universidade Federal de Santa Maria, under number 108/05. Data collection started after having the parents or tutors of the subjects had read and signed the Free and Informed Consent term.

Participants were nine children, five male and four female, with ages between 4 years and 2 months and 6 years and 6 months in the beginning of the treatment. Children were selected according to the following criteria: 4 years old or older; normal hearing as determined by a standard audiometric screening; normal oral and speech motor abilities; no prior clinical intervention; no relevant neurologic problems for speech production; reside within a monolingual Brazilian Portuguese-speaking family; absence of neurological deficits relevant to oral language production; present intellectual abilities adequate for the development of oral language; have oral language comprehension according to the mental age; present expressive language abilities well developed regarding vocabulary and length of utterances; and have phonological disorder diagnosis. Children treated by Multiple Oppositions model should also have a phonological system compatible to the proposed by Williams[5], that is, substitution of many sounds for only one sound.

All children were submitted to the following assessments: anamnesis; informal observation of receptive and expressive language; stomatognathic system; auditory discrimination; phonological awareness; vocabulary; simplified auditory processing assessment; phonology. Subjects were also submitted to complementary neurological and audiological assessments. The outcomes were in agreement with the expected standards for each age range, except for the phonological assessment.

Analysis of the contrastive phonological assessment enabled determination of the phonological system of each child, according to the following criteria[12]: a segment was considered acquired when it occurred in 80% to 100% of the possibilities during speech; partially acquired when it occurred in 40% to 79%; and non-acquired when it occurred in 0% to 39% of the possibilities.

The evaluation of the severity of phonological disorder was performed using the Percentage of Consonants Correct-Revised (PCC-R)[13], in which only substitutions and omissions count as errors. The Percentage of Consonants Correct[14] (PCC) was used to classify the speech disorder as: mild (86 to 100%), mild-moderate (66 to 85%), moderate-severe (51 to 65%), and severe (<50%).

Three research groups were established and treated with different contrastive approaches. Each group had one subject with severe disorder (SD), one with moderate-severe disorder (MSD) and one with mild-moderate disorder (MMD).

The therapeutic planning chosen for each child focused the following contrastive approaches: Maximal Opposition/Empty Set – MaxO/ES[2,4], selecting two target-sounds which differ from each other in three or more distinctive features; Minimal Opposition – MinO[4], selecting sounds that differ in only one or two distinctive features; and Multiple Oppositions – MulO[5], selecting several sounds that the child substitutes for only one phoneme. Thus, one group (subjects S1, S2, and S3) received therapy based on the MinO model, the second group (S4, S5, and S6), on the MaxO/ES model, and the third group (S7, S8, and S9) on the MulO model.

Selected children received therapy based on the session structure proposed by the research[6]. A baseline was initially established, based on a screening performed before therapy started, in which each non-acquired sound was tested, selecting the maximum of six words that contained the phoneme and could be represented by figures and the child must name them.

After determining the baseline performance, the treatment was carried out in five sessions of stimulation with the selected pairs to all worked models. In the sixth session, the first screening was done. If the child reached 50% of correct production, five more sessions were repeated with the same pairs in a sentence. If the percentage was less than 50%, the treatment at the word level was repeated and, again, in the sixth session another screening was done. In the screening, after the cycle with sentences, if the child reached 80% of correct production, new target-sounds were selected. If not, the treatment at sentence level was repeated. The therapeutic session started and finished with auditory bombardment and the parents were guided on how to do the stimulation work at home.

Therapy was implemented in two weekly sessions of 45 minutes each, totaling 30 therapy sessions distributed in blocks of five sessions and one screening. After 25 sessions, another assessment of the phonological system was carried out, collecting speech data through the same instrument used in the initial evaluation.

Table 1 shows the target-sounds selected to the therapy for intervention with each child according to the selected therapeutic approach.

To analyze the generalizations obtained by each child, the contrastive approach models were compared in relation to the degree of severity regarding initial and final PCC and to the different types of generalization: to untreated words, to other word positions, and within and across sound classes. Sometimes there was no possibility of occurrence, because there was a certain type of generalization was not possible, since the child had acquired all sounds possible to generalize.

The Friedman test was used in these analyses with significance level of 5% (p<0,05), using the software STATISTICA 7.0. Due to the small number of children a qualitative analysis was also conducted.

Table 2 shows the nine children are considering the therapeutic model and the severity of phonological disorder in relation to the differential of pre- and post-treatment of different types of generalization. In this table the results of the statistical analysis are also mentioned with the intention of verifying any significant difference among the models.

The four types of generalization occurred in the majority of children, except for S5 and S9 which did not present generalizations across and within classes, respectively. There was no difference among the models taking into consideration the analyzed generalizations.

Generalization to untreated words was observed in all approaches. In the Minimal Opposition model, it was observed a higher differential in cases with MSD (S2) and MMD (S3); in the Maximal Opposition/Empty Set model, some cases of MMD (S6) and SD (S4), while in the Multiple Oppositions model it occurred in the MSD (S8). Hence, higher differentials occurred in the Maximal Opposition/Empty Set model.

Generalization to other word positions was evident in all approaches. Minimal Opposition showed a higher differential in the MMD (S3). In the Maximal Oppositin/Empty Set and Multiple Oppositions models, higher differential was observed in the children with MSD (S5 and S8, respectively). The Maximal Opposition/Empty Set model exhibited the highest incidence of generalization.

**Table 1.** Subjects' distribution according to therapeutic approach, selected target-sounds for therapy, and number of sessions

| Subject | Approach | Severity | IPA* | Target-sound | # of sessions | FPA* |
|---|---|---|---|---|---|---|
| S1 | | SD | /b/, /d/, /k/, /g/, /v/, /s/, /z/, /ʒ/, /l/, /r/, /ʎ/, /R/, /dʒ/ | /k/x/g/ - IO /d/x/g/ -MO | 10 15 Total 25 | /b/, /d/, /k/, /g/, /v/, /s/, /z/, /ʒ/, /l/, /r/, /ʎ/, /R/, /dʒ/ |
| S2 | MínO | MSD | /t/, /d/, /ʃ/, /ʒ/, /l/, /ʎ/, /r/, /tʃ/, /dʒ/ | /ʃ/x/s/ - MO /ʎ/x/r/ - MO /t/x/d/ - IO | 5 10 10 Total 25 | /ʎ/, /r/ |
| S3 | | MMD | /l/, /ʎ/, /R/, /r/ | /R/x/l/ - IO /r/x/ʎ/ - MO | 10 15 Total 25 | /r/ |
| S4 | | SD | /b/, /d/, /g/, /v/, /s/, /z/, /ʒ/, /ʎ/, /l/, /ʎ/, /R/, /r/, /dʒ/ | /r/x/z/ - MO | 25 | /b/, /d/, /g/, /z/, /ʒ/, /ʎ/,/R/, /r/, /dʒ/ |
| S5 | MaxO/ES | MSD | /b/, /d/, /k/, /g/, /v/, /z/, /ʒ/, /l/, /r/, /ʎ/, /R/, /dʒ/ | /k/x/l/ - IO /z/x/ʎ/ - MO | 10 15 Total 25 | /b/, /d/, /k/, /g/, /v/, /z/, /ʒ/, /l/, /ʎ/,/R/, /r/, /dʒ/ |
| S6 | | MMD | /s/, /z/, /r/ | /z/x/ʎ/ - MO | Total 20 | ---- |
| S7 | | SD | /b/, /d/, /k/, /g/, /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /m/, /n/, /ʎ/, /l/, /r/, /ʎ/,/R/, /dʒ/ | /ʃ/x/z/x/ʒ/x/s/ MO | Total 25 | /k/, /g/, /ʃ/, /ʒ/, /l/, /ʎ/, /R/, /r/ |
| S8 | MulO | MSD | /b/, /d/, /g/, /v/, /z/, /ʃ/, /ʒ/, /l/, /r/, /ʎ/, /dʒ/ | /l/x/z/x/ʒ/x/r/x/ʎ/ MO | Total 15 | /r/ |
| S9 | | MMD | /b/, /d/, /g/, /v/, /z/, /ʒ/, /l/, /ʎ/, /r/, /dʒ/ | /s/x/z/x/S/x/ʒ/ MO | Total 25 | /b/, /g/, /v/, /z/, /ʒ/, /l/, /ʎ/, /r/ |

*absent sounds and partially acquired sounds based on the general phonological system

**Note:** MinO = minimal opposition; MaxO/ES = maximal opposition/empty set; MulO = multiple opposition; IO = initial onset; MO = medial onset; IPA = initial phonological assessment; FPA = final phonological assessment; SD = severe disorder; MSD = moderate-severe disorder; MMD = mild-moderate disorder

**Table 2.** Pre- and post-treatment differential representation of the different types of generalization considering different therapeutic approaches and severities of phonological disorder

| Approach | Subject | Severity | Generalizations (%) | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | Untreated words | Other word position | Within sound classes | Across sound class |
| MínO | S1 | SD | 44.82 | 30.48 | 51.35 | 31.05 |
| | S2 | MSD | 71.11 | 32.33 | 66.67 | 42.86 |
| | S3 | MMD | 74.65 | 50.31 | - | 42.15 |
| MaxO/ES | S4 | SD | 75.00 | 50.00 | 45.04 | 82.83 |
| | S5 | MSD | 28.41 | 52.75 | 28.44 | 0.00 |
| | S6 | MMD | 100 | 50.00 | 73.16 | - |
| MulO | S7 | SD | 17.7 | 30.50 | 31.82 | 25.38 |
| | S8 | MSD | 63.16 | 50.00 | 54.86 | 63.33 |
| | S9 | MMD | 18.07 | 16.24 | 0,00 | 7.45 |
| p-value | | | 0.2636 | 0.14957 | 0.71653 | 0.44123 |

Friedman test (p<0,05)

**Note:** MinO = minimal opposition; MaxO/ES = maximal opposition/empty set; MulO = multiple opposition; SD = severe disorder; MSD = moderate-severe disorder; MMD = mild-moderate disorder; - = item without occurrence possibility of generalization according to the sound treated

Generalization within sound classes was verified in all approaches. Minimal Opposition model exhibited a higher differential in the MSD (S2), while in the Maximal Opposition/Empty Set model the higher differential occurred in the MMD (S3). The Maximal Opposition/Empty Set approach was the only one that caused improvement at this severity level.

The Multiple Oppositions model produced the greatest amount of generalization in the MSD (S8). In the Minimal Opposition model the subject with MMD (S3) did not present possibilities to this type of generalization because all sound classes were treated (/l/, /ʎ/, /r/ e /R/), while the child with MMD (S9) treated with Multiple Oppositions did not present generalization due to a regression in her reassessment.

Generalization across sound classes was observed in all approaches. In the Minimal Opposition treatment greater improvement was observed in the MSD (S2) and MMD (S3) and in the Maximal opposition/Empty Set, for the SD (S4). It is emphasized that, in this approach, the child with MMD (S6) did not present possibilities to this type of generalization, while the child with MSD (S5) did not present it, even having the possibility to. In the Multiple Oppositions, the MSD (S8) obtained higher differential to this type of generalization when compared to the other children.

Figure 1 shows the nine children of this paper considering the therapeutic model and the severity of phonological disorder in relation to the difference of PCC pre- and post-treatment.

In all treated approaches, the SD obtained higher differentiation between initial and final assessment in relation to the PCC.

### DISCUSSION

Through the result analysis, verification of generalization in the phonological system of the nine treated children is
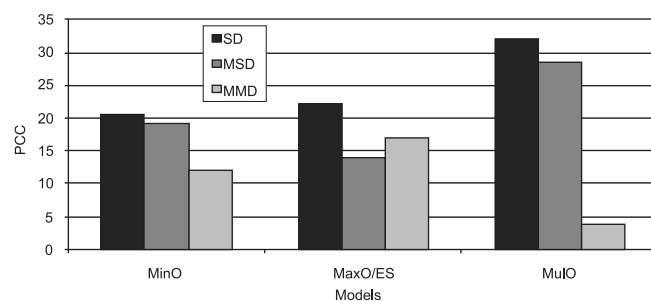


**Note:** PCC = percentage of consonants correct; MinO = minimal opposition; MaxO/ES = maximal oppostion/empty set; MulO = multiple oppositions; SD = severe disorder; MSD = moderate-severe disorder; MMD = mild-moderate disorder

**Figure 1.** Representation of the differential PCC considering therapeutic approaches and severities of phonological disorder

evident. These findings agree with previous research[10,11] that highlighted generalization in different therapeutic approaches, affirming the effectiveness of contrastive approach models in relation to generalization in the phonological systems of the children.

Generalization to untreated words was more evident in the Maximal Opposition/Empty Set model mainly for the MMD, corroborating the findings of a study[10] that found similar results.

Generalization to other word position was mainly observed in the children treated with the Maximal Opposition/Empty Set model, with the largest difference found in the child with MSD. In the Multiple Oppositions model the child with MSD exhibited the greatest generalization, while in the Minimal Opposition approach the child with MMD showed the greatest generalization. These results seem to be related to the position of the selected target-sounds, because in the Maximal Opposition/Empty Set and Multiple Oppositions

models the majority of the phonemes were in medial onset (MO). This is in agreement with a study[15] that examined the normal acquisition of Brazilian Portuguese phonemes and showed that the MO is acquired after the initial onset (IO). Thus, stimulating the target-sound in the medial position facilitates the acquisition in IO.

Generalization within sound classes was observed in the MSD in the Multiple and Minimal Opposition approaches. These results could be due to the number of contrasting phonemes in both models because all sound classes (fricatives, liquids and plosives) were targeted, facilitating generalization to sounds that do not belong to the same classes.

In the Multiple Oppositions model, generalization across sound classes was observed in the MSD (S8). The selected target-sounds to the treatment of S8 differed in features of major class, which was not true with the selected targets for the S9, that differed only in features of non-major class. These results agree with Gierut[3,4], who mentions that phonemes which differ in major class distinctions contribute to a bigger phonological change.

The SD was the level that presented the greatest improvements with treatment. A current study[9] found similar results when three different therapy models were compared. The PCC increase was higher to small values of severities, that is,

to the SD. This happens because, in this level, there are a greater number of phonemes to be acquired by the phonological system of the children.

The current study was idealized with the purpose of investigating the occurrence of structural generalizations in three therapy approaches. However, there is a significant limitation related to the small number of children in each treatment group, complicating the statistical analysis. It is expected that future research could have a larger sample of children, improving the reliability of statistical analysis, supporting the most efficient approaches for the treatment of phonological disorders in children.

## FINAL COMMENTS

In the present study, all approaches (Minimal Opposition, Maximal Opposition/Empty Set and Multiple Oppositions) favored the occurrence of structural generalization in three different severities of phonological disorder. This demonstrates the efficacy of therapeutic models with contrastive approach. In addition, all models provided an increase in PCC, that is, all children exhibited improvements in speech. Further studies are suggested using a larger number of subjects in order to confirm our findings in a broader population.

## RESUMO

Este trabalho teve como objetivo **analisar a generalização estrutural (a itens não utilizados no tratamento, para outras posições na palavra, dentro de uma classe de sons e para outras classes de sons)** em três diferentes modelos de abordagem contrastiva, considerando-se a gravidade do desvio fonológico. A amostra constituiu-se de nove sujeitos com desvio fonológico, com idades entre 4 anos e 2 meses e 6 anos e 6 meses. Todos foram avaliados, antes e após a terapia fonológica. Foram estabelecidos três grupos para o tratamento, todos constituídos por três sujeitos; em cada um havia um representante com desvio grave, moderado-grave e médio-moderado. Cada grupo foi tratado por um modelo diferente – Oposições Mínimas, Oposições Máximas/*Empty Set* e Oposições Múltiplas. A análise estatística dos resultados foi feita mediante comparação entre os modelos terapêuticos e a gravidade do desvio fonológico, utilizando-se os tipos de generalização. Verificou-se a ocorrência dos diferentes tipos de generalização em todos os grupos estudados, entretanto não houve diferença entre eles. Os três modelos de terapia aplicados favoreceram a ocorrência de generalização estrutural nas três diferentes gravidades do desvio, demonstrando que os modelos de abordagem contrastiva são eficazes no tratamento do desvio fonológico.

**Descritores:** Fala; Distúrbios da fala; Generalização da resposta; Fonoterapia/métodos; Criança

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