Shaping Word Approximations for Speech Intelligibility: Effect on Language

ASHA Convention
November 21, 2009

Diane Nancarrow, M.A., CCC/SLP
Nancy R. Kaufman, M.A., CCC/SLP
Martha Burns, PhD, CCC/SLP

www.kidspeech.com

Mirror Neurons and Their Clinical Relevance

The essence of the Mirror Neuron mechanism is that when one observes an action taking place done by someone else, a set of neurons that code for that action is activated within the observers’ motor system.

The coupling of observation with execution strongly facilitates the formation of motor memories.
Mirror Neurons and Their Clinical Relevance

Language learning is grounded in an appreciation of other’s communicative intentions, sensitivity to joint visual attention and the desire to imitate. (Kuhl, 2004)

Motor Learning Theory

Using Broca’s area goes beyond motor control
Distinct linguistic processes, word identity, grammar and pronunciation are computed within small regions of Broca's area. (Sahin, N., Pinker, S., Cash, S., 2009)

Broca’s area should no longer be seen as only the expressive language area, or Wernicke’s area, the receptive language area. These functions overlap within the brain.

Start with small units, use successive approximations.
Broca’s and Motor Learning Theory

Work from phonologically simple to motorically complex

Begin with word shells, help the child fill in the perceptual/motor details of the words. (Kuhl, 2004)

Stimulate mirror neurons by facilitating the child to be attentive, excited and vocally imitating with social connections. (Rizzolatti, Fogassi and Gallese, 2006)
The Kaufman Children’s Center provides intervention services for children with speech, language and sensory-motor challenges.

Investigation of S.P.E.A.K. Program

Investigation of Speech Praxis Experience at Kaufman (S.P.E.A.K.)

ASHA and CASANA’s characteristics of Childhood Apraxia of Speech:

- Limited repertoire of vowels
- Less differentiation between vowel productions
- Vowel errors, especially distortions
Investigation of S.P.E.A.K. Program

- Variability of errors
- Unusual, idiosyncratic error patterns
- Errors increase with length of utterance

Investigation of S.P.E.A.K. Program

- Errors increase with complexity of utterance.
- Target produced correctly in some contexts but incorrectly in different contexts.
- Difficulty between elicited or imitated productions vs. volitional and spontaneous productions.

Investigation of S.P.E.A.K. Program

- Impaired rate/accuracy on diadochokinetic tasks.
- Disturbances of prosody, including overall slow rate; timing deficits, pauses between and with syllable, excess and/or equal stress, choppy and monotone speech.
Investigation of S.P.E.A.K. Program

• Groping or observable struggle for articulatory position.
• Poor speech intelligibility.
• Restricted sound inventory.

Investigation of S.P.E.A.K. Program

• Impaired volitional non-speech movements (oral apraxia).
• Other idiosyncratic descriptions.
• Issues of impaired intelligibility and reduced expressive language.

Investigation of S.P.E.A.K. Program

Definition of CAS per the American Speech Language Hearing Association’s Ad Hoc Committee on Childhood Apraxia of Speech:

Childhood apraxia of speech (CAS) is a neurological childhood (pediatric) speech sound disorder in which the precision and consistency of movements underlying speech are impaired in the absence of neuromuscular deficits (e.g., abnormal reflexes, abnormal tone). CAS may occur as a result of known neurological impairment, in association with complex neurobehavioral disorders of known or unknown origin, or as an idiopathic neurogenic speech sound disorder. The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody.
Investigation of S.P.E.A.K. Program

• Assembling the children for intensive treatment = S.P.E.A.K.

• Evaluation pre-treatment
  1. Goldman Fristoe2 Test of Articulation
  2. Kaufman Speech Praxis Test (KSPT)
  3. Language Sample

• Individualized speech goals established within first half hour
Investigation of S.P.E.A.K. Program

• Individual speech intervention scheduled for 30 minutes, twice daily

Investigation of S.P.E.A.K. Program

• Group intervention with Nancy Kaufman scheduled for 60 minutes, once daily

Investigation of S.P.E.A.K. Program

• Once weekly, participation in a sensory-motor group for 60 minutes
Investigation of S.P.E.A.K. Program

• Participation for three weeks for a total of 28.5 hours of intervention

Method

• Kaufman Speech to Language Protocol (K-SLP) Six Steps

The Kaufman Speech to Language Protocol

• Determine what vowels, consonants and syllable shapes the child has in his/her repertoire via the KSPT
The Kaufman Speech to Language Protocol

• Establish the syllable shapes that are lacking, as well as the vowels and consonants that the child is unable to form

The Kaufman Speech to Language Protocol

• Establish a list of functional nouns and verbs for best approximations for requesting and commenting
  – Favorite foods
  – Drinks
  – Toys
  – Activities

The Kaufman Speech to Language Protocol

• Script functional expressive language
The Kaufman Speech to Language Protocol

• Build expressive language formulation through adding syntax and morphology

• Establish a home program

Results
Goldman Fristoe 2 Test for Articulation Pre vs. Post Comparison
Sounds-in-Words Score Summary
Subjects organized by age, youngest to oldest

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Age at initial testing (years, months)</th>
<th>Pre Intervention Standard Score</th>
<th>Post Intervention Standard Score</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC</td>
<td>2.11</td>
<td>58</td>
<td>66</td>
<td>+7</td>
</tr>
<tr>
<td>RM</td>
<td>2.11</td>
<td>UTT*</td>
<td>103</td>
<td></td>
</tr>
<tr>
<td>CP</td>
<td>3.0</td>
<td>71</td>
<td>90</td>
<td>+19</td>
</tr>
<tr>
<td>WK</td>
<td>3.2</td>
<td>68</td>
<td>86</td>
<td>+18</td>
</tr>
<tr>
<td>LW</td>
<td>3.3</td>
<td>83</td>
<td>97</td>
<td>+14</td>
</tr>
<tr>
<td>CC</td>
<td>3.3</td>
<td>95</td>
<td>98</td>
<td>+3</td>
</tr>
<tr>
<td>CM</td>
<td>3.5</td>
<td>70</td>
<td>79</td>
<td>+9</td>
</tr>
<tr>
<td>JB</td>
<td>3.5</td>
<td>72</td>
<td>83</td>
<td>+11</td>
</tr>
<tr>
<td>NC</td>
<td>3.9</td>
<td>75</td>
<td>82</td>
<td>+7</td>
</tr>
<tr>
<td>AK</td>
<td>4.4</td>
<td>85</td>
<td>96</td>
<td>+11</td>
</tr>
<tr>
<td>GS</td>
<td>4.9</td>
<td>UTT**</td>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

UTT = Unable To Test
*G.S. refused to continue with test, crying "Too Hard!"
**R.M. unwilling to attempt to speak

Results of pre and post Goldman Fristoe 2 testing, organized by ascending age of subject

KSPT: Pre and Post Intervention Scores
(Percent of Correct Productions)

<table>
<thead>
<tr>
<th></th>
<th>Oral - Initial</th>
<th>Oral - Final</th>
<th>Simple - Initial</th>
<th>Simple - Final</th>
<th>Complex - Initial</th>
<th>Complex - Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. S.</td>
<td>45.6</td>
<td>61.8</td>
<td>76.1</td>
<td>92.0</td>
<td>50.6</td>
<td>31.8</td>
</tr>
<tr>
<td>J. B.</td>
<td>100</td>
<td>100</td>
<td>27.7</td>
<td>32.1</td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td>C. M.</td>
<td>90.9</td>
<td>100</td>
<td>97.3</td>
<td>96.8</td>
<td>40.5</td>
<td>53.3</td>
</tr>
<tr>
<td>R. M.</td>
<td>UTT</td>
<td>UTT</td>
<td>73.0</td>
<td>90.1</td>
<td>9.9</td>
<td>62.9</td>
</tr>
<tr>
<td>A. K.</td>
<td>100</td>
<td>100</td>
<td>98.4</td>
<td>100</td>
<td>34.8</td>
<td>39.5</td>
</tr>
<tr>
<td>C. C.</td>
<td>100</td>
<td>100</td>
<td>95.2</td>
<td>100</td>
<td>55.5</td>
<td>81.7</td>
</tr>
<tr>
<td>W. K.</td>
<td>100</td>
<td>100</td>
<td>58.7</td>
<td>62.5</td>
<td>41.2</td>
<td>39.8</td>
</tr>
<tr>
<td>L. W.</td>
<td>100</td>
<td>95.7</td>
<td>95.7</td>
<td>100</td>
<td>58.1</td>
<td>56.0</td>
</tr>
<tr>
<td>M. C.</td>
<td>81.9</td>
<td>100</td>
<td>26.9</td>
<td>38.0</td>
<td>6.6</td>
<td>93.3</td>
</tr>
<tr>
<td>C. F.</td>
<td>56.3</td>
<td>72.7</td>
<td>82.5</td>
<td>87.3</td>
<td>13.3</td>
<td>13.3</td>
</tr>
<tr>
<td>N. C.</td>
<td>100</td>
<td>100</td>
<td>60.3</td>
<td>85.7</td>
<td>UTT</td>
<td>28.3</td>
</tr>
</tbody>
</table>

UTT = Unable To Test

Nancarrow, Burns, et al. 2008
Subject: MLU

MLU changes from pre to post test

Nancarrow, Burns, et al 2008

KSPT: Pre vs. Post Intervention (A.K.)

KSPT: Pre vs. Post Intervention (G.S.)

KSP Level of Complexity

Nancarrow, Burns, et al

MLU changes from pre to post test

$ t $ test $ = 0.004146 $
The Kaufman Speech to Language Protocol (K-SLP) used in this intensive format is effective for children who exhibit moderate to severe speech sound disorders that result in delayed expressive language development.

For children who can imitate isolated vowels and consonants, the focus of therapy should be upon the production of syllable shapes rather than working on gross oral motor positions.

The K-SLP focuses upon the production of syllable shapes toward improved motor speech coordination.
Conclusion

The K-SLP takes into consideration the acoustic (auditory, perceptual and processing) characteristics of language and the motor aspects of speech production.

Conclusion

The K-SLP incorporates the interests of the child and keeps the “drill” work fun and exciting, activating the Mirror Neuron system.

Conclusion

The K-SLP encompasses a linguistic and a motoric approach:
Conclusion

1. The K-SLP focuses on functional vocabulary and expressive language by providing linguistic modeling of phonological processes.

2. The K-SLP expands expressive language through assisting the child to include syntactical structures, morphological endings and advance into phrase and sentence production.

3. The K-SLP uses descriptive elements.
Conclusion

4. The K-SLP applies story narratives used for functional language generalization.

Conclusion

Through watching, listening and imitating, the K-SLP activates Mirror Neuron mechanisms.

Conclusion

The K-SLP combines motor learning theory with developmental language acquisition.
References


References


References


References
