Chapter 8

PROMPT Treatment

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The PROMPT System (Prompts for Restructuring Oral Muscular Phonetic Targets), is a dynamic tactile method of treatment for motor speech disorders which capitalizes upon touch pressure, kinaesthetic, and proprioceptive cues. The method was developed by Chumpelik (Hayden) (1984) originally for the treatment of verbally apractic children. Subsequently, however, it was reported to facilitate verbal expression among adults with apraxia of speech and Broca’s aphasia (Square, Chumpelik (Hayden), and Adams, 1985; Square et al., 1986). Depending on the nature of the speech disorder or needs of the patient, PROMPTs provide the clinician with almost total motor control of the peripheral and some proximal articulators through manipulation. In turn, this manipulation provides for the patient, a framework for spatial and temporal motor speech programming. Prompts are applied to the mylohyoid muscle, facial musculature, and through manipulation of the mandible. Depending on the nature and degree of severity of the motor speech disorder, PROMPTs may provide input for some or all of the following parameters: spatial targeting for place and sometimes manner of production; degree of mandibular excursion; protrusion or retraction of facial muscles; the number of speech muscles required to contract; and relative segment and syllable durations. The purpose of this chapter is to describe the rationale and components of the PROMPT System, and to demonstrate the efficacy of the method by providing preliminary results of single-case research.

Rationale

Recent theories of initiation and control of movement specify three processes — planning, programming, and execution (Allen and Tsukahara, 1974; Brooks, 1979). Marsden (1982) described the motor plan as...
conceiving the 'strategy for action', specification of 'where... when... and how to act', and putting 'together the package of motor actions...' (pp. 521-2). Programming, on the other hand, was described as including 'assembly of simple single sequences specifying the activity of agonists, antagonists, synergists and postural fixators' plus 'assembly of subroutines and complex sequences of the program' (p. 522). Motor execution was said to entail 'initiating or beginning the movement sequence, running necessary programs, ... controlling the course of movement, and terminating or ceasing action' (p. 552). To our way of thinking, motor planning is roughly analogous to the generation of the phonological matrix which, according to the motor theory of speech production (Liberman et al., 1967), is an abstract representation of patterns of neural activity for sets of distinctive features; for example, stridency may have one representation of neural activity while retroflexion, another. As such, this level of control of speech may be thought of as the generation of higher order linguistic phonological rules or the planning of phonemic templates. It is at this level that disruptions result in phonemic paraphasias marked by phoneme substitutions and/or phoneme sequencing disorders. Remediating such impairments may entail transcoding between phonemes and graphemes (Wiegl and Bierwisch, 1970), since each represents linguistic units.

Programming is thought to be the disrupted control mechanism in the apraxias. It is at this level of motor control that 'motor pretuning' (Kelso and Tuller, 1981), and 'phasing' (Kent and Rosenbek, 1983) of the neuromotor commands are disrupted resulting in temporospatial disorganization of movements (see Chapter 2). Finally, it is usually the level of motor execution that is disrupted in the dysarthrias in that neural activation of the muscles of the speech system is disrupted; this precludes the efficient running of programs and control of the course of movement.

Although the exact neurophysiologic mechanisms cannot be fully specified, it is known that somatosensory information from muscles, joints, and skin not only influences execution via direct routes to the intermediate cerebellum and motor cortex, but also the programming of motor events via input to the association cortex. According to Brooks (1979) the basal ganglia and cerebellar hemisphere communicate with the association cortex in programming volitional movements. Marsden (1982) stated "... the pars intermedia (of the cerebellum) updates the intended movement, based upon the motor command originally issued and somatosensory description of ... position and velocity on which the movement is to be superimposed" (p. 522); and, 'to execute a motor plan, one has to move from point to point of a sequence, the signal of
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arrival at each point being the trigger to delivery of the motor program required to shift to the next point in a sequence (Marsden, 1982, p. 535).

It is upon this model that we predicate the efficacy of PROMPT treatment. The skilled and experienced PROMPT clinician provides for the patient an enhanced and, initially, clinician-controlled somatosensory description of the postural fixators or articulatory end-points, velocities, and trajectories of movements, and the 'phasing' or temporal assembly of motor subroutines. The clinician acts as an 'external programmer' and, once having mapped in the program, ensures that the patient remains motorically but not sensorily passive. Immediately after, the patient is allowed motoric control while the clinician continues to provide somatosensory support for the constraints and patterns of movement. Eventually, the patient appears to internalize the program for each target and, especially among children, begins to generate related programs (Chumpeik (Hayden), 1984) in that principles of motor equivalence (Hebb, 1949) seem to be learned.

Method

In this section the components of the PROMPTs used for treatment will be discussed. Our readers must be aware that PROMPT treatment is multifaceted treatment and that many principles beyond those reported here comprise the method. Further, because the PROMPT System is a dynamic method, extensive training and practice are required in order to competently and efficiently administer this form of treatment. Attempts to learn the PROMPT System from the skeletal information presented here will be impossible.

When initiating a PROMPT treatment session, the clinician engages the patient by first establishing a sitting position that allows for maintenance of head control. For example, the clinician stabilizes the patient using one hand behind his/her head, while using the other hand to control and provide cues to the oral apparatus. The patient is then instructed to allow the clinician complete control through the instruction, 'let me do it'. The clinician, thus, has full liberty to program in the target phoneme, word, or phrase. Integral stimulation, that is, the instruction, 'watch me, listen to me', (Rosenbek, 1978) are also used for multimodality input. For some patients, attention to all modalities, i.e., auditory, visual, tactile, and kinesthetic may prove to be overstimulating. In those cases, the patient is encouraged not to watch the clinician but rather to 'feel the movement'. The patient's attention if further
directed to the 'sequenced' aspects of the production. That is, cues for the temporal aspects of speech movements are stressed.

The PROMPT System cannot elicit speech where there is an extremely severe neuroinnervation impairment (e.g., spastic apraxia). The patient must have, minimally, breath support, phonation ability for an open vowel, some ability to cooperate, and minimal/basic comprehension skills. The System can guide the articulators to specific postures and actions sequentially, and, thus, stimulate motor speech programming. If the clinician is skilled, the PROMPT System can help the patient to approximate phonemes successfully and independently produce programmed words/phrases, i.e., depending upon the patient's preserved abilities and extent of disability with regard to language and motor speech processes, spontaneous generalization is more or less probable but seems to occur to a much lesser degree, in aphasic-aparactic adults than among verbally apractic children.

Given the above considerations, PROMPTS work to establish the patterning of several different speech parameters. They are: place of contact; extent of mandibular excursion; resonance and phonation; number of muscles in the contracted state; duration of segments relative to one another; manner of production; and coarticulation. Each will be discussed below.

**Place of contact**

Place of contact is traditionally seen as the end point of a target 'movement' (Lindblom, 1963; Stevens and House, 1963). Traditional treatment identifies areas of orofacial structures, i.e., upper/lower lips, alveolar ridge, hard palate, and soft palate, as 'places' where various structures articulate. For example, in the production of /t/ the tongue tip touches the alveolar ridge. In the PROMPT System, four places of contact are prompted. These are designated as A, B, C, and D in Figure 3.1. They traverse the mylohyoid muscle from just behind the mandible (point A), to just above and behind the larynx (point D). Through digital manipulation of these placements the tongue may be prompted to articulate with the palate at the most anterior lingua-alveolar position to the most posterior linguovelar place. For example, an A position is used for all tongue tip/blade productions (/l/, /d/, /n/, /s/, /z/), and D for velar productions (/k/, /g/, /ŋ/). Points B and C are used for midpalatal productions, (/l/, /e/, /i/, /ə/, etc.). The clinician uses either one, two, or three fingers to stimulate the approximate area of the lingual surface (width) needed to produce the target phoneme. Through cues related to
PLACE OF CONTACT FOR TARGET POSITIONS
MYLOHYOID PLACEMENTS

9. tongue tip
10. apex
11. blade front
12. dorsum

Figure 8.1: Place of contact for target positions and myohyoid placements. (Adapted by permission from Chumpelik, O., Seminars in Speech and Language, Vol. 5, No. 2, Thieme Medical Publishers, New York, 1982.)

lingual width, the placement of production and amount of lingual excursion in the superior/inferior plane (depth of movement as signaled by amount of pressure), the clinician can:

1. Partially manipulate the structures into the placement position
2. Approximate the neuromuscular pattern needed for production
3. Stimulate kinesthetically the lingual musculature required for moving to the correct target position.
Place of contact is also signaled on the facial muscles. These prompted positions are most often bilateral using two digits, usually the thumb and index finger to provide information to the facial muscles for the labial postures of spreading and rounding, or for degree of mandibular excursion. On the face, all prompts are worked from midline or bilaterally to stimulate symmetrical action, an important goal of such training. This is especially desirable for those patients with various degrees of neuromuscular innervation dysfunction or unilateral facial paresis. As with the mylohyoid prompts, pressure is provided as a cue that deeper muscles or muscle groups which cannot be directly stimulated, are to be activated. Duration cues are also added to represent timing of activity.

In Figure 8.2, placements 1 and 2 are used to stimulate labial rounding as for /o/ or /u/, or retraction as for /s/; placements 3 and 4, the upper for /i/ and the lower for /θ/; placement 5 for /l/ or /v/ (labial manipulation only); placement 6 and 7 for /j/ and one component of /ʃ/ (contraction); placement 8 for indicating velar lowering to signal nasality (cue only); placement 9 indicating phonation for voicing (cue only); and placement 10 for jaw excursion. The latter three ‘place’ cues indicate major speech ‘actions’ while the former seven indicate movements towards spatial targets.

Mandibular excursion

Mandibular excursion relates to the amount of jaw opening needed for each target position. The proper balance of tongue–jaw action ‘phased’ with the coordinated contraction of facial muscles to achieve actions such as labial rounding, or spreading, are also critical for coarticulation. Correct extent of mandibular excursion is a crucial component of normal speech production although, in the management of some dysarthrias, mandibular stabilization may be desirable (Rosenbek and LaPointe, 1978). For some patients with AOS, mandibular kinesthesia impairments may complicate the primary motor speech programming impairment (Rosenbek, Wertz and Darley, 1973). Thus, place of contact may be correct, but segmental production may be distorted due to exaggerated or restricted mandibular action. The PROMPT System provides kinesthetic manipulation for the degree of opening required for each target, segment, or syllable as well as mandibular changes required during transitions between segments.

The four positions shown in Figure 8.3 are used by the clinician to signal different degrees of mandibular excursion. Depending on the
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FACIAL PROMPTS

1. and 2. at lip corners
   (intersection between zygomatic maj. and obicularis oris)
3. and 4. above/inside lip corners/below/inside lip corners
   (between levator anguli oris m. and zygomatic maj.)
5. on the lower lip; margin point of contact for fricatives
   (f,v)
6. and 7. beyond lip corners
   (intersection of buccinator m. and zygomatic maj.)
6. point of contact for nasal prompt
9. point of contact for voiced prompt
10. point of contact for jaw position movement.

Figure 6.2 Facial PROMPTS. (Adapted by permission from Chumpeik, D. Seminars in Speech and Language, Vol. 5, No. 2, Thieme Medical Publishers, New York, 1982)

patient's jaw length, facial, dental, or palatal structures, there will be differences in the maximal degree of opening, i.e., the distance between the extreme positions, 1 and 4, as well as between each of the four positions. Thus, the clinician must take all structural aspects into account when determining the maximum jaw opening position.

Although vowel segments are primarily influenced by jaw excursion, consonants also need varying jaw heights to achieve place of contact or to enable the tongue to move semi-independently of the jaw.
JAW POSITIONS FOR VOWEL PRODUCTION

Jaw Positions for Vowel Production

<table>
<thead>
<tr>
<th>HIGH</th>
<th>FRONT</th>
<th>CENTRAL</th>
<th>BACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>[i] head</td>
<td>[a] above</td>
<td>[u] who'd</td>
</tr>
<tr>
<td>2.</td>
<td>[æ] hate</td>
<td>[ʌ] hut</td>
<td>[o] hoe</td>
</tr>
<tr>
<td>3.</td>
<td>[ɛ] head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>[æ] had</td>
<td></td>
<td>[a] hot</td>
</tr>
</tbody>
</table>

Segments produced at jaw position 1 include the [i], [u], [p], [l]; at 2, [o], [n], [l], and [θ]; at 3, [ð], [s], and [e]; and at 4, [k], [g], [æ], and [a]. For syllabic coarticulation within phrases, jaw position is never extended beyond the 2 or 3 position. When specifically training the phonemes, [k] and [g], in isolation or the neutral environment of [ʌ], the jaw may be extended to a 4 position to encourage the movement of the dorsum of the tongue to articulate with the soft palate (place of contact). Although the patient may receive slightly exaggerated tactile and
kinesthetic cues for some positions, the prompting will facilitate the integration of this information for coarticulation, and especially when rate of speaking becomes faster.

Orality/nasality and voicing/devoicing actions

The patient learns that resonatory and phonatory control is required for production of all speech segments. Nasality is signaled by facial prompt 8 shown in Figure 8.2. The thumb provides tactile stimulation to the side of the nose and this prompt is incorporated with a mylohyoid finger prompt for place of production of /n/ or /ŋ/, or lip closure for /m/. The nasality cue is always provided for the client to ensure consistency of production. As stated above, the degree of mandibular excursion is also provided as needed, e.g., position 4 for /ŋ/.

In adult apractic patients, devoicing/voicing and nasality/orality confusions often occur (Itôh and Sasunuma, 1984). With the PROMPT System, the clinician can cue the patient for nasality, and/or voicing. A devoiced airstream may also be cued along with manipulation of other structures to achieve targets. This latter type of cueing utilizes principles of phonetic derivation (see Chapter 6). For example, /t/ may be obtained by first eliciting an airstream as for /h/ and, then, manipulating the jaw to the 1 position while using facial prompt 5 to move the lower lip into the correct labiodental position.

Once patients are clearly in control of actions for signaling voicing/devoicing and orality/nasality and are observed to associate the cued actions for achieving these end-point targets with the intended perceptual features, the clinician will usually need only to touch the area to remind the client of the added or omitted articulatory feature.

Tension

Cues for tension relate specifically to the number of muscles or muscle group(s) which should be activated in the facial or lingual systems and the relative length of time they should be activated (Shriberg and Kent, 1982). The degree of pressure applied by the clinician signals these two parameters. Also the deeper the muscles to the periphery, the higher the prompted degree of tension. For specific phonemes, lingual and facial tensions vary. Thus, increased pressure is applied for tense vowels such as /i/ and /u/, and reduced pressure for lax vowels such as /a/. Further, prompts delivered to the mylohyoid are greater in pressure than those...
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is, airstream management in this treatment approach is always dependent on the adequate prompting of other articulatory actions. For example, if a patient is producing a stop consonant, /s/, for the fricative, /s/, duration is a critical factor as well as the facial prompts for placements 1 and 2. For each manner class, different prompts may be emphasized. For example, for bilabial stop plosion, the lips need to be occluded lightly and quickly released after appropriate imploding of the airstream. Thus, PROMPTs for position, pressure, and timing are critical. For production of frication, the tongue or the cutting edge of the incisors is involved. Depending on the effectors required for each phoneme, different PROMPT parameters will be emphasized. For /f/, the lower lip would be manipulated. Contrarily, for /s/, the width and placement of tongue involvement (three fingers at a C position) as well as facial prompts 6 and 7, for labial protrusion anteriorly and buccal contraction bilaterally, are important. Airstream management (manner) is always a dynamic process and depending on the phoneme, or coarticulatory influences on phonemes, differing amounts of input by the clinician will be needed. Inherent to all of the above, is imparting to the patient the knowledge of what muscle groups must contract under specific constraints in order to achieve the appropriate action. Equally important is cueing for the coarticulation of muscle groups in a tightly ‘phased’ manner. That is, temporal prompting for the integration of all the articulatory subfeatures of phonemes and parameters of coarticulation between the articulatory features is necessary.

Coarticulation

One of the most unique functions of the PROMPT System is that it is a dynamic treatment approach. Thus, once segments can be elicited using PROMPTs, treatment immediately focuses on transitionalization between them and, to a lesser extent, sequencing of the units (phonemes) themselves. For the clinician, this may mean working predominantly at the phrase level with occasional steps back to the phoneme or syllable level to improve phoneme precision. At this level the clinician uses ‘surface’ prompts to cue key elements of the motor pattern. When prompting at the ‘surface level’, the clinician provides place and timing cues. ‘Deep prompting’ delivers more specific cues for muscle contraction and duration. During segmental production, coarticulation influences are significant and variables such as jaw height and labial rounding or retraction are dictated by the constraints of the phonetic environment. Coarticulation influences may be noted in that,
delivered to the face, as there are more layers of tissue to work through before cues for contraction of the varying lingual muscles become salient to the patient. For example, different degrees of tension and thus prompted pressure, exist for /a/, /e/ and /a`. For /a/, when trained in isolation, the jaw is at a full open 4 position and there is little or no specific pressure applied to the tongue via the mylohyoid. For /e/, the jaw is at an open 3 position and there is tension in the blade area of the tongue, at the mylohyoid C position. Adjunctively, two fingers are used and quick, firm pressure is applied. This pressure provided in such a quick manner signals the lingual muscles which should contract, as well as the duration of muscle contraction. For /a`, the jaw is loosely opened at a 1 position and consistent, firm pressure is placed on the mylohyoid at position C using three fingers. This firm consistent pressure signals the activation of deep lingual muscles of the blade and dorsum. Facial prompts at the 1 and 2 position also increase the overall tactile impression.

Relative duration of segments

Prompts for the relative timing of segments is essential for normal speech production. As noted above in ’tension’, the prompt may be quick or held longer to indicate duration of a phoneme. When there is a high amount of tension, duration will not normally signal features which require that few muscle groups be contracted. For example, little tension and a longer relative duration may signal features such as nasality. Relative duration over segments will influence the relative timing of segments at the syllable level as well as the timing of transitions between segments, i.e., coarticulation. Since coarticulation in AOS has been found to be deviant (Ziegler and von Cramon, 1985, 1986), these prompts may be of utmost importance. Further, vowel durations among apractic speakers are often deviant (see Square-Storer, 1987 for a review) and, thus, in need of timing control. The PROMPT System provides coordinated input for the programming of coordinated output.

Manner

Manner, or airstream management, is handled by combining the critical prompts for place (facial or mylohyoid), degree of mandibular excursion (of jaw opening), orality/nasality, duration, and pressure cues. That
consonant features are easily distorted and/or determined by the preceding or following vowel. For example, in 'coat' the lips are rounded while the /k/ and /t/ are produced. When needed, the clinician can provide anticipatory and regressive assimilation cues, i.e., coarticulatory cues, for such influences. The clinician, thus, focuses on these variables in order to achieve coordinated coarticulated muscle activation which results in appropriately perceived speech. If specific target production continues to be in need of prompting, the clinician may isolate the phoneme, prompt it alone and then return to the word or phrase. In adult aphasic-apraxic patients, phrases are usually the preferred stimuli for treatment as they can be 'programmed in' as easily as a single word. With phrases, however, the clinician prompts all targets dynamically. This skill demands a complete understanding of the normal dynamics of speech production as well as experience with PROMPT treatment. Excellent clinical results, however, are achieved. In the next section, we present our pilot research regarding PROMPT treatment for adults with acquired apraxia of speech with coexisting aphasia and, possible, coexisting mild dysarthria.

Evidence of the Efficacy of PROMPT Treatment

Subjects

The subjects of this investigation were three patients, two males, PW and RJ, aged 58 and 59, and one female, SS, aged 38. Each demonstrated at least ten symptoms of apraxia of speech as discerned from administration of both the Apraxia of Speech Battery for Adults (Dabul, 1979) and the Mayo Clinic Screening Battery for Apraxia of Speech. The latter is similar to the battery described by Wertz, LaPointe and Rosenbek (1984). The characteristics of apraxia of speech demonstrated by each are summarized in Table 8.1. All subjects were classified as Broca's aphasic subjects on the Western Aphasia Battery (WAB) (Kertesz, 1982). Their aphasia quotients (AQ) were 23.2 (PW), 45.5 (RJ), and 52.8 (SS). Informal testing revealed that one subject, (SS), was severely agrammatic; the other two subjects demonstrated agrammatism to a lesser degree. Each had suffered a single left-hemisphere thromboembolic accident. There was confirmation that PW's lesion was a deep one extending into the internal capsule. It was suspected that SS's lesion was also a deep one, based upon her dense hemiplegia and pervasive yet mild hypernasality. RJ's neuropsychologic profile was
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Table 8.1: Characteristics of Apraxia of Speech Demonstrated by Each Patient Undergoing PROMPT Treatment

<table>
<thead>
<tr>
<th></th>
<th>S1 (PWI)</th>
<th>S2 (RJ)</th>
<th>S3 (SS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonemic anticipatory errors</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Phonemic perseverative errors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phonemic transposition errors</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Phonemic voicing errors</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phonemic vowel errors</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Visible/audible searching</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numerous/failed all-target attempts</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Errors highly inconsistent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Errors increase with length</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fewer errors, in automatic speech</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marked difficulty initiating speech</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Intrusive schwas, CCs</td>
<td>N/A*</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Abnormal prosody</td>
<td>N/A*</td>
<td>N/A*</td>
<td>X</td>
</tr>
<tr>
<td>Awareness of errors/inability to correct</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

* N/A, due to the severity of their disorders, reliable judgements of these parameters could not be attained.

consistent with those for cortical frontoparietal lesions. Each subject was at least one year post-onset, severely limited with respect to functional verbal expression, and had been discharged from formal speech-language treatment due to lack of evidence of progress.

Procedures

Performances of each subject were baselined over three days on three types of repetition tasks. These included imitation of minimally contrastive phoneme pairs, polysyllabic words, and functional phrases. On each of three consecutive days, twenty-four pairs of minimally contrastive phonemes listed in Table 8.2 were repeated three times in different random orders. Thus, an overall total of 216 productions for each subject were obtained. Production of twenty polysyllabic words, ten laden with plosives and ten with fricatives, was probed. The words are listed in Table 8.3. Each was repeated ten times on each of three baseline days, totaling 600 polysyllabic productions for each subject. Ten functional phrases consisting of three two-syllable imperatives, three three-syllable, and four four-syllable common phrases were probed. The phrases are listed in Table 8.4. Each was repeated ten times on each baseline day, for a total of thirty productions of each or, 300 tokens per subject. Productions of all baseline stimuli were scored as correct or incorrect by two clinicians. A third investigator who had not observed the patients' on-line performances selected, from the scored data.
for probing using imitation. For two subjects (PW and RJ), four polysyllabic words were randomly selected, two for training using PROMPTS and two for probing. For the third subject (SS), six polysyllabic words were selected, three for training and three for probing. For two subjects, functional phrases were trained. For one subject (PW), two phrases were trained and two were probed. For the other subject (RJ), one phrase was trained and a second was not. Training of phrases for the third subject (SS) was not undertaken due to her severe agrammatism. Instead the subject’s performances on additional polysyllabic words, as described above, were observed.

It was decided a priori to score and analyze the data in two ways. The first was to use a binary system of correct–incorrect. The second scoring system graded each minimal pair production, or each polysyllabic word response using a 2, 1, 0 categorical system in which ‘2’ represented a response which was spatially and temporally correct, i.e., totally correct. ‘Spatially correct’ was defined as a response in which targeting for each phoneme (segment) was correct with regard to place of production and in which there were no gross distortions, additions, or omissions of segments nor any initial gropes. ‘Temporal correctness’ denoted several parameters including the perception of correct onset and termination of voicing, correct ‘phasing’ of all articulatory features, correct relative segment durations, and, in the case of polysyllabic words and phrases, no intersyllabic or word pauses. A slow rate of speech was acceptable. A ‘1’ denoted a response which was marked by a spatial or temporal error, while a ‘0’ was given for a response which was spatially and temporally incorrect or characterized by more than one spatial or temporal error. For phrases only, each word produced
correctly both spatially and temporally received one point; that is, the graded scoring system was not used. Point-to-point, inter-rater reliability using the graded scoring system was found to be acceptable in that it ranged from 81.4 per cent to 70.1 per cent. Point-to-point, inter-rater reliability using the correct–incorrect system was found to range from 89.3 per cent to 91.1 per cent. Mean reliability was 91.09 per cent.

The PROMPT training procedure was as follows. First, the patient was presented with an auditory model of a minimal pair, word, or functional phrase. No prompts were given. The patient attempted to repeat the target according to a model and a score of ‘0’, ‘1’ or ‘2’ was given. If a score of ‘2’ was received, the next item was presented for a total of twenty tokens. If, however, a score of ‘1’ or ‘0’ was received, the clinician prompted as follows: the subject was instructed not to respond as the clinician 'mapped in' the correct motor pattern for the sequence of phonemes to be produced using the PROMPT System. The clinician then instructed the subject to attempt the target phoneme, word, or phrase as the clinician simultaneously prompted the motor pattern again. The response was scored as a ‘0’, ‘1’ or ‘2’. The next token in each train of twenty was then presented auditorily for imitation and the same procedure was followed based upon the subject's ability to imitate the token after the first presentation. Untrained series of items were presented auditorily only and the subject's ability to repeat those items was scored using the same scoring methods.

Results

The results are reported for each patient according to accuracy of production of each type of stimulus item, i.e., minimal pairs, polysyllabic words, and phrases, during the course of treatment.

Minimal pairs

As graphically depicted in Figure 8.4, using the plus–minus scoring system, PW demonstrated accelerated learning curves for the phonemes which were trained using PROMPT. These are observed at the top of the figure and are indicated by the solid line. Results for those phoneme contrasts which were not prompted are shown in the lower part of Figure 8.4. No acquisition of the nontrained pairs occurred when accuracy of production was scored using the correct–incorrect method. Results using the graded 0, 1, 2 scoring system were essentially the same.
as indicated by the dotted lines on all graphs. A slightly improved performance for the trained pair, /tʃʃ/, was discerned when partial credit was given; no differences were seen for production of the untrained items, i.e., performance remained at 0 per cent correct. We were able to obtain measures of PW's performances on these minimal pairs two months after termination of PROMPT treatment. It is interesting to note that the patient maintained production of the trained contrasts even though treatment had ceased.

As shown in Figure 8.5, RJ performed similarly to PW. Using the correct–incorrect scoring system shown in the solid lines at the top of the figure, he demonstrated accelerated learning curves for the prompted minimal pairs. Further, he demonstrated poor performances on the untrained items, with the exception of one training session in which he produced 50 per cent of /dʃ/ contrasts correctly. Use of the partial scoring system reflected by the broken lines, however, demonstrated some learning of the untrained minimal pairs by RJ. Thus, it appeared that use of repetition alone facilitated some minimal and/or variable performances.

Figure 8.6 summarizes the results for SS, with regard to production of minimal pairs. Using the correct–incorrect scoring system (solid line), she demonstrated accelerated and fairly stable learning curves for the trained items as shown in the top portion of the figure. Results of performances on the untrained stimuli were not as convincing in that, for the /dʃ/ pair, considerable positive results were demonstrated, but at a slower rate and with greater variability. It may be that learning was demonstrated for this pair because the features of place and voicing were contrasted in the trained pairs. As well, plosion was PROMPT trained as it occurred in /ʃ/. Results of production of minimal pairs by SS, as derived using the partial credit scoring system, revealed even more learning of the untrained pair, /dʃ/: 95 per cent accuracy was achieved by session 12. The learning of that pair, however, was not as accelerated as for the trained pairs. Nonetheless, the partial-credit scoring system, indeed, revealed relatively stable improvement curves. For the minimal pair /tʃʃ/, some learning, although minimal and variable, was discerned from the use of the partial-credit scoring system.

Polysyllabic words

As demonstrated in Figure 8.7, PW demonstrated rapidly accelerated learning curves for the trained stimuli, 'cabinet' and 'sensation'. Using the partial scoring system (broken lines), performances on the trained stimuli were only slightly enhanced from the results obtained using the
Figure 8.5 Minimal pairs (RJ)
Figure 8.6

- **TRAINING**
  - ln
  - vlf

- **UNTRAINING**
  - dz
  - ts/s