CHAPTER 14

# Treating Communication Problems in Individuals with Disordered Language

Swathi Kiran and Chaleece Sandberg

## CHAPTER OUTLINE



The focus of this chapter will be on providing impairment-based therapy to persons with disordered language. The field of aphasiology has seen an evolution of classification of language disorders in adults. Most of the classification systems are based on etiology, symptoms, or a combination of etiology and symptoms; however, no one classification system has proven to be successful in classifying language disorders to the satisfaction of both clinicians and researchers. For example, Broca's aphasia is the term used for a collection of symptoms including word-finding difficulties, relatively preserved auditory comprehension, poor repetition, and non-fluent speech. This is a useful classification for clinicians because it immediately creates a picture of the patient. On the other hand, a researcher studying Broca's aphasia will soon discover that patients with Broca's aphasia can also exhibit agrammatism to varying degrees, which can interfere with comprehension; or apraxia, which can confound scores on word-finding measures. For this reason, the ideal scenario for clinicians and researchers is to determine each individual's specific language strengths and deficits and target each language deficit during therapy.

This chapter will first highlight the primary communication characteristics resulting from disturbances within the domain of language. Several sub-domains of language are elaborated, namely comprehension and production of phonological, orthographic, semantic, syntactic and discourse/pragmatic aspects of language

(Figure 14-1). Next, general guidelines for assessment and some specific examples of currently used assessments will be discussed. Finally, an evidence-based review of the treatment literature for the last 10 years will be presented. From this review, effective treatment techniques for each type of impairment will be selected and described for use in clinical practice. The current chapter utilizes a theoretical framework presented by Ellis and Young (Ellis & Young, 1988) that is pertinent to comprehension and production of spoken and written words. Disorders specific to the semantic system will be discussed within interactive activation models (Dell, 1986) and syntactic disorders will be discussed within theoretical frameworks proposed by Garrett (1980) and Caplan (1992).

Even though the chapter is organized into discrete levels of language processing, it is important to understand that language processing deficits in adults are not isolated modules of impairment but oftentimes are manifest as overlapping and analogous deficits that span across levels of language of processing. For instance, there is some overlap in the nature of deficits observed in orthographic aspects and phonological aspects of language processing. Likewise, there is some overlap between semantic aspects and phonological aspects of language processing. Therefore, when identifying a patient's specific language deficit and developing a treatment, one must acknowledge the possibility of overlapping behavioral markers across different levels of language.

## LANGUAGE DISORDERS

### Phonological Aspects of Language Disorders

#### Comprehension

Spoken language is comprehended from auditory input. Sound waves are decoded by the auditory system into small linguistic units we recognize as phonemes. This process is carried out by the auditory analysis system. Certain sequences of phonemes form units of meaning called morphemes. Morphemes that can stand alone are called words. Word forms are stored in the auditory input lexicon, which functions as a mechanism to verify the existence of a word in the individual's repertoire. Meanings of words are accessed from the semantic system. Although deficits in each of these systems will be described separately, keep in mind that these systems are intrinsically connected and, most often, more than one system is impaired.

Deficits in comprehension can occur at any level of phonological processing. Persons with impairment of only the auditory analysis system are said to have *pure word deafness*. These individuals have problems decoding speech, but are able to identify environmental sounds. This means that repetition and comprehension of speech are severely impaired, but other language functions are intact.

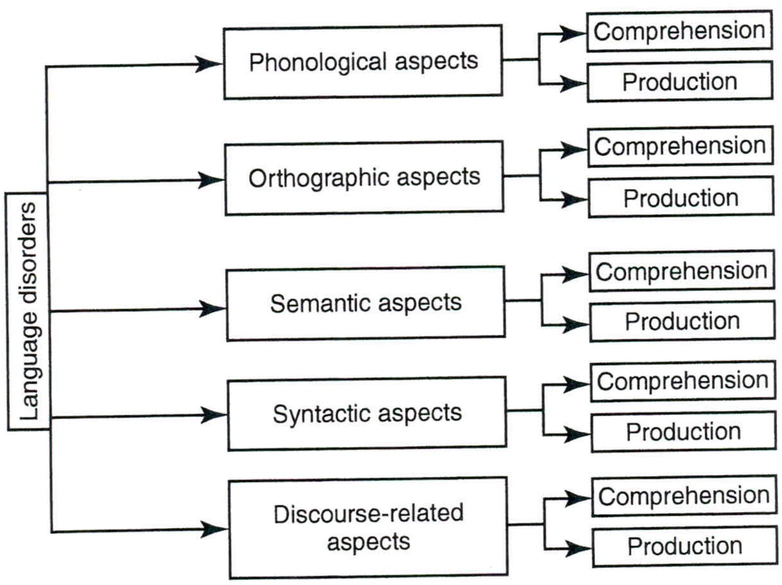


**Figure 14-1** Schematic representation of the organization of different domains of language that defines the layout of the chapter.

### Production

Spoken language production begins with a concept, which is then activated in the semantic system. This concept gains a phonological word form in the speech output lexicon. Once the word form is activated in the speech output lexicon, phoneme sequences are retrieved at the phoneme level, speech movements are planned by the motor cortex, and speech is produced.

Deficits in production can occur at any level of output processing or at the level of the semantic system itself. A disruption in the connection between the auditory analysis system and the phoneme level results in *auditory phonological agnosia*. Persons with this disorder exhibit poor repetition of nonwords, but intact lexical decision and repetition of real words with the use of the intact semantic system route. Deficits of the semantic system in particular will be discussed in another section. Deficits in the speech output lexicon and phoneme level result in mixed paraphasias. Mixed paraphasias are some combination of a semantic and a phonemic paraphasia. For example, if the target is *moustache* and the person says *whisper,* the error is in activating the word form *whisker* and assigning /p/ in the place of /k/. Deficits at the phoneme level result in phonemic paraphasias. Phonemic paraphasias can also occur as the result of verbal apraxia. Verbal apraxia is a deficit in the motor planning of phoneme sequences. Apraxia is distinguishable from dysarthria by the often preserved pronunciation of automatic phrases.

## Orthographic Aspects of Language Disorders

### Comprehension

Written language is comprehended from visual input. The visual analysis system decodes the written letters that form words. The words formed by certain combinations of letters are stored in the visual input lexicon, which accesses the meaning of the visual word form from the semantic system. The process of assigning a phoneme to a written letter is carried out via grapheme-to-phoneme conversion and can be independent from the lexicon and semantic system.

Persons with impairment of the visual analysis system and visual input lexicon have difficulty decoding and recognizing written language, but may be able to correctly assign phonemes to orthography, using the grapheme-to-phoneme conversion route. This is considered to be a peripheral dyslexia called *pure alexia* or letter-by-letter reading. Other types of peripheral dyslexia include *neglect dyslexia* and *attentional dyslexia,* which result from cognitive impairments described in Chapter 8 of this book. *Phonological dyslexia* results from impairment of grapheme-to-phoneme conversion. These individuals are forced to rely on the whole-word semantic route and therefore read both regular and irregular real words with relatively high accuracy, but are unable to read nonwords and unfamiliar words. In contrast to phonological dyslexia, *surface dyslexia* results from impairment of the visual input lexicon and semantic system. These individuals exhibit impaired reading of irregular words, but preserved ability to read regular words and nonwords. Additionally, the person's ability to retrieve the meaning of the word relies on his/her pronunciation such that *stood* may be read as *stewed* activating the meaning relating to food rather than the meaning related to position. *Deep dyslexia* is a manifestation of an impairment comprising both the semantic system and the grapheme-to-phoneme conversion mechanism. Persons with deep dyslexia produce semantic paraphasias and/or morphological errors; show effects of imageability, concreteness, and word class; and exhibit impairment reading nonwords, often substituting real words (e.g., *bride* for *bripe*).

### Production

The production of written language, like spoken language, begins with a concept, which is then activated in the semantic system. Once the concept activates a word form in the graphemic output lexicon, an abstract representation of the letters is activated in the graphemic buffer, which is thought to behave like working memory, storing the abstract letter forms until the specific letter forms can be activated. From here, a word can either be spelled orally or written. Specific letter forms (e.g., upper/lowercase, print/cursive style) are activated at the allograph level. Graphomotor patterns are then planned and executed by the motor system. The process of assigning a written letter to a phoneme is carried out via phoneme-to-grapheme conversion and can be independent from the lexicon and semantic system.

Persons with impairment at the allograph level present with letter substitutions of visually similar letters. Deficits at the graphemic buffer produce both oral and written spelling errors such as addition, deletion, substitution, and transposition of letters. These deficits in writing are referred to as peripheral dysgraphias. *Phonological dysgraphia* refers to a deficit in phoneme-to-grapheme conversion. Persons with phonological dysgraphia retain the ability to spell familiar words, both regular and irregular, but have difficulty spelling nonwords. In contrast to phonological dysgraphia, lexical agraphia or *surface dysgraphia* refers to a writing deficit that occurs at the level of the graphemic output lexicon. These individuals exhibit impairments in spelling irregular words or homophones, but relatively preserved spelling of regular words and nonwords. *Deep dysgraphia*, like deep dyslexia, involves the semantic system. Persons with deep dysgraphia produce semantic errors during free writing and writing to dictation, have difficulty writing nonwords, and the accuracy of their written output is affected by psycholinguistic factors such as imageability and word class.

## Semantic Aspects of Language Disorders

This section will describe aspects of deficits in language function that involve the semantic system and the processing of the meanings of words for comprehension and production. The semantic system receives input from several modalities: auditory verbal/nonverbal input, visual verbal/nonverbal input, tactile input, olfactory input, and gustatory input. These semantic representations appear to be organized within the semantic system hierarchically, but also in somewhat overlapping categories (Rogers & McClelland, 2003). Deficits in semantic processing, affecting either comprehension or production of language, can be modulated by psycholinguistic factors and semantic category factors. Psycholinguistic factors that affect linguistic performance include imageability, concreteness, familiarity, frequency, age of acquisition, and word class (Luzzatti, Raggi, Zonca, et al., 2002; Nickels & Howard, 1995). Semantic category factors include the category itself, animacy, and typicality (Kiran & Thompson, 2003a; Shelton & Caramazza, 1999). Based on the several studies that have examined semantic processing deficits in persons with aphasia, it is clear that a selective fractionation of the semantic system can occur resulting in specific loss of a semantic category, a certain hierarchical level of a category, the inputs and output modalities into the semantic system or in the automatic processes involved (read Shelton & Caramazza, 1999; Tyler & Moss, 2001).

Access to the semantic system and activation within the semantic system can be explained via interactive activation models (Dell, 1986). Lexical access involves the following steps (Dell, 1986; Dell & O'Seaghdha, 1992; Dell, Schwartz, Martin, Saffran, & Gagnon, 1997). The semantic units receive external input (e.g., visual presentation of the picture *cat*). Activation spreads to all potential semantic nodes and down to the phonological units linked to those semantic nodes. The semantic and phonological units are connected bi-directionally, so semantic units receive input from activated phonological units. This positive feedback activates phonological neighbors of the target (e.g., *mat, sat*), semantic neighbors of the target (e.g., *dog*), and both semantically and phonologically related words (e.g., *rat*). The most highly activated word node is selected. A phonological frame is then activated, which represents the syllabic structure of the word, and is involved in the retrieval of phonemes. Interactive activation models are appealing because of their flexibility in explaining both comprehension and production impairments. Comprehension and/or production errors could result from incomplete/incorrect activation of semantic nodes, incomplete/incorrect activation of phonological nodes, or failures in the bi-directional links between the semantic and phonological nodes.

### Comprehension

Disruptions in the semantic system itself or in semantic access result in deficits in comprehension of language and can be manifest in several ways. As noted before, deep dyslexia is a reading disorder that results from damage to the semantic system, with errors reflecting deficits in processing the meanings of words. A deficit at the level of the auditory input lexicon results in *word meaning deafness*. These individuals exhibit difficulty understanding the meaning of spoken words but intact repetition, reading comprehension, spontaneous speech, and writing to dictation. A deficit at the level of the connection between the auditory input lexicon and the semantic system results in *semantic access dysphasia*. These individuals have intact semantic representations in the semantic system as evidenced by semantic judgment tasks as well as an intact auditory input lexicon as evidenced by a lexical decision task. However, impaired comprehension of the meanings of auditorily presented words indicates problems accessing the semantic representation.

### Production

Disruptions of the semantic system also result in deficits in production of language. As mentioned previously, deep dysgraphia, like deep dyslexia, involves the semantic system. Persons with deep dysgraphia produce semantic errors during free writing and writing to dictation, have difficulty writing nonwords, and are affected by psycholinguistic factors such as imageability and word class. Deficits in verbal output, such as semantic paraphasias, neologisms, and mixed paraphasias in confrontation naming, word generation, and spontaneous speech can all be signs of damage to the semantic system.

## Syntactic Aspects of Language Disorders

The rules that we use to generate sentences are collectively referred to as syntax or grammar and can produce an unlimited number of different novel sentences. We also use these rules to decode novel sentences for comprehension. Disruptions in this rule system can take the form of *agrammatism*, which refers to a general disuse of function words, omission or misuse of morphology, errors in sentence structure, and deficits in sentence comprehension. *Paragrammatism* refers to a general misuse of function words and morphology, but relative preservation of sentence structure. This section discusses the role that syntax plays in disorders of comprehension and production of sentences.

### Comprehension

Comprehension of sentences requires not only an understanding of the meanings of the words in the sentence, but also an understanding of how the relationships between words in a sentence influence the overall meaning of the message. While reading or listening to a sentence, the average reader/listener parses the sentence, assigning syntactic structure to its parts (e.g., noun, verb, etc.) and mapping thematic roles onto the syntactic structures (e.g., agent, theme, etc.). Generally, the comprehension of a sentence is affected by the type of verb (e.g., transitive, intransitive, dative) and the number of arguments (e.g., one place verb, two place verbs, three place verbs) (Shapiro, 1997). Further, sentences that require movement of a clause (e.g., *It was the lady who the man kissed*) are considered to be more difficult than canonical sentences (e.g., *The man kissed the lady*). Persons with agrammatism either cannot reliably use their syntactic parser or cannot reliably map thematic roles onto syntactic structures, or both (Caplan, Baker, & Dehaut, 1985; Schwartz, Linebarger, Saffran, & Pate, 1987). Often, these individuals rely on a heuristic route for sentence comprehension, using real world knowledge and canonical word order to extract meaning. Therefore, non-reversible sentences (e.g., *The girl ate a cake*) are easier to comprehend than reversible sentences (e.g., *The girl pulled the boy*) and canonical sentences (e.g., *The boy kissed the girl*) are easier to comprehend than noncanonical sentences *(The boy was kissed by the girl)*.

### Production

The production of a syntactically sound sentence as proposed by Garrett (1980) requires roughly six steps: (1) the formation of a message, (2) the assignment of thematic roles, (3) the selection of lexical items, (4) the assignment of syntactical and morphological items, (5) the selection of phonological forms, and (6) the planning of articulatory movements. Persons with agrammatism often omit function words and morphological endings during sentence production and may even have difficulty producing these forms during reading or repeating of single words. Persons with paragrammatism often make substitution errors with function words and morphological endings during sentence production. Further, paragrammatism may reflect a disturbance in the ability to monitor the speech planning process (Butterworth & Howard, 1987). The omission or substitution of function words and morphological endings suggests impairment of the assignment of syntactical and morphological items during sentence planning.

Persons with agrammatism also exhibit reduced length and complexity in sentence production. Factors involved include reduced production of verbs, bias toward verbs that take fewer arguments (e.g., intransitive and transitive verbs, but rarely dative verbs), and reduced complexity of sentence structure (e.g., absence of embedded clauses) (Kim & Thompson, 2000; Thompson, Shapiro, Tait, Jacobs, & Schneider, 1996). Additionally, some agrammatic patients have difficulty generating logical relationships between lexical elements and may therefore produce sentences in which semantic aspects, such as animacy, influence word order rather than syntactic aspects, such as thematic roles (Saffran, Schwartz, & Marin, 1980). Recent studies have shown that patients typically classified as having Wernicke's aphasia also show problems with assigning accurate syntactic information (Faroqi-Shah & Thompson, 2003), reaffirming the notion that classical aphasia syndromes do not always result in unique and nonoverlapping language characteristics.

## Discourse-Related Aspects of Language Disorders

Sometimes a person will score well on tests of specific language functions, such as naming, repetition, reading, and writing, but still present with abnormal language use in conversation or monologues. This suggests a deficit at the discourse level.

### Comprehension

Discourse comprehension, or the ability to understand spoken or written text, requires a combination of language and cognitive skills for successful execution. In addition to the ability to understand the phonology, semantics, and syntax of the material, reasoning abilities such as drawing inferences and the ability to monitor information are needed to understand complex forms of discourse (Kamhi, 1997). In the process of reading or hearing a piece of discourse, the individual draws upon a range of skills including setting goals and expectations, problem solving, and shifting (van Dijk, 1987). An important aspect of conversational discourse is pragmatics. Conversation depends upon the ability for each conversational partner to understand the intended meaning of an utterance. This requires attention to the context in which the utterance is given, knowledge of each meaning that a word can have and assignment of the correct meaning to the correct context, and attention to visual (body language) and/or prosodic cues.

### Production

Impairments in pragmatics not only decrease a person's ability to comprehend conversation, but also to produce natural conversation. Successful conversation also relies upon pragmatic factors of production such as initiation, topic maintenance, and turn-taking. Another important form of discourse is the monologue: retelling a story or personal event, generating a novel story, explaining a procedure, or describing a picture. Impairments in monologic discourse are evidenced as decreased cohesion, decreased grammatical complexity, decreased and/or inaccurate information content, and disorganized narrative structure. Such impairments also contribute to disruptions in effective and natural conversation.

## ASSESSMENT

### Overall Goals of Assessment

The World Health Organization (WHO) International Classification of Functioning, Disability, and Health (ICF, http://www.who.int/classifications/icf/en/) is the international standard framework for describing health and disability. This classification system describes diseases/injuries using body function and structure, activity and participation, and environmental factors. Therefore, the main goals of assessment are to differentially diagnose the language disorder and to describe its relationship with body function and structure, how it will affect the patient's activities and participation, and how environmental factors will affect recovery as well as activities of daily living.

It is important to obtain information from the neurologist regarding the etiology of the language disorder before the assessment begins to determine the factors that precipitated the problem, which areas of the brain are affected, and the progression of the disease. This information will help guide the clinician's choice of assessment materials and inform the patient's prognosis for recovery. For example, if the patient has primary progressive aphasia or semantic dementia, then assessment and treatment will focus more on molding the environment to increase participation in activities of daily living: preparing the patient and his/her caretaker(s) for the eventual language decline, monitoring the language decline, preserving as much language function as possible through language training, and training the patient/caregiver to use augmentative means of communication. On the other hand, if the patient has aphasia due to cerebrovascular accident, then assessment and treatment will focus more on language training to increase participation in activities of daily living: identifying preserved language functions and using those to train and reorganize lost language functions.

### General Considerations

When performing an assessment, the clinician should consider the patient's age; general health status; premorbid factors; current social, cultural, and emotional situation; and any previous treatment or concurrent treatment. It is important to know details regarding the patient's physical and mental health status so that accommodations can be made for physical limitations, such as paralysis/paresis, as well as for cognitive limitations, such as visual field cuts. Pre-morbid factors, such as education level, bilingualism, developmental language or learning disabilities, history of health problems (including vision and hearing), history of drug or alcohol abuse, history of psychiatric disorders, and so on, are important to document during the assessment because they can influence the extent to which a person can recover language function. It is important to determine the social support that is available for the patient, the cultural values of the patient and his/her family, the activities in which the patient is expected to or wishes to participate, and the patient's emotional stability and motivation to participate in therapy. Finally, it is important to determine the previous therapy or concurrent therapy in which the patient may be participating in order to optimize each type of therapy. Knowledge of previous therapy will help the clinician to build on the previous clinician's work. Concurrent participation in physical therapy, occupational therapy, and speech/language therapy can be maximally beneficial if the therapists work together to create an integrative therapy program.

### General Guidelines of Testing

Whether using standardized or non-standardized measures of language function, it is important for the clinician to make general observations of the patient that may not be captured by the specific linguistic measures. The clinician's initial impression is of utmost importance during an evaluation because it is the most objective impression of the patient's strengths and limitations. The clinician should garner as much information as possible about the following: Is the patient responsive?

How appropriate are the responses? How well does she/he comprehend questions? Is the patient pragmatically appropriate? How does the patient communicate? If with gestures, can she/he be understood? If speaking, how intelligible is the speech? Is the patient oriented to time, place, and person and responding to the environmental situation? The answers to these questions will assist the clinician in creating a comprehensive report of the patient's language profile.

When choosing a test or battery of tests, it is good to begin with tests that give key information about all language modalities, such as the Western Aphasia Battery (WAB-R; Kertesz, 2006) or Boston Diagnostic Aphasia Examination (BDAE-3; Goodglass, Kaplan, & Barresi, 2000). The patient's functional level can be determined with information from an initial patient or family interview or information from the referring specialist. When administering standardized tests, it is important to: (a) follow the test protocol, (b) administer all subtests, and (c) pace the testing according to the patient's ability.

To maintain objectivity during an assessment, the clinician should refrain from "leading" the patient. The purpose of an assessment is to establish exactly what the patient's strengths and weaknesses are. If help in achieving the correct answer is given, even inadvertently, this should be noted and included in the assessment report. Maintaining a healthy balance between friendly encouragement and objectivity is a difficult, yet necessary part of performing a quality assessment. Regardless of the testing environment, it is always important to consider the patient's level of motivation, to treat the patient like an adult, and to speak more clearly to the patient rather than more loudly to facilitate comprehension.

## Supplementary Assessments: Testing Selective and Specific Language Impairments

Supplementary tests should be given in conjunction with a broad standardized test battery in order to determine each specific language deficit that is contributing to the patient's overall language deficit.

### Phonological Assessment

#### *Comprehension*

Assessment of the integrity of the auditory phonological analysis system can be accomplished through the use of subtests such as those found in the Psycholinguistic Assessment of Language (PAL; Caplan & Bub, unpublished) and Psycholinguistic Assessment of Language Processing in Aphasia (PALPA; Kay, Lesser, & Coltheart, 1992). These tests utilize auditorily presented nonword minimal pairs and/or rhyming judgment to examine the patient's ability to decode the word at the phoneme level. The use of nonwords ensures that the patient is not relying on the semantic system for decoding. Comparing performance on a nonword repetition task with performance on a real word repetition task can reveal problems with the link between the auditory analysis system and the phonological output buffer. A good test of the phonological input lexicon is an auditory lexical decision task compared to a visual lexical decision task. If the auditory lexical decision score is lower than the visual lexical decision score, but nonword repetition is intact, the deficit can be assumed to be at the level of the phonological input lexicon.

#### *Production*

Pinpointing deficits in phonological processing during production can be a bit tricky because deficits in language production can be due to a variety of factors. It is important, therefore, to first dismiss dysarthria and apraxia as possible culprits. Next, deficits in semantic processing must be ruled out. This can be accomplished by testing each input and output modality with the same set of items and performing additional tests to assess semantic system integrity. Again, subtests of the PAL and the PALPA require production of different types of words/nonwords. If all verbal output modalities (i.e., repetition, reading, and verbal naming) are affected, then it can be assumed that the deficit lies at the level of the speech output lexicon. Additionally, a pseudoword reading task can help identify phonological processing deficits.

### Orthographic Assessment

#### *Comprehension*

Reading can be assessed with test batteries designed specifically for reading assessment, such as the Reading Comprehension Battery for Aphasia (RCBA-2; LaPointe & Horner, 1998) or the Gray Oral Reading Tests (although only standardized up to age 18) (GORT-4; Wiederholt & Bryant, 2001), or through subtests of other standardized measures, such as the PALPA. The goal of the reading assessment would be to identify the locus of the reading problem. Therefore, a compilation of tasks such as reading words that increase in letter length, reading regularly versus irregularly spelled words, reading pseudowords, and identifying pictures that match written words can help identify pure alexia, surface dyslexia, phonological dyslexia, and deep dyslexia.

#### *Production*

Specific test batteries for assessing written language in adults with acquired language disorders are not currently available; however, writing subtests from standardized test batteries such as the WAB, BDAE, and PALPA can sufficiently capture a patient's specific writing deficits. Again, the goal of the writing assessment would be to identify the locus of the problem. Tasks such as written picture naming, writing regular versus irregular words, writing pseudowords, and writing automatics (e.g., alphabet, numbers 1–20, name and address) can help identify peripheral agraphias, surface agraphia, phonological agraphia, and deep agraphia.

## Semantic Assessment

One way to determine the integrity of the semantic system without the confounding effects of deficits in reading, writing, auditory processing, or speech is through semantic judgment tasks. In these tasks, individuals are asked to judge the similarity of concepts represented by pictures. One such test is included in the Pyramids and Palm Trees Test (PAPT; Howard & Patterson, 1992). Poor performance suggests that the features of each concept that overlap are not available for analysis, indicating a disruption in the semantic system.

Because anomia is a key feature of aphasia and language disorders in general, several tests are available to measure naming function. The Boston Naming Test (BNT; Goodglass, Kaplan, & Weintraub, 1983), the Test of Adolescent/Adult Word Finding (TAWF; German, 1990), and the Peabody Picture Vocabulary Test (PPVT-4; Dunn & Dunn, 2007)/Expressive Vocabulary Test (EVT-2; Williams, 2007) are a few of the tests specifically designed to measure naming. Many overall language batteries include subtests of naming objects, naming pictures, generating words in a category (e.g., animals, words that start with the letter _, etc.), and matching pictures to spoken or written words. It is important to include both spoken and written items to determine if the naming deficit is influenced by specific input or output modalities. Also, it is important to include animate and inanimate items, abstract and concrete items, items from different word classes, and items from several different semantic categories in order to determine whether or not the naming deficit is influenced by animacy, concreteness, imageability, word class, or semantic category. Other psycholinguistic factors to consider are word frequency, familiarity, and age of acquisition.

## Syntactic Assessment

### *Comprehension*

Sentence comprehension can be measured through tests designed specifically for the purpose, such as the Auditory Comprehension Test for Sentences (Shewan, 1979), the Philadelphia Comprehension Battery (Saffran, Schwartz, Linebarger, et al., unpublished), and the Northwestern Sentence Comprehension Test (Thompson, unpublished-b). Subtests of the WAB, BDAE, PALPA, and PAL also measure sentence comprehension, as does the Revised Token Test (RTT; McNeil & Prescott, 1978).

### *Production*

Sentence production can be measured through subtests of the PAL, or using subtests from the Northwestern Assessment of Verbs and Sentences (NAVS; Thompson, unpublished-a) that elicit specific sentence structures. In general, it is relatively easy for clinicians to obtain a narrative sample of a simple picture description task using pictures from the WAB, BDAE, or other material. Once the patient's utterances are transcribed, the sentences/utterances can be subjected to a linguistic analysis of discourse (Saffran, Berndt, & Schwartz, 1989) in order to determine various aspects of syntactic structures.

## Discourse Assessment

Conversational and monologic discourse can be assessed with nonstandardized techniques such as discourse analysis. In this technique, discourse is elicited through descriptive, narrative, procedural, or conversational tasks and analyzed using structured discourse analysis procedures. The Profile of Communicative Appropriateness (Penn, 1985) and Damico's Clinical Discourse Analysis (1985) analyze pragmatic aspects of discourse, Quantitative Production Analysis (QPA, Saffran, et al., 1989) analyzes syntactic aspects of discourse, Correct Information Unit (CIU) analysis (Nicholas & Brookshire, 1993) measures the informativeness of discourse, and Type Token Ratio (TTR) is a measure of lexical diversity (see Malvern & Richards, 2002, for a discussion of D, which is a variant of TTR that can be used with large and varying sample sizes). Recently, Wright and colleagues (2008; 2005) developed an analysis of main events that measures a patient's ability to provide the relationships and causation among elements in a story, above and beyond the informativeness and efficiency of the narrative. This analysis, in conjunction with a standard discourse analyses (e.g., TTR, CIU), shows promise as a sensitive tool for detecting treatment effects on narrative discourse in patients with aphasia. Comprehension of spoken and written discourse can be evaluated through the Discourse Comprehension Test (DCT; Brookshire & Nicholas, 1997). This test consists of spoken and written stories with corresponding questions that assess comprehension of directly stated and implied main ideas and details.

Finally, functional communication can be assessed with formal measures, such as the Communication Activities of Daily Living test (CADL-2; Holland, Frattali, & Fromm, 1999) and Porch Index of Communicative Ability (PICA-R; Porch, 2001), or rating scales, such as the American Speech-Language-Hearing Association Functional Assessment of Communication Skills for Adults (ASHA FACS; Ferketic, Frattali, Holland, et al., 2003).

## TREATMENT

### Overall Goals of Treatment

Once a patient's specific language impairments have been established, the overarching goal of treatment is to facilitate the general use of language for communication in order to increase the activities and participation of the patient. Treatment works toward reducing language impairment by increasing the efficacy of the residual language capacity and/or introduces compensatory strategies such as writing, drawing, or gesturing to aid the patient in conveying his/her message. Additionally, it may be helpful, especially for persons with progressive language disorders, to adapt the environment to facilitate better communication. For persons with non-progressive language disorders, the main goal of treatment should be to help him/her regain language function. Although compensatory strategies are important for the facilitation of communication, overreliance on them encourages learned nonuse of the impaired function (Taub et al., 1994).

### General Considerations

The patient's physical and mental health status must be considered before beginning a therapy program. It is important to make sure that the patient is medically stable prior to beginning therapy in order to keep from doing harm to the patient by introducing too much stimulation (Holland & Fridriksson, 2001; Marshall, 1997). However, it is also important to take advantage of the spontaneous recovery that occurs within first few weeks after a brain injury to help maximize treatment effects (Hillis, 2005).

In addition to considering aspects of the patient, aspects of the therapy programs that are available for use must also be considered. Do any of the available programs target your patient's specific impairments? How effective is the therapy? Can it be modified to be more specific or more effective? Some programs will be perfect for your patient as is; others may need to be adapted for your patient's specific needs or to increase the effectiveness of the chosen therapy program. Some programs are readily adaptable; others are not meant to be used in conjunction with other techniques. Two ways of adapting therapy for increased effectiveness are constraint-induced language therapy (CILT; alternatively referred to as CIAT (constraint-induced aphasia therapy) or intensive language-action therapy (Pulvermuller, Neininger, Elbert, et al., 2001) and the complexity account of treatment efficacy (CATE; Thompson, Shapiro, Kiran, & Sobecks, 2003). These techniques are discussed in detail in Box 14-1. In addition, the duration of treatment and frequency of treatment (number of sessions per week) need to be considered prior to beginning a therapy program. Generally, increasing the intensity of treatment (Bhogal, Teasell, & Speechley, 2003) and/or the complexity of the material being trained (Thompson, 2007) results in increased effectiveness of therapy.

### Treatment Research

In the past 10 years, research of treatments for language disorders has flourished. Efficacy of existing treatments has been examined as well as exploratory research into new methodologies. This section will review the research literature from the past 10 years and suggest promising treatment methodologies. Treatment studies were retrieved from the Academy of Neurologic Communication Disorders and Sciences (ANCDS) Aphasia Treatment Website (www.aphasiatx.arizona.edu) as well as from the PubMed and PsychINFO databases. The studies reviewed below were evaluated by Beeson and colleagues based on guidelines described in their website (noted above). For a reader to judge the effectiveness of a treatment outcome in a research study, however, there are no clear metrics that are standardized across different studies. One approach is to evaluate the effect size of either the direct effect or the generalization effect. The direct effect is the effect on the actual trained material. This is similar to a final exam in most courses in which the material being tested is exactly the material that was covered in the course. The effect size is calculated by subtracting the average performance on the material before training from the average performance on the material after training and dividing by the standard deviation of the performance before training. The larger the effect size the more robust the treatment effect (for benchmarks specific to a treatment domain, see Beeson & Robey, 2008). The generalization effect is the effect that the training had on related, but untrained material. This is akin to taking the GRE (Graduate Record Examination) in which the material being tested is related to what you learned in your undergraduate coursework but may not be exactly the material that

## Box 14-1

### Give Your Standard Therapy a New Twist

Standard aphasia therapy is standard because it has repeatedly been successful in improving language deficits in aphasia. However, just because something works doesn't mean that it can't be improved. Aphasia researchers are constantly looking for new ways to improve language therapy, making it more efficient and more effective.

One way to do that is to apply a technique from another field, such as physical therapy, to language therapy. Taub and colleagues (1993) developed a program to improve movement in chronic stroke patients in which the unaffected limb is placed in a constraining device such as an oven mitt, a sling, or a brace and the patient is forbidden to use that limb to carry out daily functions for a specified amount of time each day. This is called constraint-induced movement therapy (CIMT); it is intense and the improvements are monumental. The success of CIMT led aphasia researchers to apply the technique to language therapy.

Pulvermuller and colleagues (2001) were the first to successfully apply constraint-induced therapy to the domain of language for use in chronic aphasia, resulting in a program called CILT (constraint-induced language therapy), CIAT (constraint-induced aphasia therapy), and most recently, intensive language-action therapy. Often, patients can communicate very well using gestures and writing even though their verbal output is quite limited. In this study, the researchers discouraged the use of gestures and writing when they were not accompanied by verbal output and gradually constrained verbal output to a specific model of phrase production. The protocol used in the Pulvermuller study was a therapeutic game similar to "Go Fish," and was administered intensively at 3 hours a day for 10 days. Subsequent studies used similar methods and found similarly positive results (see Cherney, Patterson, Raymer, et al., 2008, for a review). Although there are several variations of this therapy approach that have been examined, the important principles that guide this therapy are massed practice, focusing on verbal communication and functional communication topics.

Another way to boost treatment effects is by starting with more complex material rather than working up slowly from simple to complex material. This may seem counterintuitive, but it's important to remember that persons with aphasia are not starting from scratch; the majority have simply lost some ability to express or comprehend what they already know.

Thompson and colleagues (2003) systematically tested the use of complex versus simple material in treatment for persons with aphasia while training sentence comprehension and production with TUF (treatment of underlying forms). They found that training more complex syntactic structures resulted not only in improvement of those structures, but also in generalization to less complex syntactic structures of the same type. On the other hand, training less complex structures did not result in generalization to more complex structures, only improvement in the trained structure. This effect is called the Complexity Account of Treatment Efficacy (CATE).

In the years since, Kiran and colleagues (Edmonds & Kiran, 2006; Kiran, 2007; Kiran, 2008; Kiran & Abbott, 2007; Kiran & Johnson, 2008; Kiran & Roberts, 2010; Kiran, Sandberg, & Abbott, 2009; Kiran & Thompson, 2003b) have performed a series of experiments testing the complexity hypothesis in the semantic domain in both monolingual and bilingual patient populations. Semantic complexity can come in several forms: Atypical members of a category are more complex than typical members of a category, abstract words are more complex than concrete words, and, in the case of bilingual aphasia, words in the weaker language are more complex than those in the stronger language. These studies have shown that training complex items results not only in improvement of the trained items, but also generalization to untrained less complex items; however, training less complex items results in improvement of the trained items, but not generalization to untrained complex items.

was covered in each of your courses. In patients with language disorders, generalization can be to standardized language tests or to a related, but different set of materials. The generalization effect size is calculated in the same manner as the direct effect size. It is helpful to keep this information in mind when reading treatment research articles.

## Treatment for Phonological Impairments

### Comprehension

Treatments for pure word deafness and auditory phonological agnosia have not been well researched. Tessier and colleagues (2007) utilized an errorless learning paradigm to successfully train phoneme discrimination and recognition in a patient with word deafness. Stefanatos and colleagues (2005; 2008) recently proposed a temporal processing deficit in word deafness and suggested altering the rate of speech in treatment to facilitate the perceptual discrimination of speech.

### Production

Phonological cueing hierarchies are a common method of training word retrieval and usually start with the first phoneme, then the first syllable, then repetition of the whole word, although they can be expanded to include nonword rhymes (Wambaugh, Linebaugh, Doyle, et al., 2001). This cueing technique for increasing word retrieval has been shown to be effective in isolation (Herbert, Best, Hickin, et al., 2001; Hickin, Best, Herbert, et al., 2002; Wambaugh, 2003; Wambaugh, Cameron, Kalinyak-Fliszar, et al., 2004; Wambaugh, Doyle, Martinez, & Kalinyak-Fliszar, 2002; Wambaugh et al., 2001) or when combined with orthographic, tactile, and/or semantic cueing hierarchies (Abel, Schultz, Radermacher, et al., 2005; Abel, Willmes, & Huber, 2007; Cameron, Wambaugh, Wright, & Nessler, 2006; Conroy, Sage, & Lambon Ralph, 2009; DeDe, Parris, & Waters, 2003; Fink, Brecher, Schwartz, & Robey, 2002).

Another technique that can target phonological naming deficits is errorless learning (see Fillingham, Hodgson, Sage, & Ralph, 2003, for a review), which can simply be repetition of the target (Fillingham, Sage, & Lambon Ralph, 2005a, 2005b, 2006) or a reversed cueing hierarchy (Abel et al., 2005; Abel et al., 2007). Spaced retrieval is a form of errorless learning in which the repetition of a target is conducted over increasingly longer intervals and has recently been applied in patients with aphasia (Fridriksson, Holland, Beeson, & Morrow, 2005).

Training specific phonological processes using tasks such as rhyming judgment, identifying the first/last phoneme, minimal pair discrimination, and segmenting/blending have also shown positive results for increasing naming (Corsten, Mende, Cholewa, & Huber, 2007; Franklin, Buerk, & Howard, 2002; Fridriksson et al., 2005; Kendall, Rosenbek, Heilman, et al., 2008; Laganaro, Pietro, & Schnider, 2003; Raymer & Ellsworth, 2002). Additionally, these types of treatments have been combined with gesture or semantic training (Rodriguez, Raymer, & Rothi, 2006; Rose, Douglas, & Matyas, 2002; Spencer et al., 2000).

Phonological aspects of naming have also been trained through context, where pictures with phonologically similar names are presented simultaneously for confrontation naming (Fisher, Wilshire, & Ponsford, 2009). Similarly, contextual repetition priming is a treatment approach in which phonologically or semantically similar pictures are simultaneously and repeatedly presented for naming. Patients with phonological deficits generally appear to benefit more from this treatment than patients with semantic impairments (Martin, Fink, & Laine, 2004; Renvall, Laine, Laakso, & Martin, 2003). Some studies have shown better recovery of naming in persons with phonologically-based anomia after semantically focused training (Raymer, Kohen, & Saffell, 2006; Wambaugh et al., 2001).

To summarize, when evaluating and developing treatment options for phonological impairments, it is advantageous to identify the locus of impairment prior to selecting a treatment strategy that is most applicable for the corresponding impairment (see Table 14-1 for examples of behavioral markers of phonological impairments and corresponding treatment strategies).

## Treatment for Orthographic Impairments

### Treatment for Acquired Dyslexias

Two general reading treatment approaches, Multiple Oral Reading (MOR) and Oral Reading for Language in Aphasia (ORLA) (see Cherney, 2004, for a review), have been developed for improving reading skills in patients with language disorders. In MOR, the patient repeatedly reads sentences or paragraphs aloud. This treatment has had positive results for the remediation of letter-by-letter reading (Beeson, Magloire, & Robey, 2005) but may not be sufficient for mild reading deficits (Mayer & Murray, 2002). In ORLA, the clinician reads to the patient, then with the patient, and then patient reads on his/her own, all the while pointing to each read word. This treatment has also been shown to be a successful reading treatment (Orjada & Beeson, 2005). Other reading treatments are more specific to the level of deficit.

For phonological dyslexia, patients have been trained to blend CV and VC bigraphs to form CVC words, mirrored by a similar writing treatment (Bowes & Martin, 2007); to identify, discriminate, and blend phonemes, graphemes, and syllables (Kendall, Conway, Rosenbek, & Gonzalez-Rothi, 2003); to read function or less-imageable words by pairing them with high-imageable word homophones or near-homophones (Friedman, Sample, & Lott, 2002; Lott, Sample, Oliver, et al., 2008); and to build up to reading sentences one word at a time, repeating all previous words each time (Lott, Sperling, Watson, & Friedman, 2009). Also, irregular words have been targeted by training phoneme contrasts for letters (e.g., *c* pronounced either /k/ or /s/) (Peach, 2002).

**Table 14-1 Behavioral Markers for Phonological Impairment and Corresponding Treatment Strategies**

***Behavioral Marker***

Impaired phoneme discrimination
Pure word deafness—inability to identify spoken speech
Impaired segmenting/blending
Phonological paraphasias during naming, repeating, and reading
Impaired phonological processing abilities

| **Examples of Strategies for Use in Treatment of Phonological Impairments** | **Evidence** |
|---|---|
| Rhyme judgment | Spencer et al. (2000), Franklin et al. (2002), Raymer et al. (2002), Doesborgh et al. (2004a) |
| Segmenting phonemes/syllables | Doesborgh et al. (2004a), Kendall et al. (2008) |
| Blending phonemes/syllables | Doesborgh et al. (2004a), Kendall et al. (2008) |
| Minimal pair discrimination | Corsten et al. (2007), Tessier et al. (2007) |
| Perceptual discrimination task | Stefanatos et al. (2005, 2008) |
| Monitor and correct phonetic speech errors | Franklin et al. (2002) |
| Phonological cueing hierarchy | Herbert et al. (2001), Wambaugh et al. (2001, 2003, 2004, 2007), Hickin et al. (2002), DeDe et al. (2003) |
| Phonological and orthographic cues | Fillingham et al. (2005a, 2005b, 2006) |
| Identify syllable structure/stress pattern | Rose et al. (2002) |
| Start with repetition and fade repetition cues (errorless learning and spaced retrieval) | Abel et al. (2005, 2007); Fridriksson (2005); Fillingham et al. (2005a, 2005b, 2006) |
| Phoneme identification | Franklin et al. (2002), Raymer et al. (2002), Corsten et al. (2007), Tessier et al. (2007), Kendall et al. (2008) |
| Provide pictures to name that are semantically or phonologically similar (contextual priming) | Martin et al. (2004); Renvall et al. (2003); Fisher et al. (2009) |

For deep dyslexia, patients have been trained to recognize CV and VC bigraphs, then blend them to form CVC words (Friedman & Lott, 2002; Kim & Beaudoin-Parsons, 2007); identify phonemes, letters, and retrain their correspondences (Kiran, Thompson, & Hashimoto, 2001) (see Appendix 14-1 for detailed protocol); associate an image with each word (Ska, Garneau-Beaumont, Chesneau, & Damien, 2003); and associate letters with sounds and use tactile cues for blending (Yampolsky & Waters, 2002). Stadie and Rilling (2006) found similar improvements in reading for a lexical treatment, which used a semantic prime for content words and a phonological prime for function words, and a non-lexical treatment, which trained grapheme-to-word associations, grapheme-to-phoneme associations, and blending. Kiran and Viswanathan (2008) treated a case of severe alexia by training both grapheme-to-phoneme correspondences and semantic features of the target items with positive results in both reading and written naming.

For pure alexia (letter-by-letter reading), an errorless learning technique has been used with tactile input to reinforce learning of letters (Sage, Hesketh, & Ralph, 2005).

## Treatment for Acquired Dysgraphias

Anagram and Copy Treatment (ACT), which consists of rearranging letters to form the target word, then copying the word, and Copy and Recall Treatment (CART; see Appendix 14-1 for complete description) are successful therapies for writing deficits (see Beeson, 2004, for a review). CART has been shown to be successful in isolation (Beeson, Rising, & Volk, 2003; Orjada & Beeson, 2005) as well as when combined with ACT (Beeson, Hirsch, & Rewega, 2002). Murray and Karcher (2000) trained verb retrieval with an ACT-type treatment and then simple sentence construction using the trained verbs. CART has also been used to increase naming either alone (Wright, Marshall, Wilson, & Page, 2008) or combined with repetition (Beeson & Egnor, 2006). Using a method similar to CART, Kumar and Humphreys (2008) found greater improvement for high imageability words in persons with deep dysgraphia. A modified version of CART using mnemonic devices, such as a picture of glasses taking the place of the "oo" in the word *look*, increased irregular spelling more than the unmodified version (Schmalzl & Nickels, 2006).

Another interesting writing therapy utilizes spared sound/letter correspondences in persons with acquired dysgraphias by having patients rely on sound/letter correspondences to guess at the spelling of a word, then check their guess against a spell-checker (Beeson, Rewega, Vail, & Rapcsak, 2000; Beeson, Rising, Kim, & Rapcsak, 2008) (for a review see Beeson, 2004). Similarly, Rapp and Kane (2002) and Rapp (2005) implemented a "spell, study, spell" treatment wherein the patient attempts to spell a dictated word, sees and hears it spelled correctly, then attempts to spell again. This treatment appeared to be more successful for patients with deficits in the graphemic buffer. In an errorless learning paradigm, Sage and Ellis (2006) found that training orthographic neighbors of a target (i.e., words that overlap in spelling) increased target spelling as much as training the target in a person with a graphemic buffer disorder.

Additionally, phoneme-to-grapheme conversion and grapheme-to-phoneme conversion can be specifically and simultaneously targeted to improve both writing and reading (Kiran, 2005; Luzzatti, Colombo, Frustaci, & Vitolo, 2000). To summarize, there are several treatment strategies supported by empirical evidence that can be applied for patients with orthographic input and/or output impairments (Table 14-2). Again, identifying the locus of impairment facilitates the selection of the appropriate treatment strategy on a case-by-case basis.

## Treatment for Semantic Impairments/ Lexical Retrieval Deficits

Anomia is a deficit in retrieving words from the semantic system and is the most pervasive language impairment in language disorders. Therefore, several methods have been proposed for treating deficits in word retrieval, including repetition, cueing, and semantic training techniques.

Repetition has been shown to improve lexical retrieval even without feedback regarding accuracy (Nickels, 2002). Raymer and Ellsworth (2002) showed no significant difference among rehearsal, phonologic, and semantic treatments for verb retrieval. As mentioned previously, errorless learning is a repetition method of treatment wherein the patient is given the target to repeat, and then cues are slowly faded until she/he can spontaneously produce the target. Spaced retrieval is a type of errorless learning wherein the time between correct repetitions is slowly increased. Fillingham and colleagues (2005a, 2005b) found that simple repetition errorless learning with no fading cues and no feedback regarding accuracy is similar in effectiveness to errorful learning wherein the patient is given the first phoneme and grapheme as cues for naming with no feedback.

Semantic cueing hierarchies start with the least semantic information and increase the amount of semantic information or context until the patient correctly names the target. Wambaugh and colleagues (2001; 2002; 2004; Wambaugh, 2003) have shown semantic cueing hierarchies to be successful in patients with semantically based word finding deficits. Additionally, performance seems to improve when the orthographic form is added to the treatment (Wambaugh & Wright, 2007). Studies that have combined phonological and semantic information into cueing hierarchies have also resulted in improved word finding (Abel et al., 2005, 2007; Cameron et al., 2006; Conroy et al., 2009; Fink et al., 2002). Interestingly, increasing cues (errorful learning) and vanishing cues (errorless learning) have been shown to be equally effective methods of cue presentation (Abel et al., 2005, 2007; Conroy et al., 2009). Personalized cueing, wherein patients choose salient features or mnemonics as cues, can also be considered semantic cueing and has been shown to be successful in treating naming deficits (Freed, Celery, & Marshall, 2004; Marshall, Freed, & Karow, 2001; Marshall, Karow, Freed, & Babcock, 2002). Doesborgh, van de Sandt-Koenderman, Dippel, and colleagues (2004b) successfully implemented a computer program called Multicue that allowed patients to choose their own cues from four possible choices.

Contextual repetition priming is a treatment approach in which semantically or phonologically similar pictures are simultaneously and repeatedly presented for naming (Laine & Martin, 1996). Although some patients have shown interference during the semantic context condition, this treatment has shown short-term positive effects for patients with semantic deficits (Cornelissen, Laine, Tarkiainen, et al., 2003; Martin et al., 2004; Martin, Fink, Renvall, & Laine, 2006; Martin & Laine, 2000; Renvall, Laine, & Martin, 2005, 2007) and more sustained effects with additional semantic and phonologic tasks (Renvall et al., 2007).

Semantic training specifically targets semantic representations and their connections to each other. Semantic Feature Analysis (SFA) is a type of semantic training in which the patient is asked to provide different features for each word being trained (see Appendix 14-1 for detailed protocol) (Haarbaurer-Krupa, Moser, Smith, et al., 1985). This treatment is based on spreading activation models of the semantic system and has been shown to be successful in both individual treatment (Coelho, McHugh, & Boyle, 2000; Gordon, 2007) and group treatment (Antonucci, 2009). It has also been combined with Response Elaboration Training (RET) (Kearns, 1985) with positive outcomes (Conley & Coelho, 2003). A modified version of SFA has been used

**Table 14-2** Behavioral Markers for Orthographic Impairment and Corresponding Treatment Strategies

| ***Behavioral Marker*** |
|---|
| No response in reading and/or writing |
| Semantic paraphasias in reading and/or writing |
| Phonemic paraphasias in reading and/or writing |
| Mixed paraphasias in reading and/or writing |
| Neologisms in reading and/or writing |
| Spelling errors and/or letter substitutions |
| Can read and/or write familiar words, but not unfamiliar words or pseudowords |
| Can read and/or write regular words and pseudowords, but not irregular words |
| Cannot write long words (i.e., orthographic buffer impairment) |
| Written naming more impaired than verbal naming |

| **Examples of Strategies for Use in Treatment of Reading Impairments** | **Evidence** |
|---|---|
| Retrain grapheme-to-phoneme correspondences | Kiran et al. (2001); Yamposkly & Waters (2002); Kendall (2003); Kiran & Viswanathan (2008) |
| Train phoneme contrasts for letters that map on to more than one sound | Peach (2002) |
| CV and VC bigraph training, then blending | Friedman & Lott (2002); Kendall (2003); Kim & Beaudoin-Parsons (2007); Bowes & Martin (2007) |
| Use tactile cues for blending (tap finger—single sound; drag finger—blend sounds) | Yampolsky & Waters (2002) |
| Repeat letter/word after clinician while reading and receiving tactile input (letter tracing) on the palm of the hand | Sage et al. (2005) |
| Pair function words or less imageable words with semantically salient homophones | Friedman et al. (2002); Lott et al. (2008) |
| Prime content words with semantically related words and function words with phonologically related words | Stadie & Rilling (2006) |
| Associate an image with each word | Ska et al. (2003) |
| Build up sentences one word at a time, repeating all previous words during each reading | Lott et al. (2009) |
| MOR (Multiple Oral Reading): passages are read aloud repeatedly | Mayer & Murray (2002); Cherney (2004); Beeson et al. (2005) |
| ORLA (Oral Reading for Language in Aphasia): clinician reads to the patient, then choral reading, then the patient reads alone | Cherney (2004); Orjada & Beeson (2005) |

| **Examples of Strategies for Use in Treatment of Writing Impairments** | **Evidence** |
|---|---|
| Retrain both phoneme-to-grapheme and grapheme-to-phoneme conversion skills | Luzzatti et al. (2000); Kiran (2005) |
| CART (Copy and Recall Treatment): patient copies the target word repeatedly, then tries to write word without a model | Beeson et al. (2002); Beeson et al. (2003); Orjada & Beeson (2005); Kumar & Humphreys (2008) |
| Modified CART using picture mnemonics on word cards | Schmalzl & Nickels (2006) |
| ACT (Anagram and Copy Treatment): patient rearranges letters to form the target word, then copies the word | Murray & Karcher (2000); Beeson et al. (2002); |
| Use preserved letter-to-sound correspondences to attempt word spelling, then use spell-checker | Beeson et al. (2000, 2008) |
| Patient attempts to spell the word, then studies the correct spelling visually and auditorily, then makes another attempt | Rapp & Kane (2002); Rapp (2005) |
| Train orthographic neighbors (words that overlap in spelling) | Sage & Ellis (2006) |

to train more complex exemplars in a category in order to increase generalization to untrained items (Kiran, 2007, 2008; Kiran & Abbott, 2007; Kiran & Johnson, 2008; Kiran, Sandberg, & Abbott, 2009; Kiran & Thompson, 2003b). Wambaugh and Ferguson (2007) also modified SFA for verb retrieval with positive results.

Other treatments focusing on the semantic system have included tasks such as asking yes/no questions about features of the target (Raymer & Ellsworth, 2002); performing tasks that require semantic knowledge of the target (Davis & Harrington, 2006); semantic decision tasks, such as part-whole relationships, definitions, and categories (Doesborgh, van de Sandt-Koenderman, Dippel, et al., 2004a); using circumlocution to arrive at the target word (Francis, Clark, & Humphreys, 2002); and spoken/written word to picture matching (Raymer et al., 2006). Rose and Douglas (2008) compared a semantic treatment that involved describing the use and shape of the target object with an iconic gesture treatment and a combined semantic/gesture treatment and found that although all three treatments improved naming, there were larger effect sizes for the semantic and combined semantic/gesture treatments. Table 14-3 provides examples of various behavioral markers that can be observed with patients who have semantic impairments and corresponding treatment strategies that have garnered empirical support.

## Treatment of Syntactic Impairments

### Comprehension

Treatment of Underlying Forms (TUF) is a syntactic treatment that trains thematic roles (i.e., agent and theme) as well as the movement that occurs to form noncanonical sentences and uses complex sentences for maximal generalization (see Thompson & Shapiro, 2005, for a review; see also Shapiro & Thompson, 2006; see Appendix 14-1 for detailed protocol). TUF has been shown to be successful in treating syntactic comprehension deficits (Jacobs & Thompson, 2000). In another vein, Hoen, Golembiowski, Guyot, and colleagues (2003) showed that training non-linguistic cognitive sequences (e.g., training the sequence 123–231 so that when given the first three letters GBT, the patient knows the next three letters are BTG) improves comprehension of relative sentences (e.g., *It was the man who the woman hugged*).

### Production

One syntactic treatment to improve the grammaticality of patient utterances is mapping therapy (Byng, 1988), during which patients are systematically trained to associate grammatical elements with their thematic roles (i.e., agent and theme) and asked to produce sentences based on the trained thematic roles (Rochon, Laird, Bose, & Scofield, 2005). This type of treatment has been delivered in an errorless learning paradigm with similar results to the traditional approach (Wierenga, Maher, Moore, et al., 2006). TUF has also been successfully used to improve syntactic production (Dickey & Thompson, 2007; Jacobs & Thompson, 2000; Murray, Ballard, & Karcher, 2004; Thompson et al., 2003).

Another focus of grammatical production is the retrieval and proper inflection of verbs and retrieval of the correct argument structure for each verb. Webster, Morris, and Franklin (2005) successfully trained verb retrieval with semantic tasks, verb/argument association with plausibility tasks, and sentence generation with an argument generation task. Bastiaanse, Hurkmans, and Links (2006) treated verb production at the word and sentence level by using sentence completion for both infinitive and inflected verb retrieval, and then trained sentence construction with anagrams. Schneider and Thompson (2003) compared a semantic treatment for verb naming with a treatment focusing on the argument structure of the verb and found that both treatments improved verb naming. In another study, a semantic-based treatment to improve lexical retrieval of content words in a sentence context by promoting systematic retrieval of verbs and their thematic roles resulted in generalization to sentence production for sentences containing trained verbs and to untrained semantically related verbs (Edmonds, Nadeau, & Kiran, 2009). Faroqi-Shah (2008) compared a morphophonological treatment that included auditory discrimination of differently inflected verbs, morphology generation, and oral/written transformation from one inflection to another to a morphosemantic treatment that included anomaly judgment, sentence completion with the correct inflection, and sentence construction. Both improved verb morphology, but morphosemantic treatment generalized to narratives.

Finally, AAC devices have been used to train the construction of certain sentences. Patients have been taught to assign a special symbol to the agent of a sentence and move pictures around to form the correct construction (Weinrich, Boser, McCall, & Bishop, 2001). Table 14-4 provides examples of aspects of sentence comprehension and production that can be impaired in individuals with language disorders and examples of treatment strategies that can be employed with such individuals.

## Treatment of Discourse Impairments

In addition to treating specific language impairments, the clinician should work on overall discourse impairments and/or pragmatic impairments in higher functioning patients. This type of treatment utilizes more realistic situations and sentences and can include conversing with familiar partners and incorporate activities of daily living.

**Table 14-3** Behavioral Markers for Semantic Impairment and Corresponding Treatment Strategies

***Behavioral Marker***

Semantic paraphasias during naming
Circumlocutions
Word generation as impaired as confrontation naming
Naming impairment across all modalities
Unable to match spoken and/or written words with pictures and/or objects
Unable to match semantically related words and/or pictures
Category specific impairments (e.g., only impaired in naming animals)

| **Examples of Strategies for Use in Treatment of Semantic Impairments** | **Evidence** |
|---|---|
| Phonological cueing hierarchy | Wambaugh et al. (2001, 2002, 2003, 2004) |
| Semantic cueing hierarchy | Wambaugh et al. (2001, 2002, 2003, 2004) |
| Combined semantic and phonological cueing hierarchy | Fink et al. (2002); Abel et al. (2005, 2007); Cameron et al. (2006); Conroy et al. (2009) |
| Personalized cues | Marshall et al. (2001, 2002); Freed et al. (2004) |
| Train iconic gestural cues | Rose et al. (2002); Rose & Douglas (2008) |
| Multicue: a computer program that allows the user to choose his/her cues | Doesborgh et al. (2004b) |
| Provide tactile cues for first grapheme/phoneme | DeDe et al. (2003) |
| Have the patient categorize items | Kiran & Thompson (2003); Kiran (2007, 2008); Kiran & Abbott (2007); Kiran et al. (2009) |
| Ask the patient yes/no questions about semantic features | Raymer & Ellsworth (2002); Kiran & Thompson (2003); Kiran (2007, 2008); Kiran & Abbott (2007); Kiran et al. (2009); |
| Have the patient name to definition | Kiran & Abbott (2007); Kiran et al. (2009) |
| Create a semantic map for each item, listing a variety of semantic features for each item | Coelho et al. (2000); Conley & Coelho (2003); Kiran & Thompson (2003); Boyle (1995, 2004); Gordon (2007); Wambaugh & Ferguson (2007); Kiran (2007, 2008); Kiran & Abbott (2007); Kiran et al. (2009); Antonucci (2009) |
| RET (Response Elaboration Training): repeat and expand patient's responses in treatment | Conley & Coelho (2003) |
| Repeatedly present items with no feedback regarding accuracy | Nickels (2002); Fillingham et al. (2005a, 2005b, 2006) |
| Use increasing cues for deficits in semantic memory and vanishing cues for deficits in semantic access | Abel et al. (2005, 2007) |
| Encourage circumlocution until the target is reached | Francis et al. (2002) |
| Spoken/written word to picture matching | Raymer et al. (2006) |
| Provide pictures to name that are semantically or phonologically similar (contextual priming) | Cornelissen et al. (2003); Martin et al. (2000, 2004, 2006); Renvall et al. (2005, 2007) |
| Have the patient perform tasks that require semantic knowledge | Davis & Harrington (2006) |

Some discourse treatments have focused on training both the patient and the conversational partner of the patient to use strategies to prevent or repair communication breakdowns during conversation (Cunningham & Ward, 2003; Fox, Armstrong, & Boles, 2009; Hopper, Holland, & Rewega, 2002) (see Appendix 14-1 for detailed protocol from Hopper et al., 2002). Promoting Aphasics Communicative Effectiveness (PACE) (see Davis, 2005, for a review) is a conversational training program for the patient that promotes the exchange of new information, equal participation of clinician and patient, the ability to use any communicative modality, and functional feedback from the clinician. Manheim, Halper, and Cherney (2009) trained a patient to use a computer program with recorded narrative scripts as models for improving conversation. A device called Sentence Shaper has been developed that relieves the patient of the processing load of creating sentences by

**Table 14-4** Behavioral Markers for Syntactic Impairment and Corresponding Treatment Strategies

| ***Behavioral Marker*** |
|---|
| Lack of function words, limited morpheme use |
| Abnormal word order |
| Overuse of simple sentence structures (i.e., active sentences only) |
| Overuse of simple verbs (i.e., no verbs that require more than two arguments) |
| Decreased sentence comprehension with increased sentence complexity |
| Canonical word order interpretation of non-canonical sentences |
| Overreliance on world knowledge for sentence interpretation |

| **Strategies for Use in Treatment of Syntactic Impairments** | **Evidence** |
|---|---|
| Thematic role assignment (match agents/themes with noun phrases in the sentence) for sentence comprehension | Jacobs & Thompson (2000) |
| Map thematic roles to noun phrases in the sentence during sentence comprehension | Jacobs & Thompson (2000); Thompson et al. (2003); Murray et al. (2004); Rochon et al. (2005), Wierenga et al. (2006); Dickey & Thompson (2007) |
| Train movement of noun phrases to construct non-canonical sentences | Jacobs & Thompson (2000); Thompson et al. (2003); Murray et al. (2004); Dickey & Thompson (2007) |
| Work on morphological elements of verbs for sentence production | Faroqi-Shah (2008) |
| Verb/argument structure tasks | Schneider & Thompson (2003); Webster (2005) |
| Sentence completion tasks | Bastiaanse et al. (2006) |
| Train non-linguistics sequences to facilitate access to grammar | Hoen et al. (2003) |
| Use AAC to construct active and passive sentences | Weinrich et al. (2001) |

providing a workspace for constructing sentences before producing them and after training and use has been shown to improve narratives both with and without the device (Linebarger, McCall, & Berndt, 2004; see Linebarger & Schwartz, 2005 for a review; McCall, Virata, Linebarger, & Berndt, 2009).

Other researchers have attempted to improve discourse by using it as a context for treatment. Peach and Wong (2004) focused a syntactic treatment at the discourse level by using story retelling as a way to elicit sentences and provide feedback as to the grammaticality of the sentences. The patient's syntactic errors decreased and information units increased. Murray, Timberlake, and Eberle (2007) introduced a discourse training module into a TUF treatment protocol by having the patient use one of the trained sentences in a five-sentence written narrative during each session. Robson (2001) incorporated a written treatment with a PACE-like treatment where the patient was able to practice using writing to convey information when the verbal form was not available. Herbert and colleagues (2003) trained patients who had finished a treatment for word retrieval on tasks that increasingly resembled conversation. Rider and colleagues (2008) found that simply training word retrieval using SFA increased the use of those trained items during subsequent narrative performance that required those items. Table 14-5 provides examples of various behavioral markers in discourse comprehension and production and examples of treatment strategies that can be applied to improve discourse abilities in patients with language disorders.

## Biological Treatment Approaches

Recently, some researchers have been exploring different avenues for treatment, such as pharmacology and electrical stimulation techniques (e.g., rTMS, tDCS), that directly influence the neural processes associated with language use (see Small & Llano, 2009, for a review). For example, memantine, a drug which is normally used to treat Alzheimer's disease, was combined with CIAT to produce more favorable outcomes than either treatment alone (Berthier et al., 2009). Similarly, repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS) have been used in conjunction with behavioral therapy with positive outcomes (Baker, Rorden, & Fridriksson, 2010; Naeser, Martin, Treglia, et al., 2010). For a more thorough explanation of these techniques, see Box 14-2.

## Summary of Treatment Studies

Research focused on developing effective therapies for patients with language disorders has generated a remarkable body of research providing clinicians with a wide range of treatment options to choose from.

**Table 14-5** Behavioral Markers for Pragmatic/Discourse Impairment and Corresponding Treatment Strategies

| ***Behavioral Marker*** |
|---|
| Word finding difficulties during conversation |
| Problems with initiation, topic maintenance, and turn-taking |
| Decreased cohesion, grammatical complexity, information content |
| Inability to process pragmatic cues |
| Inability to draw inferences from stories |

| **Strategies for Use in Treatment** | **Evidence** |
|---|---|
| Train the conversational partner | Hopper et al. (2002); Cunningham & Ward (2003); Fox et al. (2009) |
| PACE (Promoting Aphasics Communicative Effectiveness): focus on exchanging new information, equal participation of patient and clinician, use any modality to communicate, receive functional feedback | Robson (2001); Davis (2005) |
| Train sentence production and word retrieval to improve discourse | Herbert et al. (2003); Peach & Wong (2004); Murray et al. (2007); Rider et al. (2008) |
| Sentence Shaper: computer program that acts as a workspace for constructing sentences prior to production to alleviate processing demands of conversation | Linebarger et al. (2004); McCall et al. (2009) |

Almost all of these studies, however, are pre-efficacy studies, evaluating the success of a specific treatment with a small number of participants. In order to prescribe a certain form of therapy relative to a current gold standard, efficacy treatment studies need to be conducted, of which there are very few. Until then, clinicians need to sift through the available empirical research to decide which therapy approach has sufficient evidence to merit its application to specific types of patients. In the process of choosing a specific therapy approach for a patient one must consider several factors, including the theoretical basis for the work, the robustness of the experimental design, the number of participants, the reliability and validity of outcome measures, statistical power, and issues with confounding variables. For a more detailed approach to evaluating the evidence from empirical studies examining the effectiveness of specific therapies, the Academy of Neurologic Communication Disorders and Sciences (ANCDS) Aphasia Treatment website (http://aphasiatx.arizona.edu) provides descriptions about the criteria used to classify the research evidence based on research quality.

### Treatment for Language Impairments in Degenerative Diseases

Most of the focus of this chapter has been on reviewing the evidence available for treating individuals with nonprogressive language impairments (i.e., language impairments subsequent to cerebrovascular disease or trauma). In individuals with progressive language impairments such as primary progressive aphasia and dementia, research has focused on the combined pharmacological and behavioral management of these syndromes. Additionally, behavioral therapies reflect an integration of language, cognitive stimulation, and caregiver education. With regard to therapies for individuals with dementia, there have been several published systematic reviews of studies aiming to improve cognitive, functional, and caregiver education (Bayles, Kim, Chapman, et al., 2006; Hopper, Mahendra, Kim, et al., 2005; E. S. Kim, Cleary, Hopper, et al., 2006; Mahendra, Kim, Bayles, et al., 2005; Zientz, Rackley, Chapman, et al., 2007a; Zientz, Rackley, Chapman, et al., 2007b).

## RECOVERY PATTERNS OBSERVED WITH FUNCTIONAL IMAGING TECHNIQUES

The recovery of language function in persons with language disorders is normally assessed with behavioral measures. This is the simplest and most cost-effective way to see if your therapy program is actually working for your patient. It has also been the most practical way to ascertain the effectiveness of new treatment protocols in the research literature until recently. The improved functionality and increased availability of functional imaging techniques, such as functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG), have made it possible to observe neurophysiological changes associated with language recovery. The results from tools such as these, coupled with behavioral data, greatly enhance our understanding of the neural mechanisms

## Box 14-2

### Electrify Your Therapy

Two new techniques are rapidly gaining popularity in aphasia treatment research: transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (tDCS).

TMS uses strong magnetic fields placed over the scalp to create an electrical field which induces an electrical current in the neural tissue, changing the way neurons communicate with each other. Normally, rTMS (repetitive transcranial magnetic stimulation) is used for aphasia therapy. In conventional rTMS, the pulse (i.e., change in magnetic field from 0 to 3 tesla) is repeated at a certain frequency. If the rate is at or below 1 Hz (1 pulse per second), then the effect will be inhibitory, if the rate is above 1 Hz, then the effect will be excitatory.

Naeser and colleagues (2005) used slow wave rTMS to induce inhibitory effects in the right hemisphere homologue of Broca's area in four patients with chronic nonfluent aphasia. They found that just 20 minutes of rTMS per day, five days a week for two weeks improved picture naming significantly in this group.

tDCS uses electrical current delivered through the scalp via electrodes to either increase or decrease neuronal excitability. The polarity of the current flow determines the amount of excitability; anodal stimulation (A-tDCS) increases excitability and cathodal stimulation (C-tDCS) decreases excitability (Wagner et al., 2007).

In a recent study, Baker and colleagues (2010) used A-tDCS to excite left-hemisphere language areas in 10 patients with chronic aphasia during language therapy. An fMRI scan was used to place electrodes at the point of highest cortical activity during correct picture naming for each patient. For five consecutive days, patients were given 1 mA (milli-ampere) of current for 20 minutes while performing a computerized word-to-picture matching task. At post-test, items that were trained during A-tDCS improved significantly more than those that were trained during the sham condition.

underlying behavioral changes and the conclusions that can be made regarding the natural recovery process, the effectiveness of treatment, and the way the two interact.

For example, Saur, Lange, Baumgartner, and colleagues (2006) mapped the progress of recovery of language function in 14 patients with aphasia from the acute stage to the chronic stage using repeated fMRI scans and behavioral tests. They found that during the acute stage (1–2 days post-stroke), there was very little activity in the spared tissue of the language areas of the left hemisphere; during the subacute stage (about 12 days post-stroke), there was activation in both the left-hemisphere language areas and their right-hemisphere homologues, with the peak activation in the right hemisphere; and during the chronic stage (about 10 months post-stroke), the peak activation shifted back to the left hemisphere in the spared tissue of the language areas, which was associated with improvements on behavioral measures of language function.

Another example is a recent study in which 26 patients with aphasia were scanned with fMRI before and after 30 hours of treatment for word retrieval. The patients who showed gains in treatment also showed increased activation in spared left-hemisphere language areas post-treatment when compared with pretreatment (Fridriksson, 2010). These results challenge previously held beliefs, suggesting that transfer of language function to the right hemisphere may be maladaptive rather than supportive for persons with some sparing of language areas in the left hemisphere.

## CONCLUSIONS

The field of rehabilitation of language disorders in adults has expanded considerably over the last twenty years. Additionally, our understanding of the mechanisms underlying behavioral changes subsequent to treatment has benefited from recent advances in neuroimaging techniques such as fMRI and MEG. Clearly, improvements in language processing abilities induced by treatment can be mapped onto the brain. It is also clear now that the nature of treatment provided may influence the recruitment of regions to support recovery. Consequently, clinicians need to be very judicious about selecting appropriate treatments for their patients as the neurobehavioral outcomes of the rehabilitation can be beneficial or detrimental depending upon the treatment employed. Understanding the basis for language processing in normal individuals and the different ways in which language can be impaired goes a long way to ensure appropriate treatment choices for this population. Ultimately, the goal of this field is to have "treatment prescriptions" for specific types of language disorders based on empirical behavioral evidence and supported by neuroscience data indicating functional changes in the brain.

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