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Clinical Diagnosis and Treatment of Naming Disorders

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INTRODUCTION

Impairments of word retrieval (anomia) are common among individuals with aphasia. The functional impact is devastating in that word-finding failures disrupt the ability to carry on a meaningful, effective, efficient conversation. While the impact of anomia is difficulty in maintaining verbal interactions, the clinical assessment and treatment of word retrieval impairments are most typically accomplished through the use of picture confrontation naming tasks. As reviewed by Doriana Chialant, Albert Costa, and Alfonso Caramazza (see chapter 7), the process of picture naming requires not only the retrieval of the lexical phonological forms for words, but also mechanisms for visual object and semantic processing (figure 9.1). Presumably, it is the semantic and phonological stages that are critical for the process of word retrieval in conversation, and impairments of these processes are associated with aphasia. Deficits affecting the mechanisms for visual object processing (the agnosias) may cooccur with aphasia, further complicating the picture in naming assessment and treatment.

Christine Whatmough and Howard Chertkow (see chapter 8) have explored the neural correlates of the complex process of picture naming distributed throughout the neural cortex. Disparate cortical regions may contribute different processes or types of information to a composite functional outcome of picture naming. They note that impairments in picture naming may result from dysfunction of a number of cortical regions.

Thus, the distributed architecture of word retrieval processing is compatible with a multicomponential, functional model. Many clinical researchers have advocated the use of multicomponent cognitive models, such as the model of naming described in figure 9.1, to provide a strategic theoretical rationale for clinical decision-making in the management of patients with acquired language disorders (Byng, Kay, Edmundson, & Scott, 1990; Coltheart, 1984; Hillis, 1993; Howard & Patterson, 1989; Raymer, Rothi, & Greenwald, 1995). In turn, information garnered from treatment studies may lead to modifications in cognitive models (Berndt, 1992).

In this chapter we focus specifically on the model of naming described in figure 9.1 and its implications for assessment and management of impairments of word retrieval. Although disruption of mechanisms of visual object processing may impair picture naming performance,

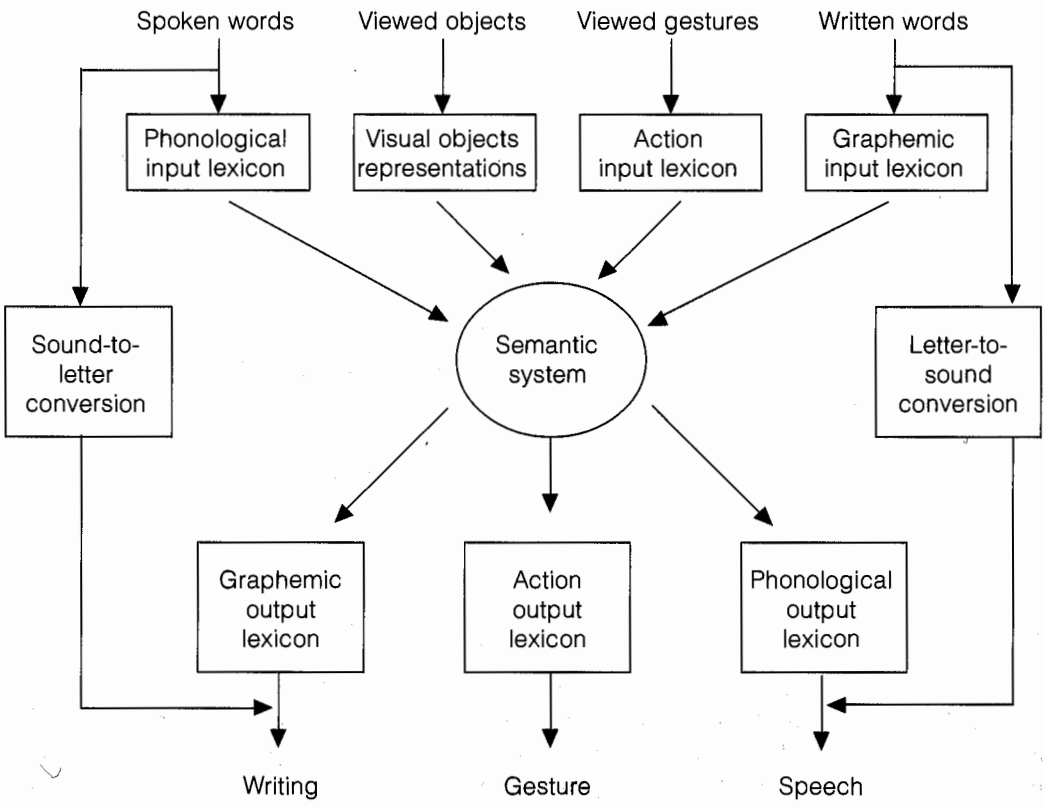

Figure 9.1. Model of lexical processing.

these impairments fall into the category of sensory-specific, prelinguistic processing, which is beyond the scope of this chapter. We concentrate primarily on dysfunction of semantic and phonological stages of lexical processing as they undermine word retrieval functions in conversational and picture naming tasks in individuals with aphasia. For each stage in the process of naming, we describe assessment procedures to characterize word retrieval impairments with respect to the model of naming. We also review studies in which researchers use this framework to develop rational treatments that either target impaired naming mechanisms or take advantage of spared mechanisms to circumvent naming impairments (Rothi, 1998). To exemplify this process in practice, we will describe the assessment and treatment of one patient, AW, who had significant word-finding difficulties.

CONSIDERATIONS IN ASSESSMENT

The goal of the assessment process we describe is to characterize a patient's word retrieval impairment with respect to dysfunction at some stage in the naming model in figure 9.1. Raymer, Rothi, and Greenwald (1995) illustrated how this approach may provide a more focused assessment of naming abilities in contrast to the standard methods used at that time. Two patients, both demonstrating anomia in standardized assessment, had distinct differences in the mechanisms for their word retrieval impairments. One patient, HH, had an impairment affecting semantic activation of the output lexicons characterized by intact performance in auditory comprehension tasks and severe cross-modality anomia in all verbal and written naming tasks (Raymer, Foundas, et al., 1997). The other, SS, had impairments affecting at

least two stages of lexical processing: visual object activation of the semantic system, and semantic activation of the output lexicons (Raymer, Greenwald, Richardson, Rothi, & Heilman, 1997). Thus, in addition to cross-modality anomia, SS had inordinate naming difficulty for picture stimuli. Assessment results using this model-driven strategy led to a targeted word retrieval treatment in the second patient, SS, as we trained word retrieval using the auditory-verbal input modality rather than the impaired visual input system (Greenwald, Raymer, Richardson, & Rothi, 1995). Below, we describe the type of assessment procedures that help to identify the underlying cognitive impairment(s) in individual patients.

Cross-Modality Comparisons

A key notion incorporated in the assessment geared to identify impairments in the naming system is cross-modality comparison. The naming assessment should include a variety of single word processing tasks in which the clinician systematically varies input (written words, spoken words, viewed objects, viewed gestures) and output modalities (speech, written spelling, gesture), and then analyzes patterns of performance for tasks sharing modalities of processing. As shown in table 9.1, the assessment typically will include a set of key tasks that assess comprehension and production of single words in phonological and graphemic forms. Published psycholinguistic tests are available that allow systematic assessment of lexical processing (for example, Psycholinguistic Assessment of Language Processing Abilities; Kay, Lesser, & Coltheart, 1992). In addition, researchers have developed experimental batteries of lexical tasks for use in their studies of naming impairments as well (for example, Florida Semantics Battery; Raymer & Rothi, 2000).

If the functioning of a lexical mechanism is disturbed by neurologic disease, modality comparisons should demonstrate that performance is impaired in all tasks dependent upon that mechanism. For example, to the extent that the processing of meaning is required to comprehend and produce words, a deficit of semantic processing will affect performance in all comprehension and naming tasks (modality consistency) (for example, Hillis, Rapp, Romani, & Caramazza, 1990). In comparison, to the extent that the phonological output lexicon supports spoken word production, a dysfunction of that mechanism will result in impairment in all verbal production tasks (for example, oral naming of pictures and oral reading of single words if sublexical processes also are impaired) (Caramazza & Hillis, 1990). In the case of phonological output dysfunction, it is not necessary for comprehension or the written modality of output to be deficient (modality inconsistency).

Lexical Stimuli

A second consideration in naming assessment is the selection of appropriate stimuli to use across lexical tasks. For example, we use the same set of 120 nouns across all tasks in our Florida Semantics Battery (Raymer & Rothi, 2000). In this way, differences observed across

Table 9.1
Battery of Key Tasks to Include in Lexical Assessment

Oral picture naming
Written picture naming
Oral naming to spoken definitions
Oral word reading
Writing to dictation
Auditory word-to-picture matching or verification
Written word-to-picture matching or verification

tasks can be attributed to the modality of processing rather than differences inherent to the stimulus items. There will be times when the clinician wants to evaluate performance for contrasting sets of words from different semantic (for example, animals versus tools) or grammatical categories (for example, nouns versus verbs). However, additional factors such as word frequency, imageability, length, familiarity, and age of acquisition (Feyereisen, Van Der Borght, & Seron, 1988; Hirsh & Ellis, 1994; Lambon Ralph, Graham, Ellis, & Hodges, 1998; Nickels & Howard, 1994, 1995) may influence naming abilities across sets. Thus, clinicians should select an array of stimuli to represent these lexical variables and evaluate their influence on naming abilities.

Error Patterns

The assessment of naming abilities also includes a consideration of the errors produced across lexical tasks, as patterns of errors may provide clues to the mechanism of naming failure. The same qualitative pattern of errors should be observed in all tasks that require processing by the suspected impaired mechanism. For example, a deficit of semantic processing may lead to semantic errors (for example, *orange* for *apple*) in comprehension as well as naming tasks (for example, Hillis et al., 1990). A phonological output lexicon dysfunction may result in parallel patterns of phonological errors (/apsIl/ for "apple") that span verbal production tasks (for example, oral naming of pictures and oral reading of single words if sublexical processes also are impaired).

Examination of error type is not sufficient to distinguish the level of lexical impairment responsible for the naming error, however. Semantic errors in picture naming are a case in point (Hillis & Caramazza, 1995b). For example, for the target picture of a carrot, semantic naming errors may include responses such as "vegetable" (superordinate), "celery" (coordinate), or "rabbit" (associated). Whereas in some patients semantic errors represent semantic system impairment (Hillis et al., 1990; Raymer, Foundas, et al., 1997; Howard & Orchard-Lisle, 1984), semantic errors also can occur from impairment at the phonological retrieval stage (Caramazza & Hillis, 1990), or during visual-to-semantic activation (Hillis & Caramazza, 1995a; Raymer, Greenwald, et al., 1997). These observations suggest the need to analyze error patterns across lexical tasks to develop a more accurate hypothesis regarding the source of the lexical error as, for example, semantic errors do not necessarily imply semantic dysfunction (Raymer & Rothi, 2000).

Final Comments on Assessment

In addition to specifying the basis for dysfunction in lexical processing leading to naming failure, the approach we describe has other advantages (Raymer, Rothi, & Greenwald, 1995). Many patients with extensive neurological lesions have dysfunction affecting multiple levels in the naming process. An in-depth assessment will frequently suggest not only what mechanisms are impaired, but also what mechanisms are spared in lexical processing, information that may be beneficial as the clinician turns toward devising treatments for each patient. Retained lexical processing in alternative mechanisms not typically part of the naming process—for example, reading and gesture mechanisms—may be implemented in compensatory or vicariative methods (Rothi, 1995) to improve word retrieval and, thereby, communication abilities.

A clear disadvantage of this approach is the increased length of assessment that we have advocated. Although some clinicians may find lengthy assessments unrealistic in clinical practice, it is possible for clinicians to adapt these methods using a more circumscribed set of available materials. For example, clinicians may select a small set of stimuli representing a variety of semantic or grammatical categories and vary modality for key lexical processing

tasks. For example, one might use this set of stimuli for oral and written naming, oral reading, writing to dictation, repetition, and word-picture matching. The systematic assessment may indeed be more cost-effective than the standard of care as clinicians characterize both their patients' impairments and retained abilities, and hence direct treatments in the most targeted manner.

PRINCIPLES OF TREATMENT

As is found with aphasia assessment, a number of clinical researchers have expressed enthusiasm for applying this model-guided approach to aphasia treatment (Coltheart, 1984; Mitchum, 1992; Raymer et al., 1995; Riddoch & Humphreys, 1994; Seron & Deloche, 1989), although others have voiced some caution (Caramazza & Hillis, 1993). Naming models provide a sound basis for leading some, though by no means all, treatment decisions. In particular, naming models are well suited to the view that the type of intervention strategy to apply should relate to the chronicity of the naming impairment. Rothi (1995) proposed that restitutive strategies, which encourage restoration of functioning in a manner compatible with normal language processing, are appropriate in early stages when neurophysiologic processes of recovery are maximal. Substitutive strategies that attempt to circumvent naming dysfunction using intact cognitive mechanisms may be beneficial during acute and chronic stages of recovery. Following the systematic lexical assessment, clinicians may choose to direct restitutive treatments at impaired semantic or phonological stages in the naming process. Alternatively, clinicians may train substitutive strategies that take advantage of intact output modes to circumvent or to vicariatively mediate word retrieval processes through gesture or reading.

SEMANTIC IMPAIRMENTS

Assessment

Word retrieval difficulties in some individuals may arise due to dysfunction of the semantic stage of naming. A patient with a semantic impairment will have difficulty performing any tasks that require semantic mediation (that is, modality consistency). Therefore, of the tasks listed in table 9.1, patients should have difficulty in comprehension of spoken words and spoken naming, not just for seen objects, but for all modalities of input (objects, spoken definitions, and so on) (Ellis, Kay, & Franklin, 1992). All modes of output will be affected as well (gesture, writing, and so on). Because sublexical letter-sound conversion mechanisms may be available for decoding or encoding written words, performance in oral word reading and writing to dictation may be less affected than naming or comprehension.

Assuming that the semantic system is structured in a similar fashion for all modalities of processing, individuals with brain damage that yields semantic system impairment should demonstrate quantitatively and qualitatively similar impairments across lexical tasks requiring semantic mediation. Researchers have described this association of impairments in some patients with vascular lesions (Hillis et al., 1990; Howard & Orchard-Lisle, 1984) and progressive neurological impairments (Chertkow, Bub, & Seidenberg, 1989; Hodges & Patterson, 1996; Lambon Ralph, Ellis, & Franklin, 1995; Raymer & Berndt, 1996).

Semantic Tasks

In practice, it may be possible for a neurological lesion to cause extensive damage to lexical input and output stages simultaneously, leading to modality consistency of impairments that mimic semantic dysfunction. Therefore, it can be beneficial to administer additional semantic

tasks that require more specific processing of semantic attributes of stimuli or that avoid the use of lexical stimuli. Patients with semantic dysfunction should have difficulty in these types of tasks as well, whereas individuals with cooccurring input modality/output modality impairments may perform somewhat better in some of these semantic tasks that circumvent verbal disturbances. In this regard, semantic picture category sorting tasks can be useful. However, it is critical that patients sort pictures from closely related semantic categories that require patients to accomplish more specific semantic processing for successful performance (for example, fruits versus vegetables, winter clothing versus summer clothing). When required to sort distant semantic categories, patients may be able to accomplish the task by recognizing only visual characteristics or more superficial semantic information, and thereby may be able to complete the task in spite of semantic impairment.

Another useful task to assess semantic processing requires patients to match semantically associated pictures. *Pyramids and Palm Trees* (Howard & Patterson, 1992) is a useful published test of this sort. We have included a semantic associate subtest in the *Florida Semantics Battery* (Raymer & Rothi, 2000). This task requires subjects to match a target item (for example, carrot) to a semantically related item from three choices (for example, associate—rabbit; distractors—squirrel, duck). This type of associate task may be sensitive to more subtle impairments in semantic activation (for example, Raymer, Greenwald, et al., 1997). It is also useful to contrast performance in the associate task for matching spoken words and matching viewed pictures to delineate impairments related to phonological input or semantic stages of lexical processing. Semantic impairments are associated with difficulty whether stimuli are presented as words or pictures.

Researchers have also described individuals with aphasia whose naming and comprehension impairments fractionate, demonstrating selective preservation or selective impairment, for specific semantic categories. Patients have demonstrated impairments for categories such as living and nonliving things (Bunn, Tyler, & Moss, 1998; Montanes, Goldblum, & Boller, 1995; Silveri et al., 1997; Warrington & McCarthy, 1983), fruits and vegetables (Hart, Berndt, & Caramazza, 1985; Farah & Wallace, 1992), tools (Ochipa, Rothi, & Heilman, 1989), animals (Caramazza & Shelton, 1998; Ferreira, Giusiano, & Poncet, 1997; Hart & Gordon, 1992; Hillis & Caramazza, 1991), and medical terminology (Crosson, Moberg, Boone, Rothi, & Raymer, 1997). Because we know that semantic impairments can be category-specific, it is useful to include assessment tasks that are structured according to this dimension. We have incorporated semantic category distinctions into the *Florida Semantics Battery,* as we test items from twelve different semantic categories. Within standard aphasia tests currently available, an astute examiner may notice either impaired or spared performance related to selective semantic categories by noting errors and exploring the possibility of a category-specific dysfunction with additional testing materials representing that semantic category. Results of testing that identifies selective categories of difficulty for a patient may allow the clinician to streamline efforts in rehabilitation, focusing on impaired categories and taking advantage of retained processing for other categories.

Semantic Treatments for Naming Impairments

Because semantic dysfunction may lead to naming impairments, researchers have investigated a number of treatment approaches that exploit semantic functioning in an attempt to improve naming abilities (table 9.2). Some of the techniques tend to activate semantic processing, whereas others encourage the reconstitution of semantic representations. Although we cannot definitively state that the techniques are restitutive in nature, the methods seem to encourage semantic processing according to principles that parallel what is known of normal semantic processing and thus appear to be primarily restitutive.

Table 9.2
Types of Naming Treatments That Have Been Tested

Restitutive	
Semantic treatments	Phonological treatments
Semantic comprehension tasks	Phonological judgment tasks
Semantic distinctions	Phonological cueing hierarchy
Semantic matrix training	Oral word reading
	Word repetition
	Rhyme treatment
Substitutive	
Letter-sound conversion self-cues	
Verbal-gestural	

Semantic Comprehension Treatments

Because the semantic system plays a role in both word comprehension and word selection, a number of researchers have investigated the utility of comprehension treatments to facilitate naming abilities. Byng and colleagues (1990) described a treatment for a patient with severe aphasia that implicated a semantic impairment. The patient participated in semantic processing tasks requiring picture categorization with increasingly related categories, and word-picture matching with increasingly difficult semantic distractors (closer semantic relationship to the target). Following this semantic treatment, the patient demonstrated improvement in naming for trained words.

A number of investigations subsequently have evaluated the effects that practice with semantic comprehension tasks (auditory word-picture matching, written word-picture matching, or answering yes/no questions about semantic details of a picture) have on naming abilities (Davis & Pring, 1991; Marshall, Pound, White-Thomson, & Pring, 1990; Nickels & Best, 1996; Pring, White-Thomson, Pound, Marshall, & Davis, 1990). However, in these studies the patients also said the words during the performance of the comprehension tasks, adding a phonological component to the treatment. Following semantic comprehension practice, subjects with impairments related to either semantic or phonologic dysfunction demonstrated significant improvement in naming abilities.

Two subsequent studies have contrasted treatments in which semantic comprehension tasks were performed with and without phonologic production of target words to determine the role that the phonologic component plays in treatment outcome (Drew & Thompson, 1999; Le Dorze, Boulay, Gaudreau, & Brassard, 1994). In both studies, subjects benefited maximally during training in which comprehension tasks were paired with phonologic output during training (oral reading, repetition), in keeping with the normal process of semantic-phonological activation in lexical output.

Semantic Distinctions Treatment

Some patients may produce semantic errors in naming because of dysfunction wherein semantic representations become underspecified (Hillis, 1991, 1998). To target such a problem, Hillis used a training protocol in which she provided her patient, HG, with semantic information about target pictures the patient was unable to name, and contrasted those features with the semantic features of a closely related object. Ochipa, Maher, and Raymer (1998) used a similar semantic distinctions treatment with their patient with naming impairment stemming from

dysfunction at a somewhat later stage in naming, in the course of semantic representations activating subsequent lexical mechanisms. In both studies, the patients demonstrated significant improvements in naming trained pictures as well as generalization to untrained pictures and untrained lexical tasks requiring semantic processing (written word production).

Semantic Feature Matrix Training

Another type of naming treatment, developed on the basis of cognitive theories of how semantic representations are structured, incorporates a semantic feature matrix (Haarbauer-Krupa, Moser, Smith, Sullivan, & Szekeres, 1985). Clinicians teach subjects to use a viewed matrix of printed cue words (for example, function, properties, category, and so on) surrounding a target picture to assist in retrieving semantic information about the picture along with its name (Boyle, 1997; Boyle & Coelho, 1995; Lowell, Beeson, & Holland, 1995; McHugh, Coelho, & Boyle, 1997). Following semantic feature matrix training, subjects have demonstrated improved naming of trained pictures as well as generalization of the strategy to naming of some untrained pictures. For example, Boyle and Coelho (1995) noted that semantic matrix training improved the naming abilities of their patient with Broca's aphasia (the cognitive basis for naming failures was not specified). Lowell and colleagues (1995) reported that semantic matrix training was effective in two of three individuals with word retrieval deficit stemming from phonological stages of naming.

Summary

Overall, a number of investigators have evaluated treatment schemes that appear to target semantic processing, recognizing aspects of the normal process of semantic activation and representation of semantic knowledge. These treatments have been effective for improving naming for patients whose impairments arise at a semantic stage of processing. The semantic treatments have sometimes been effective for remediating some impairments arising at postsemantic stages in the naming process as well. Because the semantic training protocols often included a phonologic component to the training, however, this finding is perhaps not unexpected. In studies examining the importance of the phonological step in semantic training, findings indicated that the phonologic component was particularly critical for treatment effectiveness (Drew & Thompson, 1999; Le Dorze et al., 1994). Hence, training that encompasses semantic and phonologic information, as in the normal process of word retrieval, appears to be the most effective in the remediation of naming impairments.

Another observation among semantic training studies for naming is that, to some extent, generalization of training to untrained words may be possible. The semantic matrix training protocol, which seems to encourage a process of semantic activation of pieces of semantic information, was somewhat promising in this respect. However, with only guarded optimism, we would recommend that clinicians plan for little generalization to untrained words and should accordingly select training stimuli that are functional and relevant to the individual patient.

PHONOLOGIC IMPAIRMENTS

Assessment

Word retrieval difficulties in other patients stem from dysfunction at the level of the phonological output lexicon. In the case of phonological dysfunction, the patient will be impaired in all verbal tasks dependent upon the integrity of stored phonological representations. In the initial assessment battery (table 9.1), patients will have difficulty in oral naming to pictures and

definitions. They may have difficulty in oral reading, particularly for exception words (for example, *colonel, bread*), as sublexical processes are often insufficient to derive accurate pronunciations for those words. Production errors may take a variety of forms, including semantic errors (Caramazza & Hillis, 1991), phonemic paraphasias (Kay & Ellis, 1987), neologisms (Kohn, Smith, & Alexander, 1996), and no response (Miceli, Giustollisi, & Caramazza, 1991). This variation in the form that verbal errors may take represents the spectrum of impairments that may occur in the phonological output lexicon. Some individuals may produce semantic errors or no response because of difficulty accessing the phonological output lexicon (Caramazza & Hillis, 1991; Le Dorze & Nespoulous, 1989; Miceli et al., 1991). Others may produce neologistic responses or phonemic paraphasias related to disturbance of the internal structure of representations (Kohn et al., 1996) or postlexical phonemic processes (Ellis et al., 1992).

A key distinction that presumably is represented at the level of the phonological output lexicon is grammatical category (Caramazza & Hillis, 1991). Dissociations in naming performance may be evident, as some patients with fluent aphasia and more posteriorly placed lesions may be more impaired for noun naming. Others with nonfluent aphasia and more anterior lesions may be more impaired for verb naming (Damasio & Tranel, 1993; Ellsworth & Raymer, 1998; Miceli, Silveri, Villa, & Caramazza, 1984; Zingeser & Berndt, 1990). Naming assessment then should incorporate tasks to explore grammatical category differences in naming. An initial step in assessing grammatical class in naming can be accomplished with the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983) and the Action Naming Test (Nicholas, Obler, Albert, & Goodglass, 1985). However, those two published measures are not equated on variables such as word frequency that may influence word retrieval (Williamson, Adair, Raymer, & Heilman, 1998). An alternative useful resource to evaluate naming nouns and verbs can be found in Zingeser and Berndt (1990). They provided an appendix of their noun and verb word lists equated for factors that may affect word retrieval. Clinicians may wish to develop lexical tasks incorporating these carefully selected sets of nouns and verbs. Using these noun and verb naming stimuli, we developed corollary comprehension tasks (Williamson, Raymer, Adair, Schwartz, & Heilman, 1995). This noun-verb battery allows us to explore semantic versus phonological influences on word retrieval for nouns and verbs.

Phonological Tasks

In the initial lexical assessment, tasks requiring spoken word production will require activation of the phonological output lexicon. Impairment in oral naming, oral word reading, or repetition tasks in the context of good performance in auditory and reading comprehension, written naming, and writing to dictation leads one to suspect impairment of the phonological output lexicon (Caramazza & Hillis, 1990). However, this dissociation between spoken and written output may arise with subsequent phonological planning impairments (for example, apraxia of speech).

Although comparable impairments for spoken and written naming often represent semantic dysfunction, it is possible to develop cooccurring naming impairments from dysfunction of both the phonological and graphemic output lexicons (Miceli et al., 1991). On the basis of the lexical assessment, clinicians should be able to distinguish these two distinct deficits, however. With semantic dysfunction, naming impairments should be accompanied by difficulties in lexical comprehension tasks as well. In contrast, patients with naming impairment due to parallel dysfunctions of the phonological and graphemic output lexicons should demonstrate relatively preserved performance in comprehension tasks.

To distinguish among oral naming impairments related to phonologic lexical versus subsequent phonologic planning deficits, it may be necessary to administer tasks that specifically tax phonologic lexical processing without motor speech. One such task is a homophone task in which subjects must decide whether two pictures have the same name (for example, bow: violin

bow and ribbon tied as a bow) (Caplan, 1993). A somewhat more difficult task is rhyme verification for picture pairs. In this task, the patient views two pictures and must determine whether their names rhyme (for example, *whale, nail*). Alternatively, a written homophone task in which subjects must decide whether two written words are pronounced the same (for example, *pear, pair*) may be useful. These three tasks will prove difficult for individuals who fail to activate a full lexical representation for the pictures. Comparison in the repetition of words versus nonwords may also help distinguish whether an impairment stems from the phonological output lexicon or beyond. Patients with postlexical impairments may have greater difficulty repeating nonword stimuli (Kahn, Stannard, & Skinner, 1998), whereas patients with lexical deficits alone may have less difficulty with nonword stimuli.

Phonologic Treatments

Recognizing that word retrieval abilities depend upon the integrity of the phonological stage of naming, a number of studies have used treatment protocols incorporating phonologic information in an attempt to restore naming abilities in patients with word retrieval impairments (table 9.2).

Reading and Repetition

In the naming model, the same phonologic output representation may be activated in oral reading, word repetition, and oral picture naming. Realizing this relationship, Miceli, Amitrano, Capasso, and Caramazza (1996) had their patient repeatedly practice reading aloud or repeating sets of words. Both types of practice resulted in improved picture naming for the corresponding words in their subject with phonologically based word retrieval failure. Mitchum and Berndt (1994) also used repetition practice in their patient with selective verb retrieval impairment. Following repetition training, their patient demonstrated improvements in naming trained verbs, but little progress in sentence formulation for the trained verbs.

Phonologic Cueing Hierarchy

Other treatment studies have incorporated phonologic cueing hierarchies in training to improve word retrieval impairments. In this type of protocol, patients systematically practice naming as they are given different types of phonologic information as they attempt to retrieve a target word. An example of a cueing hierarchy adapted from an earlier study is shown in table 9.3 (Raymer, Thompson, Jacobs, & leGrand, 1993). A number of patients who received training with cueing hierarchies have demonstrated improvements in word retrieval for trained words, with little generalization to untrained words (Greenwald et al., 1995; Hillis, 1993, 1998).

Table 9.3
Example of a Phonological Cueing Hierarchy (after Raymer et al., 1993)

At each step, patient attempts to retrieve the target word. If correct, the patient moves to the next picture after rehearsing the correct word multiple times. If incorrect, the patient is given the next cue.

1. Patient attempts to name target picture (for example, table).
2. Initial phoneme cue: "It starts with /t/."
3. Rhyme cue: "It sounds like *fable.*"
4. Oral reading cue: Present word for oral reading.
5. Repetition cue: "Say table."

ɔng these studies, treatment was effective for subjects with either semantic or phonologic d retrieval dysfunction, although in one study improvements were more limited in patients ı cooccurring semantic impairment (Raymer et al., 1993). Hillis (1998) noted, however, that ıtment with a phonologic cueing hierarchy was not as effective as semantic distinctions ıtment in her patient with a semantically based naming impairment.

lecause of concerns that the phonologic hierarchy was effective simply because of a final etition phase in their treatment, Greenwald and colleagues (1995) also administered a ıple rehearsal (repetition) phase of treatment for a different set of stimuli. Only minimal ning improvement was evident following simple rehearsal, compared to the more noticeable ɛcts of the phonemic cueing hierarchy treatment in both of their patients with naming ɔairments related to disturbance in semantic activation of the output lexicons.

onological Judgment Treatment

bson, Marshall, Pring, and Chiat (1998) used a different type of phonologic training scheme ıt paralleled the procedures described earlier for semantic comprehension treatment. Their tient practiced a number of tasks requiring judgments about phonologic information for ɪrds, such as the number of syllables and the initial phoneme of words, to encourage activa- ɪn of phonologic output representations. Their subject, with a naming impairment arising at phonological stage of lexical processing, demonstrated improvement in naming pictures ıined with this strategy and showed some generalization of the process in naming untrained ctures as well.

In a paradigm using the elements of semantic and phonological training, Marshall, Pring, ıd Chiat (1998) used a combination of semantic comprehension tasks and phonological judg- ent tasks to train verb retrieval for their subject with selective verb naming impairment. ollowing treatment, their subject not only improved naming for trained verbs, but also in- ɾeased the use of grammatical sentences incorporating those verbs.

emantic Category Rhyme Therapy

ecognizing the interactive nature of semantic and phonological information in the process of ord retrieval, Spencer and colleagues (2000) devised a treatment for their patient, NR, whose aming impairment stemmed from failure at the phonological output lexicon. In their treat- ent, the clinician gave NR the semantic category and a rhyming word, aspects of semantic nd phonologic information, for practice retrieving the labels corresponding to target pictures. R demonstrated improvement in naming both trained and untrained pictures.

ummary

verall, a number of researchers have investigated treatment protocols encompassing phono- ɔgic aspects of words to improve naming abilities. These phonologic treatments appear to be ffective in patients with impairments related to either phonological or semantic stages of aming; however, effects may be reduced in individuals with semantic impairment (Raymer et l., 1993). Preliminary data suggest that the use of a phonologic cueing hierarchy is more ffective than simple repetition practice in remediating word retrieval impairments (Greenwald t al., 1995). However, a cueing hierarchy may not be as effective as an alternative semantic ɾeatment in individuals with semantically based naming impairments (Hillis, 1998). Finally, eneralization of treatment effects to untrained stimuli were much more limited in the phono- ɔgic training investigations than in semantic training protocols, again suggesting the need to elect stimuli carefully for functional relevance to the individual patients.

NAMING TREATMENTS: REMAINING ISSUES

Substitutive Naming Treatments

An alternative approach to rehabilitation of naming impairments to which lexical models may contribute is the development of substitutive treatments that either circumvent an impaired lexical mechanism or vicariatively mediate word retrieval using other cognitive mechanisms. For example, the use of semantic circumlocution to describe a concept when a naming failure occurs is a substitutive semantic strategy to circumvent failure at the subsequent stage of phonologic lexical retrieval. Some treatment studies have evaluated the effects of methods to vicariatively activate word retrieval using alternative cognitive mechanisms.

Graphemic Mechanisms

Some patients with naming impairments arising at the level of the phonological output lexicon nevertheless may be able to access the word's spelling. In turn, the patient may use print-to-sound conversion processes to generate the appropriate spoken word. Bruce and Howard (1987) used this strategy with their patient who had some retained spelling knowledge for words he was unable to say. The patient typed the letters into a computer, which then generated the initial phoneme of the word to cue naming. Over time the patient improved in naming practiced words even without computer-generated cues.

A number of studies have described similar procedures in which the patient self-generates the written letter to self-cue spoken naming. Nickels (1992) reported that her patient improved word retrieval skills using a graphemic training technique, in spite of impaired print-to-sound conversion abilities. Translation of the initial letter to phoneme was sufficient to self-cue the correct spoken form of the word. Bastiaanse, Bosje, and Franssen (1996) also described a patient who was trained to use the compensatory method of writing the first letter of the word and then generating a phonemic cue to retrieve the spoken word. Over time, the patient was able to generate the phonemic cue without writing.

Holland (1998) described the process of training her patient, RR, to use graphemic information to generate the spoken form of words during conversation. RR was adept at writing the words he was unable to retrieve and learned to generate spoken names of words during picture naming tasks. However, he did not use this strategy during conversational word retrieval failures. It was not until the strategy was practiced in a generative semantic category naming task (for example, writing words in a particular category such as animals) that RR made gains in using the strategy in functional communication.

Hillis (1998) described an extraordinary patient, HG, who spontaneously used retained print-to-sound conversion abilities and access to graphemic representations to support her attempts at oral naming. HG often mispronounced words using regularized pronunciations (for example, "breed" for bread). Familiar listeners could often perform a reverse translation for her technique and determine the word HG was saying. To circumvent this maladaptive strategy, Hillis taught HG to pronounce words by memorizing regularized spellings of common words with exceptional spellings (for example, *kwire* for *choir*), which she in turn used in oral naming of the same words.

Gesture

An alternative method that researchers have applied to mediate word retrieval is the use of the action output lexicon through pantomime. Luria (1970) originally referred to such a process as "intersystemic gestural reorganization," using intact gesture abilities to activate the impaired language system. Cognitive models that recognize the interactive nature of verbal and gestural

output processing (Rothi, Ochipa, & Heilman, 1991, 1997) suggest a means for gesture to mediate activation of lexical retrieval. A desirable outgrowth of gestural training is that the patient has learned an alternative functional communication mode should verbal improvements not develop. A number of studies using traditional therapy procedures have demonstrated positive effects of verbal-gestural training in individuals with aphasia (for example, Hoodin & Thompson, 1983; Kearns, Simmons, & Sisterhen, 1982; Pashek, 1997; Raymer & Thompson, 1991). Recent studies have examined factors that may optimize gestural training effects. Pashek (1998), recognizing the differences in neural-cognitive representation for different classes of words, compared the effectiveness of verbal-gestural training for nouns versus verbs. Her findings in one subject with mild limb apraxia indicated that, whereas gestural training led to improvements in both word classes, naming performance was greater for verbs than for nouns.

Summary

Intact graphemic and gestural mechanisms of the lexical system may be used to support communication attempts in individuals with naming impairments. Some substitutive treatments may over time act vicariatively to improve spoken naming. At other times, the substitutive strategy remains the primary means of communication, as naming improvement is not forthcoming. It is crucial that clinicians evaluate the potential for alternative communication modes as a means to circumvent lexical impairments, particularly in individuals in more chronic stages of recovery from neurological injury (Rothi, 1995).

Contrasting Naming Treatments

A fairly broad literature has now demonstrated the effectiveness of a variety of treatments for naming impairments. And in these studies there has been no clear one-to-one relationship between type of impairment and type of treatment that is effective (Hillis, 1993). However, to evaluate this consideration more carefully, it is helpful to compare the effects of different treatments within the same patients to determine the most effective strategy. Howard and colleagues (1985) sequentially evaluated separate naming treatments requiring subjects to answer questions about either semantic or phonologic information for target pictures. Their group results indicated that both treatments led to improved naming for trained words, with an advantage of semantic over phonologic treatment. However, the mechanism of the naming impairments in their subjects was not well described, so it is not possible to evaluate the relationship between impairment and treatment on the basis of their results.

Ellsworth and Raymer (1998) used a training paradigm in which they contrasted phonologic and semantic question training for one subject, WR, who had a selective verb naming impairment. Intact performance in comprehension tasks and significant impairment across oral naming tasks indicated that the impairment arose at a phonologic retrieval stage in naming. In the semantic question hierarchy, WR answered yes/no questions about a coordinate action and an associated object for each trained verb. To illustrate, in training the verb *to paddle*, she was asked questions such as: Is it similar to rowing? Does it have to do with paddles? In the phonologic question hierarchy, WR answered yes/no questions about the initial phoneme and a rhyming word for each training word. So when training the verb *to cook*, she was asked questions such as: Does it start with /k/? Does it sound like *book*? A final repetition practice phase followed both treatments. Both semantic and phonologic treatments led to improvements in verb retrieval for trained verb naming and production of accurate sentences using those trained verbs. Maintenance of improvement was greatest for the phonologic treatment of verbs, in keeping with the phonologic basis to her verb retrieval impairment.

Ennis and colleagues (2000) completed a study contrasting the effects of a similar semantic question hierarchy versus a phonologic question hierarchy in their patient AS, with a noun retrieval impairment related to phonological dysfunction. In this case, the semantic question hierarchy included yes/no questions regarding coordinate, associate, and semantic category, whereas the phonologic question hierarchy queried as to initial phoneme, rhyming word, and number of syllables. Both treatments ended with a common rehearsal phase. Although both treatments were effective in improving noun retrieval, semantic treatment had an advantage over phonologic, in spite of the fact that AS had a naming impairment that arose at a phonologic stage of processing.

In contrast to patients with primarily phonologic impairment in word retrieval (Ellsworth & Raymer, 1998; Ennis et al., 2000), Wambaugh, Doyle, Linebaugh, Spencer, and Kalinyak-Fliszar (1999) contrasted phonologic and semantic cueing treatments in a patient, FS, with a semantic-phonologic basis for her naming impairment. And as in the other two studies, FS responded positively to both phonologic and semantic treatments. To some extent, however, generalization to untrained naming was more evident following semantic treatment.

On the basis of these preliminary findings, restitutive semantic and phonological treatments appear to be effective in improving word retrieval for trained words. However, there seems to be little direct relationship between type of naming impairment (semantic or phonologic) and most effective treatment (Hillis, 1993). Either semantic or phonologic treatment seems to improve naming in individuals with either semantic or phonologic impairment, although the treatment may be effective for different reasons in the two cases. For example, providing a phonological cue to a patient with a semantic deficit may help to activate the target phonological representation among many competing phonological representations activated by the damaged semantic representation. In contrast, providing a phonological cue to a patient with a deficit at the level of the phonological lexicon may provide the additional activation needed to the target lexical representation (which would have received full activation from the semantic system, but still did not quite reach threshold for selection due to damage at this level), such that the target is activated just above its threshold. This proposal is compatible with the interactive nature of semantic and phonologic processing in the course of lexical activation (Humphreys, Riddoch, & Quinlan, 1988). In fact, the best restitutive treatments appear to be those that combine semantic and phonologic components during training to encourage the process of word retrieval.

Case Example

We exemplify this approach to assessment and treatment with a description of a study we completed with our patient AW. He was a fifty-nine-year-old gentleman who was six months post onset of a left fronto-parietal stroke. AW was a retired railroad engineer with reported developmental reading and spelling difficulties that complicated his clinical presentation. On standardized aphasia testing with the Western Aphasia Battery (Kertesz, 1982), AW presented with a mild Broca's aphasia that was evolving toward conduction aphasia as he experienced more difficulty with repetition tasks and produced semantic and phonemic paraphasias in naming tasks. On the Boston Naming Test (Kaplan, Goodglass, & Weintraub, 1983) he had correct responses in only eight of sixty items, indicating a significant naming impairment.

We examined AW's naming impairment further using the Florida Semantics Battery (Raymer & Rothi, 2000), a set of lexical tasks assessing performance for 120 nouns. AW was unable to respond in the oral reading and written picture naming subtests, presumbly due to his developmental problems. Results displayed in table 9.4 indicated that in the two oral naming subtests, significant difficulties were evident, as AW provided correct names for only 43.3 percent of pictures and 35.8 percent of definitions. In both oral naming tasks, AW made a significant portion of "no response" errors and a smaller portion of semantic errors (superordinate

Table 9.4
AW's Responses on the Florida Semantics Battery

Task	N	Correct (%)	Semantic related (%)	No resp. (%)	Other (%)
Oral picture naming	120	43.3	16.7	26.7	9.2
Oral naming to spoken definition	120	35.8	10.8	51.7	1.7
Semantic picture associate matching	90	56.7	36.7	1.1	–
Auditory word-picture natching	120	90.0	10.0	–	–
Written word-picture matching	120	20.0	78.3	1.7	–
Written picture naming			could not attempt		
Oral reading			could not attempt		

words and descriptions). His other responses in oral naming were unrelated words or complex phonemic paraphasias (differed from target words by more than one phoneme). His pattern of errors in oral naming implicate an impairment at either semantic or phonologic stages in lexical retrieval. To contrast these levels of processing, we considered his performance in comprehension tasks. His performance in auditory word-picture matching (90 percent correct) and semantic picture associate tasks (56.7 percent correct) is below cutoff levels observed in control subjects, suggesting that a mild semantic impairment contributed to his naming problem. This proposal is further supported by the observation that AW was somewhat worse in the name to definition subtest that places substantial demands on semantic processing. However, the significant difficulty in both oral naming tasks along with many "no response" errors and some complex phonemic errors suggest an additional measure of impairment related to the phonological retrieval stage in lexical processing. Thus, both semantic and phonologic stages of lexical retrieval appeared to be affected as a result of his stroke, and a significant naming impairment resulted.

AW then participated in an experimental treatment study in which we contrasted the effects of semantic and phonologic treatments for his naming impairment. Table 9.5 highlights the steps incorporated in the two treatment protocols, in which we asked a series of questions designed to help AW search for pieces of information that would help him to retrieve words when a naming failure occurred. Each question sequence was followed by a common rehearsal phase for consolidation of target word production. We examined AW's performance in naming three sets of pictures and a control word repetition task over the two treatment phases. Table 9.6 displays the mean accuracy level across three final sessions in each treatment phase. After low levels of baseline performance across probe measures, we initiated the phonologic questions treatment with one set of pictures. After ten treatment sessions, the accuracy of naming increased by 65 percent for trained items. Improvement for the two untrained picture naming

Table 9.5
Question Hierarchy Used in Phonologic and Semantic Training for Patient AW

Semantic questions (for example, apple)
1. Coordinate question: Is it similar to an orange?
2. Superordinate question: Is it in the category of fruits?
3. Associate question: Does it have to do with juice?

Phonologic questions (or example, stool)
1. Initial phoneme question: Is the first sound /s/?
2. Syllable question: Does it have one syllable?
3. Rhyme question: Does it sound like school?

Table 9.6
Average Correct Performance for AW in Final Three Sessions of Each Treatment Phase for Experimental Probe Tasks

Task	Baseline (%)	Phonologic (%)	Semantic (%)	Maintenance (%)
Oral naming				
Phonologic set	13.3	78.3	56.7	50.0
Semantic set	13.3	41.7	55.0	55.0
Control set	13.3	40.0	28.3	10.0
Control word repetition	10.0	35.0	41.7	35.0

sets and the word repetition tasks was less than 30 percent, suggesting a noticeable effect of the phonologic training beyond either spontaneous recovery or repeated exposure to probe stimuli. When the semantic question protocol was instituted with a second set of pictures, naming improved an additional 15 percent for those items after ten training sessions, and AW never reached ceiling levels. In a final maintenance probe two months after the completion of treatment, AW had maintained some improvement for the two trained sets, whereas performance for untrained pictures had returned to baseline levels.

Therefore, AW, who presumably had both semantic and phonologic dysfunction underlying his significant naming impairment, had somewhat different responses to the two naming treatments. His immediate improvement in the phonologic treatment phase noticeably surpassed his progress following semantic treatment. However, the longer-term effects of the two treatments, as indicated in the follow-up observation, were similar. These results were not simply effects of spontaneous recovery or generalization of the first phonologic treatment to the second semantic training set, as AW showed no improvement for untrained pictures. Apparently, both phonologic and semantic question treatment had a modest influence on AW's naming abilities.

CLOSING COMMENTS

A substantial body of literature now exists to support the clinical utility of a model-guided approach to assessment and treatment of naming impairments. Clinicians have demonstrated that a number of different treatment methods may induce naming improvements in individuals with either semantic or phonological stages of dysfunction. However, a general conclusion that perhaps is contrary to early expectations for the use of this type of approach in treatment is that there is no direct relationship between type of impairment and type of treatment that will be most effective for those stage-specific impairments (Hillis, 1993). Some patients with semantic impairments benefit from phonological treatment and vice versa. Overall, the most effective naming treatments appear to be those that encourage semantic plus phonological processing within one treatment protocol, in keeping with the normal process of lexical activation.

One critical area for which further investigation is warranted in studies of naming treatments is the functional outcomes for patients in daily communication activities. The primary dependent variable in treatment studies for lexical impairments in aphasia has been percent improvement in the trained lexical task or in other lexical tasks sharing the same lexical mechanism. Fewer studies have investigated the generalization of lexical improvements to functional communication settings beyond anecdotal reports of the helpfulness of clinical training (Hillis, 1998). Boyle and Coelho (1995) reported no changes in conversational speech measures of words per minute and information units conveyed per minute following successful semantic matrix training for noun retrieval. However, a family member judged that the patient improved on a rating scale of communicative effectiveness (Lomas et al., 1989), which may

indicate the functional gains of lexical treatment. Ellsworth and Raymer (1998) examined conversational output following verb naming treatment in their patient with aphasia. Using quantitative production analysis of lexical and grammatical use (Saffran, Berndt, & Schwartz, 1989), they noted changes toward more normal proportions of lexical categories within sentences following treatment. Overall, however, the functional consequences of treatments using a model-guided approach have not been well studied.

Knowledge gained from studies of the cognitive neuropsychological bases for word retrieval impairments certainly have influenced clinical practice in positive ways. A number of innovative treatment strategies have been developed on the basis of normal models of lexical and semantic processing. And it appears that treatments that respect the normal process of lexical retrieval are most beneficial in treatment effects. Although the model-guided approach to assessment and treatment requires a substantial investment of time and energy in the clinical process, patients may anticipate maximum benefits as a result. Certainly cognitive models do not provide a sufficient basis upon which to base our clinical practice, as a number of medical and social factors must be considered in the clinical decision-making process (Hillis, 1993). However, this approach has the potential to guide and influence clinical practice in practical ways as we continue to study methods and determine who, what, and how to assess and treat naming impairments in aphasia.

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