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PERSPECTIVES on Language Learning and Education

AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION **DIVISION 1**

Amy L. Weiss

From the Coordinator

I don't know about you, but it's hard for me to believe that autumn will be upon us by the time you read this column. Right now I'm sitting in my office at the University of Rhode Island, wishing my air conditioner would catch up with the heat and humidity and wondering where that ocean breeze I expected to feel has gone! To the 3,330+ of you who now are Division 1 affiliates (we have been growing by leaps and bounds and remain the second largest Division), I wish you a productive new school year, fiscal year, or a "whatever designator you would like to use" year.

This issue of Division 1 *Perspectives* will be a real treat for us all. I am very grateful to Karla McGregor and her colleagues for taking the time to put together an informative and thought-provoking set of articles focused on "Word Learning" for our Division affiliates. We appreciate your contributions, Karla. Note that we had a higher proportion of our Division 1 affiliates responding to our survey either through electronic or hard copy means than ever before and, with few exceptions, they commented on the positive value of the *Perspectives* offerings. Thanks to our hard-working Editor (Trish Hargrove) and Associate Editor (Mona Griffer), the contributions of knowledgeable authors, and the guidance of Jean White in the ASHA National Office, we have had another stellar year bringing you three outstanding issues.

Let me sneak in a little reminder here. When you send in your CE forms, please be sure you are sending them to the correct person. The name and address of the CE administrator for the issue will be included in the instructions and may not always be the same person, especially when we coordinate with other Divisions as we did in July. In any event, I am not the correct person to receive the CE forms so I would encourage you to check the instructions carefully!

Did you pick up on the big "thank you" embedded two paragraphs ago? Those of you who took the time to respond to our survey have provided us, your Steering Committee (SC), with guidance for planning future events and materials accessible to more affiliates. Another acknowledgment is due to all of you who responded to the e-mail request for reviewers either for ASHFoundation grants or for our modules. The response was so overwhelming that I did not have the time to reply to each of you. Names were forwarded to the Foundation and used to designate module reviewers. We had so many Division affiliates responding that we could not use everyone on this set of reviews. We did our best to match up interests and expertise from the information you sent us, but if you weren't selected this time please do not be discouraged from volunteering when another call for assistance comes about.

Our thoughts are with our colleagues and those they serve who have suffered personal hardship and loss as a result of the devastation caused by hurricanes Katrina and Rita.

Here is some important new information. Your Division 1 SC met in Indianapolis just prior to the ASHA Schools Conference (I was glad to get to meet some new Division affiliates at our table). We had several weighty agenda items. The one we probably

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spent the most time on was attempting to put together a committee structure for the Division. The reasons for this are two-fold. First, a committee structure will provide opportunities for more Division affiliates to participate and with participation often comes identification of new Division leaders. Second, with more affiliates participating in Division activities it is likely that we will be responsive to our members' expressed interests in developing non-ASHA convention related CEU opportunities.

We would like to make our proposed committee structure the central topic of our annual affiliates meeting which will be held in San Diego at the ASHA Convention immediately following our Division-sponsored Short Course. Our Short Course, "Are You Prepared to Support Students in Reading Strategically?," presented by Barbara Ehren, Associate Division 1 Coordinator, is scheduled from 12:00 noon to 3:00 p.m., Sunday, Nov. 20. We need your input at the meeting and beyond as we discuss the roles and responsibilities for Membership, Continuing Education/Conference, Best Practices, and Legislative Issues/Advocacy committees. We will be looking for volunteers for each of the committees so keep a look out for a call for volunteers some time after our affiliates' meeting, probably in December.

Our affiliates' meeting will also be a chance for you to hear a progress report of what your Division 1 SC has been busy doing for you and some of our plans for the future, including the details of a Web-based, meet-the-experts live event. We also use the annual Division meeting as an opportunity to recognize affiliates who have been honored by ASHA and recipients of Division 1 grants for 2005. We welcome you to share in the congratulations. To further entice you to give up some of your San Diego "out and about" time, we will be having drawings for Division membership registration waivers, ASHA Bookstore gift certificates, and additional valuable prizes. So, if you are going to be in San Diego for the ASHA Convention, please mark your calendars for the affiliates' meeting as well as Barbara Ehren's Short Course.

Please also consider signing up for Rolanda O'Connor's Pre-Convention Clinical Skills Workshop on Nov. 17, 1:00–5:30 p.m. A flyer with the agenda and registration form is attached to this issue. Attendance for the Short Course and Workshop is limited, so register as soon as possible. Don't forget, Division 1 affiliates can receive a discount on registration fees for both of these CE events!

In closing, I want to again thank you for your past participation and encourage you to find a venue of interest to help make Division 1 even more responsive to the needs and interests of all its affiliates. I am sure that I can speak for the rest of the Steering Committee when I say that it is our pleasure to be associated with our Division 1 colleagues. As always, you can reach me at alw@uri.edu with suggestions or concerns about Division 1. And, we hope to see many of you in San Diego!

Congratulations

to Division 1 affiliates **Amy Finch**, who has been named an **ASHA Fellow**, and to **Ben Munson**, who is receiving the **Award for Early Career Contributions in Research**. Both will be honored at the 2005 ASHA Convention!

SPECIAL INTEREST DIVISION 1

Language Learning and Education

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Children's Word Learning: An Introduction

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Children know the wonder and power of words. How pleased they must be with the reaction to their first spoken word. How determined they seem when, as toddlers, they address their hundredth "wha dat?" to a harried parent. How entertained they are by playing with the sound and meaning of words in those, by adult-standards, seriously unfunny knock-knock jokes.

In my roles as a researcher, a speech-language pathologist, and a very committed aunt, I am frequently amazed by the child's capacity for word learning. I am not alone. In study after study, researchers conclude that children can link a new word to its referent after hearing the word only once or twice in context. These contexts need not contain ostensive cues and their referents do not need to be within sight (Tomasello, 2000); it is not even necessary that the words be directed to the child (Akhtar, Jipson, & Callanan, 2001)—apparently children also know the power of eavesdropping!

No question about it, children are great at the fast mapping of word to referent. However, most of the research on fast mapping is limited in its scope. Typically, the words to be learned in these research tasks are nouns and the referents are objects. Typically, the child's job in the task is to demonstrate a receptive link, that is, to recognize the referent upon hearing its name. And typically, the children who participate in these studies are, well, typical.

Nouns are one of the many word classes children learn; objects, just one of the many referents. There is a great deal to learn about words, the link between word and referent is just the initial step in the process. Once we consider these aspects of word learning, we have a truer picture of the child's task and the extended time course required to complete the task. Once we consider children who are not developing language normally, we have a truer picture of how that task is accomplished by all children, not just the modal child.

In this forum, I am pleased to present a set of papers by authors who have seriously considered these issues in word learning. In the first paper, Prahlad Gupta develops a useful framework for conceptualizing various aspects of word learning—word-form representations, semantic representations, and the expressive and receptive links between them—and summarizes literature pertaining to each aspect.

Jill Hoover and Holly Storkel further develop Gupta's notion of word form learning. They provide a useful overview of the role of phonotactic probability and lexical neighborhood density on children's word learning and then demonstrate that those same effects do not hold for word learners who have phonological delays.

Katharina Rohlfing places children's learning of spatial prepositions within Gupta's framework. She reviews evidence of linguistic and sociocultural influences on the establishment of semantic representations. She uses this evidence to motivate a study in which she teaches the preposition "under" ("pod" for her Polish-speaking subjects) by contrasting it with conceptually simpler "on" and "in" with the result being more extensive learning on the part of children experiencing these contrasts.

Finally, Shelley Gray, true to Gupta's model, measures children's learning of word forms, semantic information, receptive, and expressive links, but extends these measures in two ways. First, she includes both normally developing children and children with specific language impairment. Second, she more fully examines their learning over an extended period of time. By not limiting herself to the fast mapping period, she is able to more accurately ascertain the challenge of word learning for children with specific language impairment.

Clinically useful ideas run through these papers. Gupta helps us to think more clearly about the aspects of word knowledge that we need to assess in our young clients. The other contributors demonstrate the need to move beyond standardized vocabulary tests in these assessments as they are not sensitive to differences in learning strategies (Gray, this issue; Hoover & Storkel, this issue) or degree of word knowledge (Rohlfing, this issue). Rich teaching implications can be found in these papers as well. Hoover and Storkel demonstrate that choosing word targets on the basis of their lexical and phonological characteristics can affect learning outcomes. Rohlfing illustrates that enriching the semantic information provided during training can enhance the child's extension of newly learned semantic concepts to untrained exemplars. Gray describes a clinical intervention program for promoting word learning and demonstrates that, in particular, semantic cues aid receptive learning and increased frequency of exposure to words in context aids expressive learning, thus taking us full circle to Gupta's argument that semantic

keywords and repetition facilitate different aspects of word learning.

Other exciting findings and additional helpful ideas come to mind as I review these papers but I will not spoil your fun. I think you will enjoy this forum of thoughtful papers summarizing current data on children's word learning and ways to best foster that learning.

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Save the date. . . for ASHA Health Care 2006!

April 1 & 2, 2006 in Nashville, TN

Conference topics include a 2-day adult dysphagia track, TBI and aphasia, and trachs and vents. Early intervention topics include autism, apraxia, and orofacial anomalies. Division 1 is a conference sponsor!

What's in a Word? A Functional Analysis of Word Learning

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An unexceptionable view of word learning or vocabulary acquisition is that it entails learning a word form, a meaning, and the link between them (e.g., Desrochers & Begg, 1987; Saussure, 1916). However, this simple formulation encompasses a multitude of different abilities and subcomponents. As a result, the terms "vocabulary acquisition" and "word learning" have been used to mean a wide variety of different things. This article begins by outlining a simple functional framework for thinking about various types and aspects of word learning. It then applies this framework to characterizing several important streams of investigation within the word learning literature, in the belief that locating these investigations with respect to each other is a useful endeavor.

We will reserve the term *word learning* to refer to the specific phenomenon of learning one or a small number of new words in a relatively short period of time. On this view, *vocabulary acquisition* will refer to the cumulative outcome of multiple instances of word learning. This article is concerned with word learning rather than with vocabulary acquisition.

We next need to specify what we mean by word form, meaning, and link. We will operationalize "word form" as an auditorily experienced human speech stimulus; we are thus discussing spoken, not written, language. We use the term *word form* rather than *word* to emphasize the fact that such a stimulus may be a known word or a novel word to a particular language learner/user. We assume the existence in the cognitive system of such a user of an internal phonological representation for each known word form. This internal representation must be created through learning from exposures to that word form; we term such a representation a "word form representation."

What is the meaning of a word form? This question has been the subject of inquiry through much of recorded history, and we cannot even begin to do justice here to this topic. We simply offer an operationalization of the notion of meaning as an internal mental representation of (an) object(s), action(s), event(s), or abstract entity/entities. We term this internal representation "a semantic representation." Such a representation can exist independently of a name. The meaning of a word form to a particular individual (rather than to a community of individuals) is then simply the semantic representation that is activated via activation of the internal word form representation of that word form.

Finally, what is the link between a word form and a meaning? We will operationalize the notion of the link as a connection between representations, whose existence allows the one representation to activate the other. There are actually two links that must be considered: one from the word form representation to the semantic representation ("the receptive link") and one from the semantic representation to the word form representation ("the expressive link").

Investigations of Word Learning

Inferences about Semantics

One major area of research in word learning can be characterized

as having investigated the construction and making of inferences about the semantic representation. The learner must, for example, figure out what the denoted entity is. For instance, if it is an object, is it an animal. . .a bird. . .a machine? Is the entity the sole possessor of the name, or is it an example of the kinds of things so named? A great deal of research can be seen as having addressed such questions. For example, some studies have investigated the process whereby children extend the novel words to untrained referents (Nelson & Bonvillian, 1973; Oviatt, 1982; Samuelson & Smith, 1999). Others have examined the rate of acquisition as a function of the child's referential or nonreferential orientation (e.g., Leonard, Schwartz, Morris, & Chapman, 1981). Some studies have addressed the complex issue of how meaning is inferred from context of usage (social, linguistic non-syntactic, or syntactic) rather than from perceptual information, as it necessarily must be for abstract referents (see Sternberg, 1987, for review). The extensive literature on constraints or biases or tendencies in children's word learning (e.g., Markman, 1984) can also be seen as having addressed the issue of how the learner figures out what the denoted entity is. Thus, one major focus of research on word learning can be seen as investigating creation of the semantic representation component of the overall word learning task.

Learning Word Forms

For a learner to construct a phonological representation of a novel word form, he or she must in the first place have the ability to represent the word form phonologically. Learning a new word form thus requires the existence of at least some level of knowledge about the phonological structure of the language. (See Jusczyk, 1997, for a review of the development of such knowledge.) Several other abilities must also underlie the ability to learn new word forms. One of these is the ability to segment the speech stream into word forms. Additionally, even if the learner can segment the speech stream so as to identify word forms, a novel word form must be processed and attended to, rather than simply present in the environment. There is also the problem of knowing which word in the speech stream is the one that refers to the intended referent. Other problems include recognizing the identity of the word form when spoken by different talkers, or at different speaking rates, or in noise.

It is possible, however, to study situations where word forms are presented in isolation to a learner who already knows the phonological structure of the language, thereby sidestepping issues of the development of phonology, segmentation, attention, and identification. A considerable amount of research on word learning can be characterized as having adopted this strategy, in order to examine the learning of the word forms themselves. Much of this research has required subjects to learn auditorily presented word forms, sometimes as pretraining for a subsequent process in which they were mapped to semantics (Horowitz & Gordon, 1972; Pressley & Levin, 1981). There has been some examination of the effect of the phonological composition or lexical neighborhood of the novel word on its learning (Leonard et al., 1981; Magnuson, Tanenhaus, Aslin, & Dahan, 2003). Some studies have examined the ability of infants and/or adults to engage in statistical learning tasks that would necessitate that they had segmented a continuous speech stream into words (e.g., Saffran, Newport, Aslin, Tunick, & Barrueco, 1997). These lines of research can all be characterized as having addressed the learning of word form representations.

Learning the Links

A third line of experimental research in word learning has involved provision of both semantics and word form to the learner with the focus being more on creation of the expressive and receptive links. An important dimension along which these studies can be categorized is according to the direction of mapping they investigated.

Word form > Semantics mapping. One line of investigation has focused on the *word form > semantics mapping* (i.e., the receptive link). The operational measure in these studies has been the learner's ability to explain the meaning of the word in some manner; let us call this "receptive learning." Within this focus, one approach has been concerned with creating a rich semantics through the use of context and contextual inference to facilitate formation of a strong link from the novel word form to the semantics (e.g., Sternberg & Powell, 1983). Other research has focused directly on encouraging creation of the link itself, using mnemonic keyword strategies (see Pressley, Levin, & McDaniel, 1987, for a review). As an example of such strategies, to learn the meaning of the word "carlin" (an old woman), a learner might be encouraged to associate the new word with a mental picture of an old woman sitting in a car. In terms of promoting receptive learning, this keyword method has proved effective and superior to other strategies such as rote repetition and the provision of context (Desrochers & Begg, 1987; Paivio & Desrochers, 1981; Pressley et al., 1987).

Semantics > Word form mapping. A second line of investigation can be characterized as having focused on the *semantics > word form mapping* (i.e., the expressive link). The dependent measure in this second line of research has been the learner's ability to produce the correct word form label, when prompted with its semantics, after the learning procedure; let us call this expressive learning.

A major focus of such research

has been to examine how such learning can be facilitated. It appears that the keyword method is relatively less effective in promoting expressive learning than in promoting receptive learning, and that repetition may be a more effective strategy (Ellis & Beaton, 1993; Pressley, Levin, Hall, Miller, & Berry, 1980). However, it appears that the keyword method becomes effective if the novel vocabulary items have already been learned as responses; that is, if the word forms are pretrained (Desrochers & Begg, 1987; Horowitz & Gordon, 1972; Pressley & Levin, 1981). This suggests that the role of repetition may be primarily in the process of encoding the word form itself, while the provision of a keyword may facilitate the creation of links between the word form and its semantic representation. Thus, when a subject is given a novel word form and its meaning, repetition is necessary for expressive learning of the novel form. Provision of a keyword does not further facilitate expressive learning. However, an elaborated keyword (i.e., a keyword plus context) can result in such further facilitation (Gallimore, Lam, Speidel, & Tharp, 1977).

Semantics <—> Word form mapping. A third line of investigation has examined the learning of new mappings in both directions (i.e., the *semantics <-> word form mapping*, or receptive and expressive learning). For instance, in the "carlin" example above, receptive learning would be demonstrated by being able to provide the meaning, when cued with the word, and expressive learning would be demonstrated by being able to produce the word *carlin* when cued with the meaning. The results suggest that a combination of keyword learning and repetition is most effective (Ellis & Beaton, 1993; Ellis & Sinclair, 1996; Horowitz & Gordon, 1972). The keyword method promotes receptive learning, while repetition of the stimulus pair promotes expressive learning (Ellis & Beaton, 1993). This is consistent with the analysis made in the preceding paragraphs.

Fast Mapping

A fourth body of research has examined "fast mapping" or the speed of word learning processes. In its original sense as introduced by Carey (1978), the term *fast mapping* referred to the fact that children can learn the meanings of new words very rapidly, in just one or very few exposures. The investigators emphasized that the lexical representations that are formed may be preliminary, especially with respect to their semantics, are based on very little information, and are refined gradually over time. In our terms, what was being learned very quickly was a semantic representation and the receptive link, and such studies can be categorized as having focused primarily on the speed of such learning. The focus of other research has been the speed with which new word forms can be learned, including expressive learning. For example, Dollaghan's (1985) study of 31 children aged 2:1 through 5:11 found, with respect to expressive learning, that 45% of the children produced recognizable labels for new word-object pairings, following only two exposures.

In these experiments, receptive and expressive fast-mapping abilities were demonstrated by approximately 24 months of age. Evidence has been somewhat mixed regarding the presence of such ability at younger ages (e.g. Oviatt, 1980; Schafer & Plunkett, 1998; Schwartz & Leonard,1984; Werker, Cohen, Lloyd, Casasola, & Stager, 1998; Woodward & Hoyne, 1999; Woodward, Markman, & Fitzsimmons, 1994). Expressive fast-mapping abilities may also not be present when multiple word-referent pairs are presented, a point also emphasized by Carey (1978).

The following picture therefore emerges. Fast mapping occurs when the learner first notices a new lexical item and rapidly encodes it (i.e., creates a representation of the word form) after even a single experience with it. In natural settings, the learner will also store some semantic/conceptual information about it and create a mapping between the word form representation and the semantic representation. Expressive fast mapping likely occurs both in children above the age of 2 and in adults. Dollaghan (1985) found no evidence of systematic developmental differences in fast mapping ability across the age range of 2 through 6 years, and Markson and Bloom (1997) found no difference between children and adults. Receptive fast mapping may occur more quickly, starting as young as 12 months of age. Over a longer period of time, both the word form and the semantic representations may be refined and/or augmented as the learner obtains more information from subsequent encounters with the word (Carey, 1978).

Functional Analysis

The foregoing functional framework is intended to serve two purposes. First, it emphasizes the complexity of the issues underlying the seemingly simple process of "learning a new word." Second, it highlights the fact that studies that are all regarded as investigations of word learning actually address a range of rather different issues and helps locate these issues with respect to each other. Let us consider just a few issues that could usefully be examined in terms of the framework and distinctions we have outlined.

- What are the aspects of word learning that are amenable to fast mapping? Is it the creation of a semantic representation or a phonological representation or the links?
- How does the richness of the representation of the referent affect word learning, and is the effect different for

receptive versus expressive learning?

- What is the effect of the similarity between referents, in situations where multiple pairings are to be learned?
- What is the effect of the phonological or neighborhood characteristics of the word form that labels the referent, and do these effects differ for receptive versus expressive learning?

An answer to any of these questions would make a contribution to improved understanding of "word learning." To the extent that the functional analysis facilitates the framing of such questions, it will have served a useful purpose.

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Continuing Education Questions

1. In this article, the term *word learning* is used to refer to the learning process for individual words, whereas the term *vocabulary acquisition* is used to refer to

a. the process of second language learning.

b. the cumulative outcome of many instances of word learning.

c. the outcome in cases of language impairment.

d. the use of strategies to learn a vocabulary.

2. The article highlights the following functional components of word learning:

a. learning to distinguish between objects, events, and actions; and learning the phonology of the language.

b. learning the name of the word and learning the meaning.

c. learning the word form, learning the meaning, and learning the expressive and receptive links.

d. learning the pronunciation of the word and understanding its etymology.

3. Which of the following seems most likely as something for which a person might have a semantic representation, but no associated one-word name?

a. The body part that the person smells with

b. A common house pet that makes a "meow" sound

c. The clicky part of a ballpoint pen

d. A rose

4. Which of the following would not be a manifestation of expressive learning?

a. Producing the correct name, when cued with a picture

b. Pointing to the correct object, when provided with a name

c. Providing a definition, when provided with a name

d. Producing the correct native-language translation equivalent for a foreign word

5. Which of the following would not be an implication of the functional analysis presented in the article?

a. The factors that facilitate expressive language learning must necessarily be the same as those that facilitate receptive learning.

b. Fast mapping is the same for expressive and receptive learning.

c. Word learning is a unitary process, without identifiable subcomponents.

d. It is possible to learn just a word form (such as supercalifragilisticexpialidocious) even without an associated meaning

Understanding Word Learning by Preschool Children: Insights From Multiple Tasks, Stimulus Characteristics, and Error Analysis

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Lexical acquisition occurs rapidly and with relative ease in typically developing children. Children can form an initial representation of a novel word following only a single exposure (e.g., Dollaghan, 1985). The number of root words known increases from approximately 3,500 at the beginning of kindergarten to about 6,000 at the end of second grade (Biemiller, 2001; Biemiller & Slonin, 2001).

While there is clear evidence that children learn words rapidly, what remains to be discovered is how children are able to accomplish this complex task so effortlessly. To learn a word, a child must store in memory two types of representations—semantic and word form—as well as the links between them (see Gupta, this issue). The *semantic representation* refers to the meaningful information regarding a referent (e.g., "a toothed strip of rigid material for arranging the hair" for "comb"). A *word form representation* refers to the combination of sounds as a whole sequence and constitutes the word form (e.g., /koUm/ for

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"comb"; Vitevitch & Luce, 1999). Moreover, children may capitalize on known phonological representations to support word learning. A *phonological representation* refers to the individual sounds of the language (e.g., /k/ /oU/ /m/ in "comb"). Gupta formalizes these levels of word learning in his functional framework. Here we extend the framework to children, examining groups of typical learners and learners with phonological delays. In addition, we illustrate how using multiple tasks, manipulating the stimulus characteristics of the words to be learned, and analyzing errors can provide a window into the formation of each type of representation.

Multiple Tasks

A series of tasks can be used to examine the formation of phonological, word form, and semantic representations during word learning by preschool children (Storkel, 2001, 2003, 2004; Storkel & Maekawa, in press). For example, children are exposed to nonwords paired with novel objects in a story narrative. Learning of the novel words is repeatedly tested as the story unfolds through three tasks: referent identification, form identification, and picture naming. In *referent identification*, children are shown three novel objects from the story. A nonword is presented auditorially and the child is asked to select the referent of the nonword by pointing to one of the three pictures. The presentation of the nonword may activate the child's word form representation. The word form representation then activates the appropriate semantic representation via the receptive link, allowing the child to select the correct picture. This task taps the receptive link and the semantic representation itself.

In *form identification*, children are shown a picture of one novel object followed by the sequential presentation of three auditory nonwords. In some studies, nonwords are paired with a colored square, whereas in other studies nonwords are paired with a picture of the target object (i.e., three pictures of the same object). The child's task is to select the correct nonword name of the picture. Presentation of the picture presumably activates the child's semantic representation, which activates the word form representation via the expressive link, allowing the child to correctly select the target nonword. This task provides a window into the status of the expressive link and the word form representation.

Finally, *picture naming* requires children to spontaneously produce a trained nonword upon presentation of the corresponding referent. This task, like form identification, is thought to activate the child's semantic representation, in turn activating the word form representation via the expressive link. However, picture naming provides more detailed information about the child's word form representation than does form identification, because a complete and accurate representation of the word form is needed to correctly produce it, whereas an incomplete representation could be sufficient to support correct selection of the appropriate nonword during form identification.

Stimulus Characteristics

In addition to the use of multiple tasks, the phonological and word form characteristics of nonword stimuli, namely phonotactic probability and neighborhood density, can be manipulated (Storkel, 2001, 2003, 2004; Storkel & Maekawa, in press). *Phonotactic probability* is a phonological characteristic and refers to the likelihood of occurrence of a sound sequence in a language (Vitevitch & Luce, 2004). Words can be composed of either common sound sequences or rare sound sequences. Common sound sequences (e.g., *sit*) contain individual sounds that occur in many other words in the same position and sound sequences that co-occur in many other words of the language. On the other hand, words composed of rare sound sequences (e.g., *these*) contain combinations of sounds that co-occur infrequently.

Neighborhood density is a word form characteristic and refers to the number of words that are phonologically similar to a given word, differing by only one phoneme (Luce & Pisoni, 1998). Words can reside in dense neighborhoods, having many neighbors (e.g., neighbors of *sit* include *bit, hit, sat, seat, sip*, and many more), or sparse neighborhoods, having few neighbors (e.g., neighbors of *these* include *cheese, peas, fees, those, ease*, and a few others).

Common sound sequences tend to have many neighbors, and rare sound sequences tend to have few neighbors. Thus, past studies have typically manipulated these variables in tandem. Manipulation of these characteristics provides evidence of how known phonological and word form representations influence the creation of new word form and semantic representations during word learning. That is, word learning depends on the other sounds and words that the child already knows, and how the new word relates to these existing words may influence the speed of learning.

Error Analysis

Another way to assess the formation of underling representations is by analyzing the errors made by children across word learning tasks (Storkel, 2001, 2003, 2004; Storkel & Maekawa, in press). Error analysis is based on the hypothesis that knowledge is gradient, rather than all-or-none (Capone & McGregor, in press). Therefore, when a child fails to select the correct answer in a particular task, he

or she may have partial knowledge (i.e., an incomplete representation) or no knowledge (i.e., no representation) of the new word. For example, in the referent identification task, the pictures presented to the child aid in determining the status of the semantic representation. One picture is the target object (e.g., a medium-sized purple pet with big ears), one is a semantically related object (e.g., a small green pet with antennae), and one is a semantically unrelated object (e.g., a machine that dispenses red candy balls). If the child selects the semantically related object, then this suggests that the child has only learned the general semantic category of the object, indicating a holistic representation. In contrast, if the child selects the semantically unrelated object, then the child's semantic representation may be nonexistent, highly impoverished, or inaccurate because the child has not yet stored even basic semantic information about the referent of the target nonword.

Turning to form identification and picture naming, errors reveal the status of both the target and the substituted nonword. For example, if the child is shown a picture of one pet (e.g., a medium-sized purple pet with big ears named /φɛIπ/) but responds with the name of the other pet (e.g., a small green pet with antennae named /κoYϕ/), then this would be a semantic error. In this case, the child has a holistic representation of the target referent and has only associated one word form representation (e.g., /κoYϕ/) with it. Thus, the word form representation of the target word may be holistic or impoverished and/or lack an expressive link, whereas the word form representation of the substituted word would be intact and have an expressive link to the holistic semantic representation. In contrast, if the child sees one pet (e.g., a medium-sized purple pet with big ears named /φɛIπ/) but responds with the name of an unrelated object (e.g., a machine that dispenses red candy balls named /μIδ/), then this would be an unrelated error. Here, the child may have an impoverished semantic or word form representation of the target. The substituted word would be viewed as having an impoverished semantic representation and/or expressive link, but an intact word form representation because the child is able to produce the nonword.

Typically Developing Preschoolers

Storkel (2001) provides an example of how multiple tasks, manipulation of stimulus characteristics, and error analyses can reveal the complexities of word learning. Storkel examined noun learning by presenting preschool children with eight nonword-novel referent pairs embedded in the context of a children's story. Learning was tracked periodically using the three previously described tasks. In addition, the characteristics of the nonwords to be learned were manipulated with half of the nonwords being common/dense sound sequences and half being rare/sparse sound sequences. Errors were analyzed in each task to determine which representations were vulnerable to failure during learning.

Multiple Tasks and Stimulus Characteristics

Analysis of correct responses in the referent identification task showed that referents of common/dense sound sequences were identified more accurately than those of rare/sparse sound sequences. Therefore, phonotactic probability/neighborhood density affected the formation of semantic representations and receptive links. Analysis of the form identification data showed that common/dense sound sequences were identified more accurately than rare/sparse sound sequences. Phonotactic probability/neighborhood density appeared to influence the formation of a word form representation and an expressive link. Finally, on the picture naming task, children named common/dense sound sequences more accurately than rare/sparse sound sequences, proving further support that phonotactic probability/neighborhood density influenced word form representations. Therefore, phonotactic probability/neighborhood density appeared to have a global effect on word learning. Manipulation of stimulus characteristics lead to the additional insight that known phonological and word form representations influence how children learn words. Specifically, novel words that are similar to many other known words (i.e., common/dense) are learned more readily than those similar to few other known words (i.e., rare/sparse).

Error Analysis by Task and Stimulus Characteristic

In addition to the analysis of the correct responses across tasks, the errors made by children in each task were analyzed as another method of determining how phonotactic probability/neighborhood density influenced the formation of word form and semantic representations. On the referent identification task, there were more semantic errors made for common/dense than rare/sparse sound sequences. This suggests that when the target referent was similar to many other words, children were able to glean the general semantic features of the referent. In complement, children made more unrelated errors for rare/sparse than common/dense sound sequences during referent identification. Thus, when nonwords were similar to few other words, children were unable to retain even the most general semantic features. Taken together, nonwords composed of rare/sparse sound sequences were more vulner-

able to the formation of weak semantic representations than nonwords composed of common/dense sound sequences.

The results of the error analysis for the form identification task mirrored those of the picture naming task; therefore, only the picture naming errors are described here. When a child saw the referent of a rare/sparse sound sequence s/he tended to respond with the common sound sequence name of the semantically related referent. This shows that the child was able to create a holistic semantic representation of a rare/sparse nonword, by retaining the feature of semantic category membership but was more apt to create an expressive link to the word form representation of the common/dense nonword rather than the target rare/sparse nonword. Analysis of the unrelated errors on the picture naming task suggested that, regardless of the phonotactic probability of the target nonword, children tended to produce a word that was composed of a rare/sparse rather than a common/dense sound sequence. This suggests that children may have an accurate and detailed word form representation of rare/sparse nonwords but lack a correct expressive link.

Therefore, the creation of an expressive link for rare/sparse sound sequences appeared especially vulnerable to failure.

Populations With PD

This approach from Storkel (2001) also has been applied to clinical populations of children, namely children with phonological delays (PD). Given the nature of their impairment, manipulation of phonological and word form characteristics may not lead to the same effects on word learning in children with PD as compared to their typical peers. Children with PD may not rely on phonological or word form representations in the same way as their typically developing peers when learning new words.

Storkel (2004) manipulated the phonotactic probability/neighborhood density of the nonwords and analyzed both correct and error responses. Multiple tasks were used, but the picture naming results were the most revealing. The results showed that children with PD learned a similar number of words as their typical peers but different types. Specifically, children with PD showed a rare/sparse advantage when learning new words. This is the opposite pattern from typically developing children. Moreover, error analyses revealed that when children with PD were shown the picture referent of a common/dense sound sequence, they primarily responded with an unrelated rare/sparse sound sequences. Likewise, children with PD infrequently produced common/dense sound sequences. Thus, children with PD learned different words than typically developing children because of difficulty creating a link and a word form representation of common/dense sound sequences. Because of their weak phonological representations, children with PD may not have been able to differentiate common/dense novel words from other phonologically similar known words. This may have lead to confusion between the novel word and other known words, impeding acquisition.

Clinical Implications

The results of Storkel (2001, 2004) highlight a variety of methods that can be used to gain knowledge of the formation of word form and semantic representations in children with typical language and in those with PD. These results suggest that word learning abilities may differ between these two populations. Importantly, children with PD scored within normal limits on standardized vocabulary tests, suggesting that these tests may be insensitive to differences in word learning (Dollaghan & Campbell, 1998). Current clinical diagnostic methods allow one to determine only the quantity of known words, rather than the representations that are vulnerable to failure during word learning. This is particularly important when planning treatment so that intervention can be directed towards the child's critical weakness. Assessment may be enhanced by incorporating additional diagnostic methods previously used solely in research settings. For example, Perdue and Storkel (2004) have examined the stimulus characteristics of several standardized vocabulary tests and have used this information to create a specially designed vocabulary probe that might allow identification of the types of words that are difficult for children to learn. Furthermore, tasks that are more sensitive to the process of word learning are being examined. Specifically, we are manipulating stimulus characteristics of items in a complex working memory task (Hoover & Storkel, 2005). The use of working memory measures has been found to be beneficial over standardized vocabulary tests, given their ability to detect differences in the process of word learning (Dollaghan & Campbell, 1998) and to reduce cultural bias (Rodekohr & Haynes, 2001). Clinicians may need to consider supplementing standard diagnostic practices with some of these newer techniques. To begin, clinicians may explore the manipulation of stimulus characteristics at the following Web sites: (a) phonotactic probability http://www.people.ku.edu/%7Emvitevit/PhonoProbHome.html; (b) neighborhood density http://128.252.27.56/neighborhood/Home.asp.

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Continuing Education Questions

1. What aspect of language does phonotactic probability represent?

a. Morphology
b. Syntax
c. Phonology
d. Semantics

2. Given the effect of phonotactic probability/neighborhood density on word learning in children with typical language development, which of the following patterns is true?

a. Common/dense sound sequences are learned more easily than rare/sparse sound sequences in all tasks.
b. Rare/sparse sound sequences are learned more easily than common/dense sound sequences in all tasks.
c. Common/dense sound sequences and rare/sparse sound sequences are learned at the same rate in all tasks.
d. The effect of phonotactic probability varies by task

3. Given the effect of phonotactic probability/neighborhood density on word learning in children with phonological delays, which of the following patterns is true?

a. Children with phonological delays learn new words the same way as typically developing children.
b. Common/dense sound sequences are learned more easily than rare/sparse sound sequences in all tasks.
c. Rare/sparse sound sequences are learned more easily than common/dense sound sequences in all tasks.
d. Common/dense sound sequences and rare/sparse sound sequences are learned at the same rate in all tasks.

4. Analysis of unrelated errors in referent identification allows one to assess the formation of

a. phonological representations.
b. both lexical and semantic representations
c. lexical representations.
d. semantic representations.

5. Standardized vocabulary tests can be used to assess

a. the quantity of words known by children.
b. the types of words known by children.
c. how children learn new words.
d. phonological, lexical, and semantic representations.

Learning Prepositions

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According to the framework presented by Gupta (in this issue), semantic learning involves, in part, the extension of labels to new, relevant exemplars of a category. Thus, in the process of subsequent encountering with a word, a child refines or augments the semantic representation and comes to know, for example, that the word *car* applies to all makes and models, not just the vehicles mom and dad drive. However, most of the data on children's extension of word meaning are based on research about noun learning in typically developing children. Here, I too focus on typical learners, but ask whether the proposed framework can be extended from nouns to the word class of spatial prepositions like *in*, *on*, and *under*.

Prepositions

One reason why prepositions might be acquired differently from nouns is their particular relationship to cognitive processes. The acquisition of spatial prepositions is related to conceptual development —concepts formed on the basis of children's experiences in space (Halpern, Corrigan, & Aviezer, 1983; Johnston, 1988; Johnston & Slobin, 1979; Thiel, 1985). Hespos and Spelke (2004) report that the concept for containment seems to be formed very early in development, around 5 months of age. Consider, thus, the following argument: If we admit that the "lexical competence" (Parisi & Antinucci, 1970, p. 197) of a spatial preposition involves knowledge of the affiliated spatial relation, then the meaning of a preposition would be the content of a corresponding concept. Thus, if children already have a spatial concept of, for example, containment due to their experience in space, they would have only to map the corresponding label, the preposition *in*, to the concept (Johnston & Slobin, 1979).

In the last 20 years, however, the direct correspondence between the concept of a spatial relation and the meaning of a spatial preposition has been challenged by cross-linguistic data. Bowerman and Choi (2003) pointed out crucial language-specific differences in categorization of space. While in English, for example, to put a book in a bag or to put a cassette in its case is categorized as the same relation *in*, in Korean, these events are categorized differently; putting a book in a bag is termed NEHTA (put X loosely in, or around, Y), while putting a cassette tightly into its case is KKITA (put X in a tight-fit relation with Y). Moreover, KKITA also describes *tight-on*-relation, like "putting a pen top on a pen." In a cross-linguistic comparison, children of every age group classified space significantly more like adult speakers of their own language than like same-age children learning other languages. Thus, the meaning of a spatial preposition cannot simply be mapped onto preexisting spatial concepts; rather, it is formed in interaction with the semantic structure of the language being acquired.

If, however, the meaning of a word—as it is proposed in Gupta's approach—is expanded and refined over time, then there is a possibility that early stages of a word meaning might be influenced by conceptual processes, whereas the more advanced stages of lexical knowledge might result from a greater interaction with the semantic structure of the target language.

To get more insight into the development of the semantics of spatial prepositions, Rohlfing (2001) investigated children's lexical knowledge about the Polish preposition *na* (*on*) and focused on their ability to extend their understanding of the preposition to new situations. Extension implies some refinement of the initial word-to-referent mapping (Carey, 1978; McGregor, 2004). In Rohlfing (2001), extension was tested by presenting toddlers (ages 20 to 26 months) with two types of situations in which they were instructed to relate two objects in an *on*-relation. In a familiar situation, objects and toys were used that the infants knew from their everyday lives; in the unfamiliar situation, children were presented with a novel wooden construction. The wooden construction addressed the need to use "neutral objects" (Grieve, Hoogenraad, & Murray, 1977, p. 247) and consisted of two geometrically shaped objects covered with Velcro®. The two objects were an interchangeable landmark object (cube, shelf, sphere) and a mobile ball that could be attached to each of the landmarks in an *on-*, *under-* or *behind*-relation. It was assumed that in this unfamiliar situation, children have to abstract the geometric features of an *on*-relation and apply them to the objects given. Such abstraction constitutes evidence of decontextualized word knowledge.

The results were that the toddlers understood instructions containing the spatial relation *na* (*on*) in the familiar situation, but not in the unfamiliar situation. It could, therefore, be concluded that 20- to 26-month-olds struggle with the decontextualization of some aspects of a word meaning and rather apply co-linguistic strategies in order to follow instructions containing locative prepositions (Paprotté, 1979).

Co-linguistic Strategies

Originally, Clark (1973, p. 168) suggested the term "non-linguistic strategies" to characterize children's incomplete semantic knowledge about spatial prepositions and to highlight that children are more sensitive to context than to linguistic utterances. Crucial information from the context might be, for example, the physical property of an object that appeals to the child's perception and provokes a certain type of behavior. Clark observed that, regardless of the linguistic instruction, if an object includes a surface (e.g., a table), children are more inclined to put something (e.g., a toy dog) on this surface. If the object is a container, children will put something inside it.

Wilcox and Palermo (1974) as well as Johnston (1988) and Grieve and colleagues (1977) pointed out that childrens' understanding is influences by not only objects' perceptual appearance but also by children's sociocultural experience with objects. Recently, Coventry, Prat-Sala, and Richards (2001) identified that functional relations between objects include knowledge of how objects typically function (their canonical function) and knowledge of how objects can function (noncanonically) in context (see also Freeman, Lloyd, & Sinha, 1980; Richards, Coventry, & Clibbens, 2004). For example, it is canonical for cups to go *on* tables but the noncanonical relationship, such as a cup *under* a table, is possible as well. Canonicality is strictly linked to the familiarity of objects. If an object is familiar, its canonical function and appearance are known. Along the same lines, Casasola and Cohen (2002) found that infants recognize relationships between familiar objects prior to novel objects.

A true test of such sociocultural influences on the learning of locative meanings would be the occurence of age-of-attainments that vary from culture to culture. A study by Jensen de López (2002) provides precisely that. In the Zapotec culture, baskets are used to cover food or in children's games to catch something, so that the objects are more frequently *under* than is typical of western cultures. In a task, in which an *under*-relation was required, Zapotec-speaking children (ages 17 to 46 months) performed better than Danish-speaking children of the same age (in Danish, locative particles are semantically similar to spatial terms in English).

The Case of Under

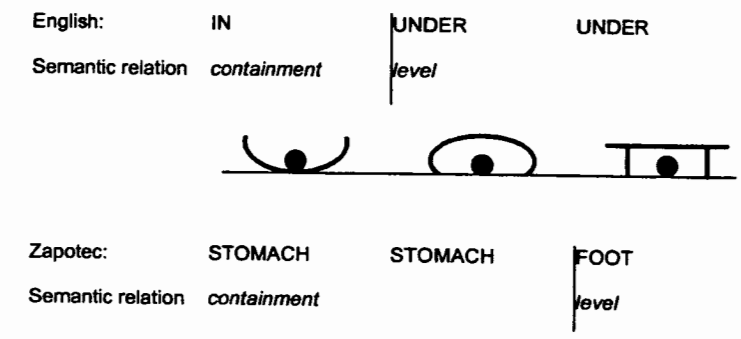
One phenomenon that illustrates the correlation between perceptual and sociocultural salience on the one hand and linguistic salience on the other is order of acquisition; specifically, *in* and *on* are acquired before *under*. This phenomenon has been reported cross-linguistically (Clark, 1973; Grieve et al., 1977; Halpern et al., 1983; Paprotté, 1979; Savic & Andjelkovic, 2005; Thiel, 1985; Wilcox & Palermo, 1974).

Imagine a child between 20- to 26-months-old with a small toy dog and a toy table in front of her. The child then hears "Put the dog under the table." Many children of this age will put the dog *on* the table as if they could not understand the preposition *under*. Co-linguistic strategies may be responsible for this behavior. A good example is the *on*-relation, because the way that objects behave in the *under*-relationship is constrained by gravity (Johnson, 1998). In this sense, by the geometry of the *on*-relation, children can easily discern the function of support, which in turn can simply be tested by whether an object is supported by another or not. The function is even easier to discern in the case of a container relationship (as the meaning for *in*), where the hollow space establishes the crucial physical feature and the motion of one object will induce a parallel motion in the other object. *In* and *on* might, therefore, belong to a "limited subset of the most cognitively and semantically simple locative particles" (Sinha, Thorseng, Hayashi, & Plunkett, 1999, p. 102). In learning spatial words, then, children gradually extend their repertoire to include cognitively and semantically more complex ones, such as *under*.

Yet, the Zapotec data reveal another reason for the late acquisition of *under* in languages such as English, Polish or German. As can be noticed in Figure 1, a single containment-relation in Zapotec is relevant for the semantics of English and Polish terms for *in* and *under* in those cases in which the trajector is inaccessible to perception. This containment-relation is expressed in Zapotec by a single word *láani* (Jensen de Lopez, 2002) and is glossed with the English term *stomach* (Sinha & Jensen de López, 2000, p. 23).

Thus, in comparison to Zapotec, the relation *under* in English as well as the Polish POD com-

Figure 1. Differences in categorizing the spatial relation UNDER in English and Zapotec.



bines "some aspects of both the basic container-contained and bearer-burden relation [...], which receive canonical marking by respectively in and on" (Sinha et al., 1999, p. 109). It is plausible to assume that this polysemy (i.e., multiple meanings captured by the same word) in languages such as English or Polish makes the semantics of *under* more complex to process (see also Halpern et al., 1983). This polysemy is resolved in Zapotec. In Figure 1, the crucial distinct relationship is depicted in the middle. While in Zapotec it is still regarded as a containment, it is already categorized as a level in English (also in Polish), even though some objects do not have a hollow space (like a coin).

Can the easier prepositions *in* and *on* be used systematically to resolve or weaken the polysemy involved in *under* and to facilitate its acquisition? *In* and *on* would not only have the potential of being conceptually basic for *under;* when contrasted with *under* during the mapping process, they may enable establishment of a richer representation of the meaning of *under* in the mental lexicon. In the work by McGregor and her colleagues (McGregor, Sheng, Graham, Grohne-Reilly, & Keegan, 2004), for example, enriched semantic information is reported to facilitate the receptive linking of word form to referent.

A training study (Rohlfing, in press) was designed to investigate the question whether a systematic use of *na* (*on*) and *do* (*in*) facilitates the acquisition of the Polish preposition *pod* (*under*) by children ages 20 to 26 months. Children were assigned to one of four learning groups: the *under-on* group, in which the new *under*-relation was introduced by contrasting it with the *on*-relation (e.g., Look, the dog is under the table, not on.); the *under-in* group, in which the experimenter explained the *under*-space by referring to it as a hollow space and using the *in*-relation (e.g., Look, the dog is in the hole, under the table.); the *under* group in which the experimenter explained *under* without reference to any basic relation (e.g., Look, the dog is under the table.); and, finally, the control group who played with the same toys during the training sessions, but did not receive any instructions. Given the hypothesis that introducing and simultaneously explaining the *under*-relation in terms of the basic relations (*in* and *on*) will facilitate learning, it was predicted that children should be more responsive to linguistic training when input includes these basic relation terms.

Given that word knowledge is gradient, learning was assessed within subjects in three types of situations: (a) a familiar situation with familiar, trained objects, (b) a transfer situation with familiar, untrained objects, and (c) an unfamiliar situation with geometrically shaped novel objects as described above; the latter two situations allowed measurement of the children's extension of the learned label. Learners were predicted to perform best in situations that involved familiar objects in trained relationships.

Gradient Learning

As predicted, the best performance in understanding *pod* (*under*) was achieved in the familiar trained situation. Thus, children at the age studied are most sensitive to recurrent situations, and their understanding is based on concrete interactions with objects. With reference to the effect of facilitation in acquisition of *pod* (*under*); however, no differences were found between the different learning groups in the familiar situation. It was, therefore, concluded that the process of mapping was neither hindered nor facilitated by providing additional semantic information in terms of *na* (*on*) and *do* (*in*). This finding illustrates the robustness of the child's fast mapping ability; even with minimal learning context, most children demonstrated mapping of a new word to a trained object relationship.

A more challenging task for the children was to extend their understanding of *under*-relation to new objects in contrast to their performance in the familiar trained situation. In the situation with familiar but untrained objects, the learning effect of the group which received only the preposition *pod* (*under*) without additional semantic information was moderate. In comparison, the other trained groups, those who witnessed *under* contrasted with either *in* or *on*, were better able to extend the preposition to familiar objects in the untrained situation.

No group demonstrated learning as tested in the unfamiliar situation with geometrically shaped novel objects. Presumably, the ability to demonstrate knowledge of *under* in a situation so devoid of contextual cues would require additional slow mapping development.

In addition to a statistical analysis, the consistency in children's performance was analyzed by determining how many children scored more than 50% of correct answers in the familiar situation and how many in a transfer situation. With the exception of one child, children demonstrated understanding of *under* in the transfer situation only if their performance in the familiar situation was outstanding as well. This suggests that the process of extending a word is dependent upon a successful fast-mapping process and further illustrates the gradient nature of semantic knowledge.

The competence to abstract the meaning of *on* and to apply it to a novel context seems to change dramatically within a few months. In a pilot study with 8 children who were 28 months old, 71% of the participants could specify the location on the novel sphere according to the preposition *on* and 100% could specify the location under the

sphere in their response to an instruction with the preposition *under*.

In conclusion, similar to nouns, several processes underlie learning spatial prepositions: (a) mapping a learned label to a given referent and (b) extending a learned label to new relevant exemplars of the referent, with the latter building upon the former. Additional semantic information, as was exemplified by contrasting *under* with *on* and *in*, seems to facilitate the extension process. Since the co-linguistic strategies described above contribute crucially to the early stage of children's lexical knowledge, they have to be considered in assessing the extent of the child's word learning. Gradient knowledge can be tapped by varying the canonicality of objects and the familiarity of the situation used to measure learning. Clinicians should keep in mind that comprehension of canonical objects and object relationships in familiar settings is only the first step towards the child's deeper appreciation of word meaning.

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Word Learning by Preschoolers With Specific Language Impairment

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The prevalence of specific language impairment (SLI) in young children is approximately 7%, with more boys diagnosed than girls (Tomblin et al., 1997). In addition to problems acquiring morphology and syntax, many children with SLI have difficulty learning to comprehend and to produce new words. Their initial vocabulary growth is often slower than that of normally-developing peers (Paul, Hernandez, Taylor, & Johnson, 1996; Rescorla, Roberts, & Dahlsgaard, 1997), and their vocabularies contain a limited variety of words (Watkins, Kelly, Harbers, & Hollis, 1995). This is illustrated by performance on norm-referenced vocabulary tests. SLI groups frequently score significantly lower than age-matched groups with normal language (NL) on both receptive and expressive measures (e.g., Gray, Plante, Vance, & Henrichsen, 1999).

Continued on page 18

Continuing Education Questions

1. What is children's task in learning a spatial preposition?

a. To map a preposition onto the corresponding concept of a spatial relation

b. To pick up the prototypical core-meaning which consists of the geometric feature of the relation and additional derivational rules for deviating cases

c. To let the conceptual knowledge about a corresponding spatial relation interact with the semantic structure of language being acquired

d. To increase the use of verbs before the use of nouns in their lexicon

2. Which prepositions are acquired before *under*?

a. *In* and *on*

b. *On* and *next to*

c. *Next to* and *in front of*

d. *In back of* and *in front of*

3. Additional information about the relations *in* and *on* facilitates the acquisition of *under*

a. only in a familiar situation with well-known objects.

b. only in a transfer situation with new objects.

c. only in an unfamiliar situation with artificial objects.

d. only in an unfamiliar situation with real objects.

4. Which factor contributes to a co-linguistic strategy?

a. Sociocultural salience of a relationship

b. Syntactic simplicity of instructions

c. Morphologic simplicity of the relational term

d. Phonologic accuracy of the children's utterances

5. What does the term "co-linguistic strategy" refer to?

a. Children's preference for syntactic simple instructions

b. Children's preference for morphologic simple relational terms

c. Children's sensitivity to non-linguistic factors such as sociocultural salience of a relationship

d. children's rapport with others in their environment

6. When do children show the ability to abstract geometric features of a spatial relation (i.e., to decontextualize the meaning of a spatial preposition)?

a. At the age of 24 months

b. At the age of 26 months

c. At the age of 28 months

d. At the age of 36 months

SLI

Continued from page 17

Because of its negative impact on oral language, literacy development, and academics, it is important to identify the deficits that underlie poor lexical acquisition in children with SLI and to develop effective treatments. One approach is to evaluate word learning as it occurs, during the initial stage known as "fast mapping" and as children are taught words in dynamic contexts. Depending on how learning is measured, such an approach *permits* assessment of word form representation, semantic representation, and the receptive and expressive links described by Gupta (in this issue).

Clinical Research

In our lab, we have conducted a series of studies teaching novel words to children with SLI and to age- and gender-matched peers with NL in a "supported learning context." This approach uses instructional techniques similar to those used in language therapy. The researcher provides repeated models of new words in daily teaching sessions for 4 days, provides feedback to the child about accuracy of response, and encourages ongoing adult-child interaction during play with toys. Children are asked to imitate the new words and are prompted to produce them.

In an initial study, we evaluated whether 30 preschoolers with SLI learned fewer words than 30 age- and gender-matched peers with NL when three novel words were taught in a supported learning context (Kiernan & Gray, 1998). We assessed receptive recognition (comprehension) of new words three times each session by asking children to identify the correct referent when given its name. To answer correctly, the child would need a word form representation, semantic representation, and a receptive link between them for each new word. We also assessed expressive recall (production) three times each session by asking children to name the referent. Like receptive recognition, the child would need word form and semantic representations of the word and an expressive link between them to answer correctly. We found that the majority of children with SLI learned to comprehend as many words as the NL group, but learned to produce significantly fewer words. Why might this be? Children had already stored word form and semantic representations, plus a receptive link between them, as demonstrated by successful comprehension. Perhaps production requires a "stronger" or "more elaborated" word form and/or semantic representation than comprehension. Another possibility is that the expressive link between those representations was not sufficiently developed in children with SLI. In either case, it did not appear that the SLI group could not create word form or semantic representations, but that more exposures to the words may be required before the quality of representations or expressive links was sufficient to support production.

In the Kiernan and Gray study (1998), some children with SLI appeared to be successful word learners; therefore, we were interested in identifying the skills that predicted word-learning success. One candidate skill was fast mapping ability, a term coined by (Carey, 1978) to describe the ability to hear a word once or twice and to store enough information about it so that future phonological, semantic, syntactic, and nonverbal experiences elaborate its stored representation. In Gray (2003), we added a fast-mapping task prior to teaching words in a supported learning context. Thirty preschool children with SLI and 30 age- and gender-matched controls participated. During the fast-mapping portion of the experiment, we introduced four novel words used as names for objects. To encourage participation, we also included four objects that children could already name. During a single fast-mapping session, children heard the names of the objects modeled three times. Three probes that assessed receptive recognition (comprehension) and three that assessed expressive recall (production) were interspersed with the models.

The SLI and NL groups did not differ significantly in the number of correct responses made to either comprehension or production probes. Both groups made significantly more correct responses to comprehension than to production probes, and both produced few object names. As in the previous study, these results suggested that the *SLI* group could create word-form and semantic representations and link them receptively. However, the NL group went on to comprehend and to produce significantly more words than the SLI group in the word-learning portion of the study. Further, they reached criterion for word-learning comprehension and production in fewer trials than the SLI group, suggesting that they were more efficient "elaborator" of stored word form and/or semantic information.

Interestingly, language test scores did not predict word-learning performance for either group; however, fast-mapping performance predicted a small, but significant, amount of word-learning variance. Clinically, an important finding from this study was that some children with SLI required twice as many exposures to new words as their NL peers before comprehending them and twice as many additional exposures before producing them.

Because it appeared that children with SLI had difficulty creating and/or retrieving word form and semantic information, Gray (2004) investigated whether phonological memory or semantic word knowledge predicted word-learn-

ing success and whether performance on these measures could help identify poor learners. Twenty preschoolers with SLI and 20 age- and gender-matched children with NL participated.

Unlike the previous study, the NL group produced significantly more correct responses to receptive recognition probes than the SLI group on the fast mapping task. As in the previous study, no significant between-group differences were found for production, with both groups producing few words and both performing better on receptive recognition than expressive recall probes. These results suggest that the limited number of exposures provided during the fast-mapping task were insufficient to allow children with SLI to create word form and/or semantic representations and/or the links between them to support comprehension, and insufficient for both groups to support production. In the word-learning portion of the study, the NL group learned to comprehend and to produce significantly more words than the SLI group, and they did so in fewer trials.

The strongest predictor of children's fast-mapping receptive recognition and expressive recall was their existing vocabulary as measured by Peabody Picture Vocabulary Test–Third Edition (PPVT-III; Dunn, Dunn, & Williams, 1997) scores. The same was true for the number of words they learned to comprehend during the word-learning portion of the study; however, performance on the Structured Photographic Expressive Language Test–II (SPELT-II; Werner & Krescheck, 1983) was the best predictor of word-learning production. This test primarily assesses expressive grammatical morphology and syntax. The SPELT-II has been shown to accurately discriminate preschoolers with SLI and NL (Plante & Vance, 1994, 1995) and thus may serve as an index of language impairment. As we had expected, our measure of phonological memory, a nonword repetition task (Dollaghan & Campbell, 1998), predicted a significant amount of word-learning performance of children with SLI, suggesting that they were having difficulty creating word form representations.

By analyzing individual and group performance, we found that 30% of the children with SLI learned as many words as the NL group, 30% performed similarly to their SLI peers, and 35% were considered poor learners relative to their SLI peers. We also found that fast-mapping performance could help to identify poor word learners. Every poor learner in this study scored below the SLI group mean for the number of correct responses to receptive recognition and expressive recall probes on the fast-mapping task. With one exception, every poor learner in this study also scored below the SLI group mean on the PPVT-III; however, this mean score was within the normal range for that test. To use PPVT-III scores as a possible identifier would require clinicians to calculate mean scores representative of SLI groups in their area. These data could be collected from ongoing assessments or children's performance might be compared to data reported in the test manual for language-impaired groups.

We adapted a drawing task developed by McGregor and Appel (2002) to assess children's referent learning paired with receptive recognition. Children were asked to draw the objects they were learning to name after completing the fast-mapping task and again at the end of the word-learning portion of the study. Overall, poor learners appeared to create strong enough word-form and semantic representations of the objects to permit children to draw them and to comprehend their names, but they had difficulty producing the names.

Because many children with SLI had difficulty creating, storing, and/or retrieving phonological and semantic information in this study, Gray (in press) investigated whether phonological or semantic cues, presented immediately after new words were modeled, would promote better word learning for children with SLI. We hypothesized that phonological cues could strengthen the initial phonological representation of words and that semantic cues could facilitate creation of semantic representations. Twenty-four preschoolers with SLI and 24 age- and gender-matched children with NL participated in fast-mapping and word-learning experiments. Phonological and semantic cues were not presented during the fast-mapping portion of the study. Each child learned one set of four words in the semantic condition and a different set of four words in the phonological condition. Semantic cues provided information about the object's superordinate category, physical characteristic, action/use, parts, or association. Phonological cues provided the word's initial sound, initial syllable, the word produced by syllable, or a rhyming cue.

For fast mapping, between-group differences were significant for both receptive recognition and expressive recall for 5-year-olds, with the NL group outperforming the SLI group, but significant between-group differences were not found for 4-year-olds. This raises the possibility that the ability to create word form and semantic representations of new words and/or the links between them increases at a faster rate for children with NL than children with SLI during the preschool years. Both groups had difficulty producing words during the fast mapping task.

For the word-learning portion of the study, the NL group comprehended more words than the SLI group and, as in previous studies, was at ceiling, suggesting that receptive recognition was easy for them. The SLI group comprehended

more words in the semantic than the phonological condition. We hypothesize that the semantic cues helped children with SLI strengthen the links between phonological and semantic representations, resulting in more accurate responses. We further hypothesize that because the word form was provided during comprehension probes, phonological cues were less useful than semantic cues for comprehension.

On average, the NL group learned to produce three more words than the SLI group. In contrast to comprehension findings, the SLI group learned to produce more words in the phonological than the semantic condition. We hypothesize that phonological cues helped the SLI group maintain the new words in working memory, resulting in the creation of more stable word-form representations. This made successful retrieval and production more likely.

As in previous studies (Gray, 2003, 2004; Kiernan & Gray, 1998), a proportion of the SLI group learned as many words as their NL peers, but more than half were considered to be "poor learners." Their mean SPELT-II scores were lower than normal learners' scores, but their individual scores overlapped normal learners' scores, reducing our ability to accurately identify poor learners.

Clinical Implications

Some good news follows from this series of studies. Preschoolers with SLI are capable of fast mapping and many can learn new words successfully in a supported learning context. The more challenging findings are that many children with SLI (and a few with NL) are poor word learners, even in 1:1 teaching situations, and they are not easily identified.

What should clinicians, parents, and teachers do? First, realize that children with SLI approach word learning with limited language processing resources; therefore, teaching objectives must be prioritized. With input from the Individual Education Plan, clinicians should take a lead in choosing and tracking key vocabulary that teachers, parents, and the clinician will work together to teach. Target lists should comprise words from all word classes that are important for oral language, literacy, and academic development. In our experimental contexts, normally developing children learned four new words per week quite easily, but four words per week were a challenge for children with SLI. Your data will help you decide how many new words to teach each week for a particular child.

Second, choose vocabulary that the child does not already know. Do not rely on vocabulary tests for this information. Rather, create situations where the child should use the key vocabulary and see if they do. Follow the same procedure to determine whether your teaching has been effective. Third, vocabulary teaching must be planned and explicit, with new words embedded in language rich, meaningful contexts such as books, dramatic play, conversation, and directed teaching activities. Help the child focus attention on the phonological and semantic characteristics of new words during these activities. Fourth, repetition is critical. Until we have robust data showing that particular teaching techniques such as phonological or semantic cueing are effective in large populations, multiple exposures to new words in rich semantic contexts, paired with multiple opportunities to *say* those new words, is the most promising approach. Recall that in our studies, children with SLI required twice as many exposures as children with NL to develop word-form and semantic representations, then twice as many again before they produced the words. Those children were hearing and repeating the new words 24 times a day. Children on your caseload will not have the same learning opportunity unless everyone knows the words you are teaching and intentionally chooses activities to encourage their use. This means that target vocabulary should be included in lesson plans, and there should be an efficient means of keeping the words visible. One method that seems to work in the preschool classroom is to write key vocabulary words on a label that the child wears at school and then takes home each day. Fifth, the phonological characteristics of the words and semantic characteristics of the referents will likely affect learning outcome. For example, Storkel (2001) found that children learn nonwords composed of common sound sequences more rapidly than nonwords composed of rare sound sequences. In our most recent study Gray (in press), poor learners had more success learning to comprehend a new name for familiar (e.g., *dalmation* for *dog*) rather than unfamiliar objects. Even more repetition and enrichment activities may be required for lower frequency words that refer to objects, actions, or concepts that are unfamiliar to children. Finally, all of the effort is worth it. Vocabulary is crucial to school success.

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Continuing Education Questions

1. Which type of evidence did the author note has been used to document that preschoolers with SLI have difficulty acquiring vocabulary?

a. Ratio of nouns to verbs

b. Child's ability to define words

c. Type/token ratio

d. Slow initial vocabulary growth

2. Which of the following is a component of the "supported learning context" described in this series of studies?

a. Clinician repeatedly models words.

b. Child is asked to define words.

c. Clinician selects targets from published vocabulary tests.

d. Child is asked to judge his/her productions.

3. If children show evidence that they can comprehend a new word but cannot produce it, this suggests that

a. they cannot store word form representations.

b. they cannot store semantic representations.

c. more exposures to the word are necessary to create stronger word form and semantic representations and expressive links.

d. more exposures to the word are necessary to create stronger receptive links.

4. Which of the following might help identify poor word learners?

a. Standard scores on an expressive language test.

b. Standard scores on the PPVT-III in relation to groups with language impairments

c. Number of different types of words in their vocabulary

d. Comprehension lower than production on word learning tasks

5. In choosing key vocabulary to teach, clinicians should

a. prioritize words in consultation with the IEP team.

b. concentrate on nouns.

c. plan to teach 12 new words per week.

d. choose words from vocabulary tests.

The 7th annual Leadership Conference of Division 12 (Augmentative and Alternative Communication) on **Evidence-Based Practice and AAC** is scheduled for January 27-29, 2006 at the Menger Hotel in San Antonio, Texas. The Call for Poster Sessions and registration form are available online at www.asha.org/about/membership-certification/divs/div_12.htm.

Summary of Division 1 Student Research Grant: A Multiple Linguistic Approach to Literacy Remediation

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For some time, researchers have studied the influence of different linguistic factors on spelling and reading development. Phonemic awareness has received a great deal of attention and numerous studies have revealed the importance of this as a preliteracy skill (Bird, Bishop, & Freeman, 1995; Treiman, 1993; Wagner & Torgeson, 1987). Recently, researchers have begun to look at other factors affecting reading and spelling including orthographic and morphological knowledge (e.g., Abbott & Berninger, 1999, Apel & Masterson, 2001; Berninger et al., 2003; Carlisle, 2000; Katz & Carlisle, 2001; Lovett, Steinbach, & Frijters, 2000; Masterson & Crede, 1999).

Masterson and Crede (1999) and Apel and Masterson (2001) provided case studies of children who received orthographic pattern analysis and showed significant growth in spelling and word decoding skills according to standardized tests. Both case studies utilized treatment activities incorporating phonological awareness and orthographic pattern word sorts and Apel and Masterson (2001) utilized an additional morphological awareness remediation component.

Further research was conducted by Carlisle (2000) and Katz and Carlisle (2001) investigating the influence of morphological awareness on reading comprehension. In a study conducted by Carlisle, results showed third and fifth-grade students utilized the awareness of word structure and meaning (e.g., morphological awareness) to comprehend and read words at single word and text levels. Katz and Carlisle developed and implemented a reading instructional approach based in morphological knowledge with one fourth grade and two sixth grade students. Results of these case studies revealed increased reading decoding and comprehension skills.

Given the past research regarding the importance of morphological awareness on reading and spelling skills, a small evidence-based study was conducted by Wolter and Apel in the summer of 2004 to investigate the effects of a multiple component literacy intervention on reading and spelling development in second grade children.

Method

Participants

Nine 2nd-grade students were referred by teachers and local speech-language pathologists for a 9-day summer literacy clinic at a midwest university speech-language-hearing clinic for concerns regarding reading and spelling abilities. All participants were assessed to be at risk for or having a language-literacy deficit. The children had no documented hearing loss or cognitive impairment and no previous direct instruction in phonemic awareness, orthographic knowledge, or morphological awareness. The students were randomly assigned to two groups (5 students in Group A and 4 students in Group B).

Procedures

All student participants attended a summer literacy clinic daily for 90 minutes for 9 consecutive weekdays. Two certified speech-language pathologists and four graduate student clinicians provided treatment. The clinicians facilitated self-discovery through a direct explanation approach in which *talk alouds* were modeled. Further, an "I do, We do, You all do, You do" approach was integrated in which multiple clinician models, group modeling, and team work were incorporated prior to individual application of newly learned strategies.

For 45 minutes, all 9 students received orthographic pattern instruction. The students' self-discovery of the patterns and rules of spelling (e.g., long- and short-vowel rules) was facilitated and clinicians modeled for the students how the utilization of orthographic knowledge (i.e., knowledge of rules, awareness of how sounds related to spellings) could be used to increase spelling accuracy and overall decoding abilities. This was done through the use of orthographic rule-based word sorts and activities which were adapted from the book *Words Their Way* (Bear, Invernizzi, Templeton, & Johnston, 2000). The 5 children in group A received 45 additional minutes of instruction in orthographic pattern analysis in a separate small group session.

In addition to orthographic pattern remediation, reading comprehension was targeted for all children using the *ASKIT* self-questioning reading comprehension approach (Shumaker, Deschler, Nolan, & Alley, 1994). The "ASKIT" model required the children to *a*ttend to clues, *s*ay questions (who, what, why), *k*eep *p*redictions in mind while reading, *i*dentify answers in the text, and *t*alk about these answers within a large group. The students were also instructed to look for newly learned orthographic

rules in the words they read while reading at home with their parents. Parents were given information regarding the ASKIT approach and instructed to use these components at home when reading the daily homework chapter assignments.

The 4 children in group B, received additional morphological awareness instruction in their subsequent 45 minute small group sessions. Morphologically based remediation tasks included activities that provided students with the opportunities to use their morphological awareness skills and target their understanding of patterns affecting word meanings, that is, base words, suffixes, and prefixes (Berninger et al., 2003; Katz & Carlisle, 2001). Children were directed to think about words as "families." That is, the analogy was made that, just like similar or different looking family relations and friends, words can look similar or different whether or not they are related. For example, family members and ultimately words can look alike and be related (e.g., *swim* and *swimming*) or not look or sound alike but be related (e.g., *sign* and *signature*). In addition, just as friends can look alike but not be related, words can look similar but remain unrelated in meaning (e.g., *car* and *carrot*). Furthermore, morphologically based concepts were targeted each day through the daily introduction of new prefixes and affixes (Katz & Carlisle, 2001). The morphological concepts, such as affixes and prefixes, were discussed in the small group and children were facilitated to self-discover and discuss how words' meanings changed when new prefixes/suffixes were added (e.g., *-er* added to *paint* made a *painter*). Adapted games from *Words Their Way* (Bear et al., 2000) were then used to provide multiple activities in which the children wrote and talked about morphological derivatives and inflections.

Analysis

All participants' reading, spelling, phonemic awareness, and morphological awareness skills were assessed, pre- and post-intervention, using the following measures: the Woodcock Reading Mastery Test-Revised Word Attack and Word Identification subtests (WRMT-R; Woodcock, 1998), the Test of Written Spelling Test of Written Spelling (Larsen, Hammill, & Moats, 1999), the Spelling Performance for Evaluation of Language and Literacy (SPELL; Masterson, Apel, & Wasowicz, 2002), Comprehensive Test of Phonological Testing Nonword Segmentation subtest (CTOPP; Wagner, Torgeson, & Rashotte, 1999), nonstandardized morphological awareness tasks (inflectional and derivational morpheme tasks adapted from Carlisle, 2000), and nonstandardized reading comprehension measures (i.e., cloze, maze, question verification tasks). These pre and post-intervention standardized test data were analyzed for significant changes (i.e., non-overlapping standard scores including SEM on standardized measures). Furthermore, effect size was conducted on the groups' pre- and post-intervention scores for both treatment intervention groups.

Results and Discussion

Results revealed positive trends of improvement in areas of reading and spelling. For detailed results see Table 1 on page 24. For both the orthographic only treatment group (Group A) and the combined orthographic and morphologically-based treatment group (Group B), the children's spellings improved in that the children increased their accuracy of orthographic patterns usage as measured by increased spelling accuracy in the SPELL analysis. The intervention also appeared to have improved all children's reading comprehension (as measured by moderate to strong effect sizes, see Table 1). Of the four children in the morphologically-based treatment Group B, one child significantly improved in her reading decoding, sight word, and spelling abilities as judged by nonoverlap-ping standard pre- and post-intervention scores on standardized measures. Furthermore, children in the Group B made marked improvements on all measures of morphological awareness and made even more gains in reading comprehension than group A (as seen by effect sizes in Table 1).

Although this was a small feasibility study, which needs to be replicated with a larger participant sample, these findings are promising given the limited participant sample and short duration. The results indicate that a morphologically based remediation component in literacy intervention may be a useful linguistic addition that positively contributes towards young school-age children's literacy progress. Of particular note in this study is the fact that the children who received the additional morphologically based approach made improvements in their reading comprehension above and beyond what the children who received the orthographic pattern only remediation did, despite the fact that all children received the same reading comprehension remediation (ASKIT). These findings contribute to a growing body of evidence-based research and practice for developing a multiple-linguistic approach to working with children with language-learning disabilities (Apel & Masterson, 2001; Berninger et al., 2003; Katz & Carlisle, 2001). Future research suggestions include replicating this study with a larger sample of children with more severe language-literacy deficits over a longer duration of time.

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Table: Pre- and Post-Intervention Scores and Effect Sizes for Children Receiving Orthographic Pattern Remediation Only (Group A) and Additional Morphologically-Based Treatment Remediation (Group B)

	Group A		Group B		Change	
TEST	**Pretest mean (SD)**	**Post-test mean (SD)**	**Pretest mean (SD)**	**Post-test mean (SD)**	**Group A Change**	**Group B Change**
Word Attack	95.2 (5.76)	94.0 (8.0)	96.25 (6.95)	98.0 (10.36)	5 w/in SEM	3 w/in SEM **1 improvement***
Word ID	95.8 (3.63)	96.4 (2.61)	100.3 (10.59)	105.8 (11.56)	5 W/in SEM	3 w/in SEM **1 improvement***
TWS-4	81.6 (3.36)	80.8 (3.77)	83.0 (11.34)	86.0 (16.06)	5 w/in SEM	3 w/in SEM **1 improvement***
C-TOPP	10.0 (1.00)	10.8 (2.59)	10.5 (3.11)	11.5 (1.73)	5 w/in SEM	4 w/in SEM
Morphology Syntactic Task	4.4 (1.81)	6.2 (1.79)	5.3 (2.22)	7.8 (.50)	***d* = .15**	***d* = .78****
Morphology Relational Task	5.2 (1.30)	5.4 (.89)	3.3 (.96)	4.0 (1.41)	***d* = .98 ****	***d* =1.13***
Reading Comp. Cloze Task	7.2 (2.17)	8.6 (1.95)	6.5 (1.73)	7.5 (3.32)	***d* =. 65 ****	***d* = .58****
Reading Comp. Maze Task	5.6 (1.52)	6.2 (3.70)	5.0 (3.56)	6.3 (3.40)	***d* = .39**	***d* =1.44****
Reading Comp. Verification	6.6 (1.95)	7.0 (.71)	6.3 (2.06)	6.8 (1.50)	***d* = .21**	***d* = .24**
Patterns: Orthographic Tx	9.0 (3.08)	6.6 (2.61)	7.8 (2.63)	4.8 (2.87)	***d* = -.78 ****	***d* =-1.14****
Patterns: MOI Tx	5.4 (2.19)	5.6 (1.95)	6.0 (2.00)	6.3 (.96)	***d* =.09**	***d* = .13**
SPELL Score Consonant Rules	.81 (.08)	.84 (.08)	.85 (.09)	.86 (.20)	***d* = .34**	***d* = .11**
SPELL Score Digraph Rules	.69 (.15)	.68 (.23)	.73 (.11)	.74 (.17)	***d* = -.06**	***d* = .09**
SPELL Score Short Vowel Rules	.71 (.16)	.72 (.05)	.79 (.09)	.76 (.20)	***d* = .06**	***d* = -.33**
SPELL Score Long Vowel Rules	.31 (.09)	.37 (.20)	.42 (.31)	.50 (.27)	***d* = .67****	***d* = .26**

*= Improvement judged significant by nonoverlapping SEM on pre- and post-test scores

** = Moderate or large effect size

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Continuing Education Questions

1. The orthographic pattern instruction included

a. rhyming activities.

b. reading comprehension tasks.

c. activities for identifying spelling rules.

d. activities highlighting word changes associated with prefixes and suffixes.

2. The morphological awareness instruction involved

a. activities highlighting word changes associated with prefixes and suffixes.

b. sound blending activities.

c. activities for identifying spelling rules.

d. activities for identifying rhymes.

3. Children in the combined orthographic and morphologically based treatment group

a. improved only their spelling skills.

b. improved their reading comprehension and spelling skills.

c. improved their morphological awareness, reading comprehension, and spelling skills.

d. did not improve markedly.

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Editor's Note: This tutorial is a brief review of classic measures for evaluating tests. Those who are comfortable with concepts of reliability, validity, and standard error of measurement might consider skimming or disregarding this tutorial. Those who wish to go beyond the brief review are referred to basic textbooks in assessment and/or testing available in the Communication Disorders literature.

EBP Tutorial #9: Critiquing the Assessment Evidence—Classic/ Traditional Metrics

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Most texts (e.g., Straus, Richardson, Glasziou, & Haynes, 2005) on evidence-based practice (EBP) focus solely on EBP metrics (e.g., sensitivity, specificity, positive likelihood ratio, etc.) for the critiquing of tests. However, it is also important for EBP practitioners to consider traditional or classic measures such as reliability and validity. These measures quantify the worth of tests by determining their accuracy and the consistency. By identifying tests that exhibit strong reliability and validity, clinicians can identify tests that are candidates for use in their own clinical context with their own clients (Tickle-Degnen, 2002). Moreover, as will be addressed in future tutorials, selected classic measures can be used to validate the use of tests for various purposes. This tutorial will address three classic measures of validity, reliability, and standard error of measurement.

Validity

Validity typically is defined as a representation of a test's ability to assess what it is purported to assess. Hutchinson (1996) maintained that validity can be logical and/or data based and that rather than differing types of validity there are, in fact, different sources of support such as content, criterion-related (concurrent, predictive) and construct.

Content Validity

Content validity can be determined by identifying the purpose of the test and determining how well test items measure behaviors represented in the purpose. This determination is usually undertaken by purported expert judges in the area who explore the appropriateness, completeness, and sampling of test items (Haynes & Pindzola, 1998).

Criterion-Related Validity

Criterion-related validity involves the relationship between performance on the test in question to other positively regarded tests. Criterion-related validity can be of two forms: *concurrent* or *predictive*. Concurrent validity is determined by comparing groups of clients' performances on tests to accepted measures of the behaviors being assessed. One key aspect of concurrent validity is that the testing of the participants on the two tests should be undertaken in the same time frame. Predictive validity, on the other hand, represents the relationship between test performance at one point in time and at a later date.

Construct Validity

Hutchinson (1996) reported that the definition of construct validity has evolved from a purely statistical view to one that integrates quantitative and qualitative support for the model that the author(s) used to develop the test. Qualitatively, construct validity may be inferred by reference to models that underlie the test or by explanations of how the subtests contribute to a representation of the overall construct. Alternatively, statistical evidence—usually describing associations among subtests of the test in the form of correlations or factor analyses (Hutchinson, 1996)—can be used to represent quantitative construct validity.

Reliability

Reliability signifies the stability or dependability of a test. For formal, standardized tests, the commonly reported forms of reliability in communication sciences and disorders are test-retest reliability (i.e., the agreement between clients' scores on two separate administrations of the test), *interobserver reliability* (i.e., the agreement of the judgments of the same test by two administrators), *intraobserver reliability* (i.e., the agreement of the judgments of the same test by the same administrator), and *split-half reliability* (i.e., a measure of internal agreement within a test in which one section of a test or subtest is compared to another section).

Standard Error

The metric *standard error of measurement* may be used to signify an aspect of reliability that reflects the likelihood that a certain score represents the client's true score and the range of scores likely to contain the true score. As will be seen in later tutorials, it is an important measure to be aware of when one is attempting to progress.

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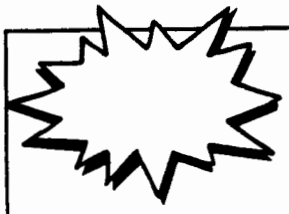

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