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Imagery and the Language Processing Spectrum

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If I can't picture it, I can't understand it. - Albert Einstein

Albert Einstein's achievements are milestones in the history of science and have become an integral part of the 20th century. No other modern physicist has altered and expanded our understanding of nature as significantly. Named "man of the century" by *Time Magazine,* Einstein's esteemed contributions were the result of his ability to think critically and creatively. He made his thinking concrete with a specific sensory system function—imagery. His statement, "If I can't picture it, I can't understand it," not only illuminates his genius, but also embodies a truth about language processing that may unlock some answers for children and adults with weakness on the language processing spectrum.

The language processing spectrum ranges from processing words (decoding and encoding print) to processing concepts (comprehending and expressing language). When there is weakness on the spectrum, labels such as "dyslexia" appear on the left and those such as "hyperlexia" appear on the right, extending into the label of autism. Figure 1 highlights the language processing spectrum.

Language Processing

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Processing Words	***Processing Concepts***
(Symbol Imagery)	*(Concept Imagery)*
Dyslexia	Hyperlexia→Autism

Figure 1. The Language Processing Spectrum

As causes and solutions have been sought for children and adults with weaknesses on the spectrum, important knowledge has been gained. Researchers know that the sensory system is the issue—the heart of good language processing or the root of the problem. People can process language across the spectrum because they can receive and process sensory information, generally in the form of imagery. Strength in imagery results in language processing strength; weakness in imagery results in language processing weakness—words and concepts.

On the left side of the spectrum—the processing of words—a rather recent breakthrough has changed the lives of many dyslexics. We now know that in order to read and spell written language, the human sensory system needs to process sounds and letters within syllables, referred to as *phoneme awareness* and *symbol imagery.* However, during the years of searching for answers, the professional community was lost for awhile. Dyslexia was often viewed as an array of symptoms so disparate that, it was thought, they could not be related. Dyslexia was attributed to everything from misreading words to not being able to program a VCR. Rampant symptoms seemed unrelated. With the problem so extensive, uncovering a primary cause seemed both impossible and improbable. Statements such as "not everything works for everybody" and "not everybody is the same" worsened the problem. Too often, each dyslexic was viewed as unique rather than as sharing a simple, yet core, sensory weakness. After years of studying the problem, some organizations suggested that there was no cure for dyslexia. Compensation strategies were offered that didn't fix the problem. Learning to live with dyslexia was painful and gave little hope to the many that suffered.

Fortunately, however, persistent research provided answers and solutions. Stimulation at the sensory level—phonological awareness and symbol imagery—brought significant improvement in reading and spelling skills. Gains, seemingly impossible before, were made even with adult dyslexics. As a core sensory deficit was specified, treatment became specific rather than random. In addition to the research, the shortcomings of the "whole language" movement provided additional information about the importance of developing phonological processing. By failing to stimulate phoneme awareness, the whole language approach increased the incidence of poor reading and dyslexia increased. This failure provided a contrast and an additional lesson about the underlying sensory processing necessary for reading and spelling words. Unfortunately, while the professional community searched and debated, children and adults often were not given appropriate sensory stimulation.

Research and insight about the sensory system has since contributed to solving some issues on the left side of the spectrum. Because of a better understanding of the sensory system, improvements are now being made that were previously considered impossible. But what about the right side of the language processing spectrum? Has the volume of symptoms and their seeming disparity caused scientists to think that there may not be primary sensory causes, or contributors, to the range of symptoms and labels on the right side? If Einstein used imagery for his genius of thought, is imagery a primary sensory system factor related to weak comprehension, hyperlexia, and possibly even autism? Is imagery just imagery, or is there more than one type of imagery? Is the imagery for letters the same as the imagery for concepts? Is imagery a two-sided coin?

A TWO-SIDED SENSORY COIN: MARCUS AND HANNAH

There are two primary language processing deficits that cause individuals to perform below their potential: weak decoding/encoding of words and weak comprehension/expression of concepts. These two deficits are the two sides of the sensory processing coin. Each side uses imagery in a specific manner, opposite in nature from the other side. One side images and processes parts, while the other images and processes wholes.

The story of Marcus represents the side of the coin concerned with difficulty in processing concepts, the primary focus of this chapter. His symptoms stem from weakness in his sensory system, and are not disparate or disconnected. Hannah, Marcus's twin, represents the other side of the coin. The following case study, told in his mother's words, describes how Marcus functions.

Marcus's Story

"Our son, Marcus, is 9 years old now, and we have been everywhere for help. We don't know what to do. They are suggesting a special day school, but we are reluctant to make another change. Marcus has been in speech therapy since he was 4 years old. We've tried special therapy, special classes, summer programs, and medication. We just don't know what to do. Marcus is a sweet boy, but no one seems to be able to help him—or us.

"What? Oh, yes. He's been tested, repeatedly, by a variety of professionals. I have accumulated everything in a file that's about 4 inches thick. It began when he was a toddler because he wasn't developing language as well as his twin sister, Hannah.

"Yes. They first diagnosed Marcus as having a delay in speech development and more recently he was diagnosed as hyperlexic. He can read words, but he can't understand what he reads. Actually, remembering back, it seems that he could read before he could talk! He learned to read long before he went to school, and in first and second grade, he got really good marks in reading. It's just that he can't comprehend or understand what he reads…but he can read it.

"No, he doesn't seem to understand what he hears either. For example, at the dinner table, or in any conversation, he doesn't appear to get what is going on around him—but he is very easy to be with since he tends to entertain himself.

"What? Well, yes, he has a good oral vocabulary. He generally tests well in vocabulary. He seems to understand the meaning of individual words very well.

"His expressive language? Like how much does he talk? Well, no, he doesn't talk a lot, like his sister does, but he can talk. He has never had trouble saying words. He just doesn't talk a lot.

"Sequence? No, his expression doesn't seem sequential. It comes out 'out' of sequence. Sometimes he tells us things, but we have difficulty putting what he says together. He talks about the last thing first, or the middle thing last, and his language gets all messed up and he gets frustrated. And, sometimes it seems as if he is stuck on some detail, like a specific part in a movie he watched or a detail from a television show.

"What? No, he doesn't contribute much to conversation. Well, sometimes he does if it is about a very specific thing he is interested in. He has difficulty making friends and almost seems confused by social situations. It seems like he isn't getting what is going on around him. Sometimes we see him off by himself, just playing with a certain toy or a certain computer game. He is generally quiet. He does answer questions...though sometimes I have to repeat the questions to him quite a few times.

"No, he is not generally a behavior problem. His teachers say that he is pleasant, but sort of spacey. Do you know what I mean? Sometimes he just looks a little dazed when you're talking to him. I think he wants to have friends because I see him watching other children. I think he just doesn't know what to do or how to interact, and he ends up being alone.

"Yes, he has a lot of trouble following directions. He doesn't seem to pay attention to what you say to him, and he can't follow a stream of directions, especially with more than one or two things to do. It seems like what I say just goes in one ear and out the other. One physician thought he had attention deficit disorder, and we have been trying medication. He is a little better on medication, but it still hasn't fixed the problem. I keep thinking we're missing something.

"No, he doesn't get jokes easily. In fact, he is pretty serious most of the time.

“What? No, he never had difficulty with spelling! He can spell anything! His sister can’t, however. His sister, Hannah, has recently been labeled learning disabled and put in a special class one hour a day. She is having trouble reading and spelling words. They think she may be dyslexic.

“Hannah? No, she has never had trouble understanding conversation. Hannah is talkative, friendly, and very social. She has lots of friends and tells us all the things that happened to her during the day. Pretty much just the opposite of Marcus.

“Yes, I read to both children when they were little, but Marcus didn’t like it. Sometimes he looked at the pictures, but then he got bored and left. Yes, his sister liked to listen to stories. Yes. She definitely gets what she reads; she just has trouble reading the actual words. They seem to have exactly the opposite problem! Marcus can read the words but can’t comprehend. Hannah can comprehend, but she can’t read the words.

“Hmmm. Now that you ask, a few years ago a physician did suggest that Marcus might be autistic. It seems that some of the best and most caring professionals have given attention to Marcus, but nothing seems to really be helping him. We’ve tried everything.

“A few days ago, I took Marcus to a new professional who told me that if something didn’t change by the time Marcus is 12… well, it is very likely it will never change. I came home, pulled the drapes, and spent the rest of the day crying on the couch for my son. I’m calling you for one more try.”

Weak Concept Imagery: A Primary Deficit for Marcus

Marcus’s weakness in processing language had not been diagnosed or addressed, even by age 9, despite care and concern from many qualified professionals. The symptoms he exhibited were on the right side of the language processing spectrum and matched those of hyperlexia and high-functioning autism, perhaps Asperger’s syndrome.

In response to his mother’s concern, Marcus was given an extensive battery of diagnostic testing for language processing. During the testing, Marcus did not express himself easily, make eye contact well, relate to the tester, or appear to understand directions or conversation. Though his oral vocabulary was at the 75th percentile and he could read words at the tenth grade level, he performed at a 5-year-old mental age level in oral language comprehension and the 5th percentile in following oral directions. He scored above the 99th percentile in paragraph decoding, but below the 1st percentile in comprehension.

When asked what his favorite thing in school was, he didn’t answer at first, then finally said, “What?” He appeared not to hear the language. The question was repeated and again he said, “What?” This time he appeared confused. Finally, the question was stated as simply as possible, “What do you like best in school?”

“Recess.”

“What is the hardest thing in school?”

After a delay, Marcus replied, “Paying attention.”

Marcus had a primary weakness in his sensory system—*weak concept imagery.* As he took language in, he did not have adequate imagery activity to make language stop, make language connect, or make language relate. Language entered adequately through the auditory channel but then faltered for lack of sensory activity in imagery.

Concept imagery is the ability to create imaged gestalts—wholes. Marcus’s sensory system could not easily create mental representations for the whole, but he could easily create mental representations for parts.

Words seemed to go in one ear and out the other without the sensory mechanism of concept imagery to anchor and relate them. The side of his sensory coin that imaged and processed parts was functioning well, but the side that imaged and processed wholes was not.

Processing language—cognition—is a parts-whole issue. Some individuals, Einstein included, are able to *rapidly and automatically* create an imaged gestalt from what they read or hear. They can combine parts into a whole. Most important, with the imaged gestalt they can process language and think critically. From the gestalt, they can comprehend oral language, comprehend what they read, problem solve, think logically, think creatively, "get the big picture," move from concrete to abstract thinking, express themselves relevantly, make their point, get humor, read social situations, make inferences, draw conclusions, and pay attention. Referring to imagery's contribution to thought and problem solving, Einstein said that *imagination is more important than knowledge*.

Although the ability to create gestalt imagery is a basic and primary asset in the sensory system, there are many individuals who find concept imagery difficult, slow, partially accessible, situation-specific, or unavailable. These individuals, like Marcus, may process *parts* well. Many even appear to be stuck on parts—details—because their sensory system is able to image them rapidly and automatically. They can create images for parts—letters, isolated facts, names, and dates—and they can often read and spell words well. Their sensory system easily and rapidly gives them information about bits and pieces by easily and rapidly creating mental representations for parts of language, parts of conversations, parts of oral language, parts of directions, parts of written language, parts of movies, and parts of social situations. Sometimes the parts seem to be overwhelming and consuming.

A part in a conversation or lecture is imaged and processed, then discussed, often irrelevantly. The point of a conversation is missed, but the parts are processed. The main idea is lost somewhere in an array of random parts. The critical thinking ability to draw a conclusion or make an inference is impaired because there is a limited gestalt, or whole, from which to process or think. Unrelated or unconnected imaged parts float around in a sensory-cognitive system, contributing to erroneous conclusions and inferences.

The random and unconnected imaged parts often bounce back in the form of random and unconnected language expression. As parts are taken in, they come back out. Parts are expressed. Bits and pieces that are imaged and processed are expressed. Language expression may not be sequential. With no imaged gestalt, written or oral language expression is an array of parts with the first, middle, and last out of sequence.

Social interaction and conclusions may suffer the same fate. Parts of social situations are processed. A part of a situation is misread and then reacted to, with limited understanding of "cause and effect." Personal interaction may be difficult. Language swirls around, parts are processed and parts are expressed. Social interaction with a language-filled environment is difficult if the primary, incoming sensory information is in "parts."

Weakness in concept imagery may range from mild to severe, with some individuals experiencing moderate difficulty comprehending and expressing language. Those individuals might have to study a little harder or read chapters a few more times. However, as the weakness in imaging gestalts becomes more severe, so do the symptoms. Labels such as hyperlexia, Asperger's syndrome, and autism begin to surface. Weak concept imagery is a primary sensory deficit for hyperlexia, and while it is not the only weakness related to autism, poor concept imagery may be a primary contributing factor. The right side of the language processing spectrum requires concept imagery function.

Marcus received 6 weeks of intensive concept imagery instruction (4 hours a day, 5 days a week) and improved from the 5th to the 75th percentile in following oral directions and from the 1st to the 50th percentile in reading comprehension. He also began to engage in conversation, interact socially, and understand humor.

SYMPTOMS OF WEAK CONCEPT IMAGERY

Understanding the range of weakness in concept imagery is important in order to understand the symptoms it presents. College students and educated adults may experience language processing weakness stemming from the same sensory system weakness as Marcus had. For example, Sam, a college graduate, experienced mild concept imagery weakness that had negative consequences for his chosen vocation. With good decoding and above average intelligence, Sam attempted to enter medical school; however, he was unable to pass the MCAT entrance test. His reading comprehension score was 4, but 8 was average. He waited a period of time and retook the test. Again he scored 4. Persistent and committed to becoming a physician, he sought help to improve his reading comprehension. During the diagnostic testing, in which he scored significantly below his potential in reading comprehension, Sam described his frustration throughout his schooling. He felt that he missed most of his academic course content, indicating that information seemed to go in—but out again. He likened his comprehension disability to an incomplete cognitive tool kit.

"I couldn't get [comprehend] things, but I'd look around me and others seemed to get things easily. I couldn't understand how they did it…and why I couldn't. It seemed like when I opened up my cognitive tool kit there was something missing."

Another student had a more serious weakness in concept imagery, though still not severe. Peter had good oral vocabulary and good decoding, but was on academic probation in college, despite having saved the difficult classes for his last years in college. He said, "There wasn't one thing I could do right in school. I couldn't easily get the lectures, and I didn't remember anything I read. It was very frustrating. I read each sentence three times and then went on to the next sentence and read it three times. It didn't make any sense put together…If I read the information enough times, I could remember it for maybe 30 seconds and then I had no clue." Peter dropped out of college.

Sam, Peter, and Marcus are examples of individuals with mild to severe concept imagery weakness, but there are a host of others, some milder and some more severe. The weakness moves on a continuum, a spectrum. As the sensory weakness becomes more severe, so do the symptoms.

The following behaviors are symptoms of weak concept imagery, based on a range of individuals, from young to old, with mild to severe weakness. The issue of a weak gestalt contributes to each symptom. At the time these symptoms were noted several years ago, the diagnosis of autism was not as prevalent.

Symptoms of Weak Concept Imagery

An individual with weak concept imagery has:

- *A tendency to process parts more than, or rather than, wholes.* Gets details rather than big pictures. Attends to facts more than concepts.

- *Difficulty with conceptual, critical, logical, and/or abstract thinking.* Gets stuck on details and parts. Enjoys facts rather than concepts. Appears to be a concrete thinker because is processing specific part-images.
- *Difficulty grasping oral language, whether stories, conversations, or lectures.* Is not interested in listening to stories, can't seem to pay attention. Misses the point of a lecture or conversation. Appears to process irrelevant or incidental parts of what is heard. Often asks and re-asks the same question. May be labeled as a poor listener or inattentive.
- *Weak reading comprehension.* Though oral vocabulary and decoding may be sufficient, may only get a few facts from what is read. Has trouble answering higher-order thinking questions, such as the main idea, a conclusion, an inference, and a prediction. Has to read sentences, paragraphs, and chapters more than once. May still not get the big picture or point, and may do poorly on tests that measure more than just facts.
- *Difficulty following directions, oral or written.* Gets confused with more than one or two directions. Language appears to go in one ear and out the other. Seems unable to pay attention to language or successfully engage in a social environment.
- *Weakness in expressing language orally.* Language expression is a random array of parts, facts, and details. Talks about irrelevant parts or issues. Tells stories out of sequence. Talks very little or talks a lot, but is scattered and disconnected.
- *Difficulty expressing language in writing.* Often writes in unrelated parts. Has "five essays in one." Does not connect thoughts and make a point, a whole. Does not begin with a topic, support the topic, and summarize the topic. Cannot easily answer a question due to missing the point of the question.
- *Difficulty understanding humor.* Misses the joke. Takes language literally and doesn't see the imagery in humor. May respond to physical humor, such as slipping on a banana, but can't comprehend language-based humor. Laughs at inappropriate times.
- *Difficulty reading social situations.* Attends to a part of an expression or situation. Based on a part, makes inappropriate expressions or takes inappropriate actions. Has difficulty understanding cause and effect.
- *Appears to find language and social interaction a confusing mix of disconnected parts.* Prefers own company. The world seems to be a puzzling, disconcerting, and meaningless array of parts.

CAUSES AND CONTRIBUTORS TO WEAK CONCEPT IMAGERY

Because more research, particularly brain research, is needed, theories about the specific cause of the sensory weakness in creating an imaged gestalt are still speculative, but they are based on substantial experience, clinical insight, and logic. As with other disorders, including dyslexia, heredity appears to be a factor. Children and adults with weak comprehension often have one or both parents exhibiting a similar deficiency. As the issue of imaging and processing a whole is explained, typically one parent acknowledges difficulty comprehending and expressing language. The more severe the concept imagery weakness, the more likely a parent experiences a similar problem or tells of someone else in the family with a similar issue. The familial reference may range from comprehension weakness to autism.

Environmental issues appear to contribute to an increased incidence in mild to moderate comprehension problems. For example, in a culture in which television is a primary source of entertainment, the sensory system may not be receiving enough imagery stimulation. This becomes of particular concern when noting the duality of coding for cognition, as in Paivio's theory.

Paivio's dual coding theory (1986) emphasized the critical role of imagery for cognition and stated that cognition is proportional to the extent that mental representations (imagery) and language are integrated. The increased cultural activity of television and video games may have a negative cognitive impact on one-half of the cognitive code—imagery. When someone listens to an old radio shows or story records, sound effects enhance the imagery of language. In contrast, when a person watches television, the mind is provided with images. Watching television may have an atrophying effect on imagery because the images are created for the viewer. Further impacting cognition, the time an individual spends watching television or playing video games may consume the time that individual might otherwise have spent reading, storytelling, or conversing: in other words, time that could have been used for stimulation of concept imagery and language expression.

Another concern currently being discussed is the environmental and medical use of chemicals called *neurotoxins*. For example, childhood vaccines are under investigation as contributors to language processing disorders and learning disabilities, including autism.

Whether the cause is a hereditary factor, environmentally induced, or both, the ability to image a gestalt appears to be a function unto itself. Although impaired phonological processing and impaired decoding, weak oral vocabulary, and reduced prior knowledge and background experiences may contribute to weak concept imagery, these factors do not appear to be causal. As with Marcus, hyperlexics often have good decoding, oral vocabulary, and imagery for isolated words, but they are not able to comprehend concepts and answer higher-order thinking questions. The same applies to individuals considered to have poor reading comprehension but not given the label of hyperlexia. Many individuals with wide experiences and good education are not able to comprehend language effectively and efficiently. In contrast, many poor decoders, including severe dyslexics, are able to comprehend language and create images for concepts. If language is presented orally to these dyslexics, they appear brilliant in their ability to interpret and reason. Their imagery weakness is on the opposite side of the sensory coin and is similar to Hannah's—they can't image letters, which are the parts of words.

Weak oral vocabulary may interfere with concept imagery and comprehension; however, imagery plays a significant role in the development of appropriate vocabulary. Stimulating imagery for vocabulary aids in the storage and retrieval of meaning for isolated words. Smith, Stahl, and Neil (1987), after a study with 142 university students, stated, "The significant difference that occurred between the definition only and the definition and sentence and imagery groups supports Paivio's dual coding theory. In accord with Paivio's theory the visual image did provide an additional memory trace that improved long term memory for the vocabulary items in the study. This finding mirrors research spanning the years as far back as Kirkpatrick in 1894."

Deficits in prior knowledge and background experience may interfere with language comprehension, but instructional techniques designed to access prior knowledge, such as first discussing material, setting the scene, and teaching vocabulary, do not necessarily stimulate independent comprehension. Imagery is assumed. An individual needs to be able to set the scene with language by imaging and interacting with stored images to create and process the new concept. This interaction needs to be quick and easy—automatic. If it is labored and difficult, the whole may be lost and random parts prevail.

STIMULATION OF CONCEPT IMAGERY: THE VISUALIZING AND VERBALIZING™ PROGRAM

The firm "earth" of experience was the basis for the initial hypothesis of two types of imagery: concept imagery and symbol imagery. A clinical environment, laden with individuals of all ages and all types of language processing weakness, led to cognitive theory and the instructional procedures of the Visualizing and Verbalizing™ for Language Comprehension and Thinking (V/V™) program.

The first realization in applying theory to procedure was that individuals need to develop the ability to image a whole. The next was that imagery couldn't just be developed by a reminder or simple cue, such as, "Visualize what you read." For individuals with a sensory weakness of bringing parts to whole with imagery, specific steps and specific questions needed to be presented.

The steps of V/V™ are sequential and require the teacher or therapist to ask questions directed to the sensory system. Pribram (1971) said, "We cannot think about something of which we are not consciously aware, and we cannot be aware of something not perceived sufficiently at the sensory level to come to consciousness." *Therefore, teacher language must directly stimulate specific sensory-input.*

"What did you *hear*?" may not be specific enough to stimulate imagery. Such a question may direct the child to attend primarily to the sensory stimuli of the airplane whirring by or the tapping of the woodpecker on a nearby tree. But the question, "What did you *picture*?" directs the child's attention to the specific sensory information of imagery. The next sensory-directed question builds concept imagery by directing the child to continue picturing the same subject while extending it to action. "What did you *picture* the white horse doing—running or jumping?" The language directs the student to compare the input of imagery to the input of language—stimulating the integration of verbal to nonverbal sensory stimuli.

The V/V™ procedure develops concept imagery with the smallest unit of language—a word—and extends the imagery to sentences, paragraphs, and pages of content. The specific steps follow.

Steps of V/V™

1. *Picture to Picture*

   The goal is to develop fluent, detailed verbalization from a given picture (prior to requiring detailed verbalization of a *generated* image in the next step).

   The individual describes simple, given pictures. *Structure words*—what, size, color, number, shape, where, when, background, movement, mood, perspective, and sound—are introduced to provide concrete descriptive elements. The choice and amount of structure words presented depends on the severity of the weakness or age of the individual. The teacher questions with "choice and contrast" to stimulate verbalization of the picture and directs the student to monitor and compare his verbalization. Not looking at the given picture, but imaging from the student's language, the teacher says, "What should I picture for the boy's pants? Does he have on blue pants or red pants? Are they long pants or short pants?" This reference to imagery in the question helps the student think about relevant and detailed verbalization—the goal of this step and the preparation for the next step.

2. *Word Imaging*

   The goal is to develop detailed visualizing and verbalizing (dual coding) for a single word.

   The individual describes a generated image for a single word, beginning with a personal image and extending it to a high-imagery known noun, such as "clown" or "cowboy." The structure words, introduced earlier, are used to provide detailed, vivid imagery. The teacher uses choice and contrast to ask sensory-driven questions to specifically develop imagery. "Are you picturing a white hat or a black hat on the cowboy? Does he have hair or no hair?"

3. *Phrase and Sentence Imaging*

   The goal is to extend the imagery and language from one word to a phrase and then to a single, simple sentence.

   As the steps overlap, the individual uses a specifically imaged known noun as the subject of a sentence to be imaged. For example, the clown that was imaged as a single word, with vivid images from the structure words and questioning, is now the imagery to which action, a verb, is attached. "Keep the same clown we just visualized, and now picture this, the clown jumped on the red ball." The extent of the imagery stimulation is dictated by the age and severity of the dysfunction (the sentence could have only one subject and one verb to image; that is, the clown jumped, the clown cried, the clown laughed, the clown snorted).

4. *Sentence by Sentence Imaging*

   The goal is to extend the integration of imagery and language to a gestalt—sentence by sentence.

   The procedure begins receptively, from a short, self-contained paragraph, with each sentence read to the individual. As the individual visualizes and verbalizes each sentence, colored squares are placed sequentially in front of him to designate the imaged part (the sentence). Structure words are used to develop detailed imagery for the first sentence (the topic, or gestalt, sentence). At the completion of the paragraph, with approximately four to five colored squares representing the sentences, the individual gives a "picture summary." Touching each colored square, he says, "Here I saw…" At the completion of the picture summary, the colored squares are collected and put away. The student then gives a "word summary," using his imagery to paraphrase the paragraph.

5. *Sentence by Sentence with Higher-Order Thinking Skills (HOTS)*

   The goal is to develop critical thinking from the imaged gestalt developed in the previous step.

   The same sentence-by-sentence procedure of placing colored squares for the parts, verbalizing with a picture summary to sequentially summarize the imaged parts, and verbalizing with a word summary to paraphrase the whole is used to establish the cognitive base for interpretation. With the imaged whole as the base, the student is asked the main idea, conclusion, and inference questions. "What was the main thing you *pictured* from that paragraph? Did you *picture* elephants or fleas…and what did you picture about the elephant, how it eats, how it sleeps…?" "From all *your images*, why do you think the elephant might destroy a forest?" "What do you *picture* might happen if…?"

6. *Multiple Sentence, Paragraph, and Whole Page Imaging with HOTS*

   The goal is to increase and extend the language input, either receptive or expressive, to develop the imaged gestalt and apply that cognitive base to critical thinking, problem solving, and interpretation.

   The succeeding steps increase the language from which the individual visualizes and verbalizes, creating the gestalt. HOTS questions are included for every paragraph, and the material may become longer and denser, depending on the age and level of the student. The stimulation is from oral language as well as from language the student decodes.

The steps of V/V™ develop an individual's ability to bring parts to whole and think with an imaged gestalt. Once the gestalt is able to be imaged, it can be brought to a conscious level for problem solving, paragraph writing, comprehending and studying content, following directions, logical thinking exercises, mathematics, play, and interpreting and responding appropriately to social situations.

Dual Coding Theory and Visualizing and Verbalizing™

The V/V™ program was developed to meet language processing needs, but its importance and direct relationship to dual coding theory was noted later. Paivio (1979) states, "The most general assumption in dual coding theory is that there are two classes of phenomena handled cognitively by separate subsystems, one specialized for the representation and processing of information concerning nonverbal objects and events, the other specialized for dealing with language." The nonverbal (symbolic) subsystem is referred to as the imagery system because its critical functions include the analysis of scenes and the generation of mental images. The language-specialized system is referred to as the verbal system. The V/V™ program stimulates and integrates the two systems of language and imagery and heads toward the imaged gestalt for cognition.

Paivio also (1986) writes, "Human cognition is unique in that it has become specialized for dealing simultaneously with language and with nonverbal objects and events. Moreover, the language system is peculiar in that it deals directly with linguistic input and output (in the form of speech or writing) while at the same time serving a symbolic function with respect to nonverbal objects, events, and behaviors. Any representational theory must accommodate this functional duality." The V/V™ Program stimulates language and imagery, integrating the two systems in a systematic, sequential format—accommodating the functional duality.

The simplicity of dual coding theory—the duality of verbal and nonverbal subsystems—is compatible with clinical experience when cognition is observed on the language processing spectrum. From dyslexia on the left to comprehension and expression on the right, the integration of imagery and language is at the core of successful processing. Imagery for parts—symbol imagery—integrates imagery and language for processing words. Imagery for wholes—concept imagery—integrates imagery and language for processing concepts, abstractions, and the big picture.

PARTS-WHOLE AND SYMPTOMS OF AUTISM

As discussed earlier, the more severe the concept imagery weakness, the more severe the symptoms, which may move onto the autistic spectrum. Although not the only weakness causing the symptoms of autism, it is likely that weak concept imagery is a primary contributing factor.

The integration of verbal and nonverbal processing is critical for children on the autistic spectrum. The nonverbal system of imagery provides sensory support for their language processing ability—with the imaging of concepts foremost. In noting language processing as a parts-whole issue, many of the symptoms on the autistic spectrum can be traced to weakness processing the whole.

The following well-accepted symptoms of autism can be separated into parts-whole processing strengths or weaknesses.

Ability to process parts contributes to strength in:

- Rote memory
- Mechanical tasks
- Acquisition of simple information
- Simple procedural tasks
- Simple associations
- Word recognition
- Spelling
- Rote computational tasks
- Short-term immediate repetition of oral material

Inability to process wholes contributes to weakness in:

- Complex information processing
- Concept formation
- Abstract and critical thinking
- Interpretive oral language comprehension
- Interpretive reading comprehension
- Complex memory for oral and written material
- Following complex oral/written directions
- Problem solving
- Analysis and synthesis of information
- Organizational strategies

With the parts-whole issue in mind, the specific type of imagery an autistic child may be able or unable to do needs to be identified. For example, is "visual thinking" thinking in parts, or is it thinking in wholes? Does "visual-spatial thinking" mean imagery for parts or imagery for wholes?

IMAGERY AND VISUALLY BASED MATERIAL

It is often noted that autistic children respond well to visually based material because it makes language and the physical environment concrete for them. Auditory input is supplemented with visual "back-up." The following section lists the benefits of using visually based material, such as cue cards, to supplement auditory information (Twachtman-Cullen 1998). Note that "visual imagery" can be substituted in each item, as shown, and that the stimulation of imagery can offer children an internal visual back-up system.

Strengths of Visually Based Material

- Visually based material is stable over time. *(Visual imagery is stable over time and internal for children, taken with them wherever they go.)*
- By supplementing the auditory channel with visual back-up, the individual has the benefit of two input channels. *(By supplementing the auditory channel with visual imagery, the individual can inte-*

grate verbal with nonverbal sensory information, anywhere at anytime.)

- Visual information is an "eye catcher" for capturing and maintaining attention. *(Visual imagery is the same eye-catcher, only internal, enabling the individual to attend and focus.)*
- Visual supplementation aids processing ability. *(Given that visual imagery is the nonverbal code for dual coding, visual imagery aids processing ability and is available to the individual anywhere at anytime.)*
- Visual information helps make concepts more understandable by making them concrete. *(Visual imagery makes concepts concrete with sensory information that can be internally manipulated, related, and processed.)*
- Visual information can increase understanding in general. *(Visual imagery for the gestalt enables individuals to process concepts, anywhere at anytime.)*
- Visual supports can be used to prompt individuals. *(Visual imagery can be used to prompt individuals through conscious questioning of imagery relative to the event or concept, or through the individuals' own internal "prompt," which allows them to contrast and compare with imagery.)*
- Visual supports can help minimize anxiety. *(Visual imagery for concepts helps minimize anxiety by making the world less a jumble of random parts. With the imaged gestalt, meaning can be derived from both oral and written language.)*
- Visual supports can render information more memorable. *(As research shows, imagery is related to memory and recall; hence, visual imagery renders information more memorable.)*

Although visual back-up is helpful and effective, visual imagery can be stimulated at a conscious level and then supplemented and eventually substituted for visual aids. As the imagery begins to reside within the child, independence is developed for crossover to all environmental situations.

Concept Imagery for Floor Time, Play, and Pragmatics

With an imaged gestalt developing from V/V™ stimulation, teachers and therapists can drive "the sensory" bus by asking specific imagery-related questions or giving specific imagery-related stimulation. The imagery stimulation, either in conjunction with adapted V/V™ or separate from V/V™ stimulation, is applicable for floor time (see Greenspan & Wieder, Chapter 12, this volume) and play activities.

During floor time and play, imagery can be specifically stimulated with questions that draw attention to mental representations for actions or events. Following the child's lead, imagery can be consciously activated as a connection to the play and the language. Even if imagery cannot be brought to a conscious level for the child, the reference to it causes stimulation in the sensory system and awareness of imagery as a cognitive tool. For example, while following the child's lead in a play activity, ask, "I'm picturing that the horse is going to fall off the wall. What are you picturing? Let's picture it, then do it." Use choice and contrast by asking, "Tell me how you picture him falling, on his head or tail? Now let's do it and check it."

Then reverse the stimulation and begin with a play action, followed by talk about the imagery of the action. For example, consciously connect imagery to memory by picturing an action that didn't happen yet. "That was fun. Let's see if we can picture it. I'm picturing that the horse fell on his tail. Is that what you pictured?" Repeat the play action to compare it to imagery. “Hmmm, let’s check to see if what we pictured happened.” Even if the child can’t image easily, and is responding minimally to the language, it is important to connect the concrete activity of play to the concreteness of imagery, helping to move the child into symbolic play based on mental representation ability. The more absurd the play and imagery, the more contrast there is and the more likely the child will engage and begin to make the play-imagery-language connection.

As the play interaction progresses, extend the play-imagery-language stimulation to prediction and abstract thinking. Use imagery to make thought concrete. “If our big truck (a toy truck) runs into this little fence, what do you picture will happen to the fence? Okay, let’s see if what you pictured really happens.” Verify imagery with action, then use language to describe both.

Language such as, “What do you *think* will happen next?” or “What do you remember?” doesn’t direct and specify attention to imagery. However, language such as, “What do you *picture* will happen next?” drives the sensory bus and directs the child to attend to the specific and more concrete sensory input of imagery. A young boy, labeled high-functioning autistic, made an illuminating comment, “What I like about V/V™ is that you don’t have to think anymore.”

Regarding pragmatics, the play-imagery-language interaction can be used in connection with V/V™ or separate from formal V/V™ stimulation. However, using imagery for pragmatics requires that the individual have the ability to image a whole. To meet this prerequisite, as a student is developing gestalt imagery through the steps of V/V™, the therapist can overlap concept imagery to have the student vicariously experience social situations, problem solve, and determine appropriate reactions. For example, the therapist can set up an imaged social situation, visualize the setting and the characters, and then create different actions and reactions. Imagery can be used to interpret the situation, the cause of the event, and the appropriate and/or inappropriate reactions or responses. From the imagery, conclusions, inferences, and predictions can be asked and answered. This imagery practice for social situations allows individuals to use the sensory input of concept imagery to monitor, self-correct, and become independent in a social situation without a parent or therapist present.

RESEARCH ON THE V/V PROGRAM

The effectiveness of using the V/V™ program for concept imagery stimulation has been consistently evident for many years in Lindamood-Bell clinical intervention. Significant gains have been noted in following oral directions, reading recall, reading comprehension, and visual-motor skills. The clinical population studied included students on the autistic spectrum, though usually not with what would be described as severe autism or a Type IV classification (Greenspan & Wieder, 2000).

What follows is a summary of the research on the V/V™ Program. Spanning nearly a 10-year period, the data to date note positive effects of V/V™ on language processing skills. While the data have remained consistent, continued research is needed to further understand and document the role of imagery in language processing skills, specifically for target populations with labels such as hyperlexia and autism.

The first reporting of V/V™ Program success was in 1991, when Bell measured statistically significant gains for 22 males and 23 females, ranging in age from 9 to 57, who had received V/V™ only stimulation. Although performing poorly in language comprehension, their performance on other diagnostic tests indicated a normal range for receptive and expressive oral vocabulary, phonemic awareness, word attack, and word recognition. After an average treatment time of 47.26 hours, with a range of 16 to 110 hours, all study participants noted significant improvement in comprehension. For example, pretesting of the group indicated a percentile mean for reading comprehension on the Gray Oral Reading Test, Revised (GORT-R), of 43.94 and a post-testing percentile mean of 75.55 ($p<.001$). A subgroup of 16 of the 45 individuals, who ranged in age from 15 to 57 years old, were given the Descriptive Tests of Language Skills of the College Board, Reading Comprehension subtest. Their percentile mean was 56.06 on the pretesting and 71.29 on the post-testing ($p<.001$).

The Lindamood-Bell™ clinical gains continue to verify that the V/V™ program produces statistically significant gains in language processing. With an N of 843, V/V™ program-only students from 1994 to 1998, including some identified on the autistic spectrum, had an average pretest score in the 15th percentile for reading comprehension on the Gray Oral Reading Test-3, (GORT-3). After an average of 72 hours of instruction, the post-test average was at the 37th percentile ($p<.0001$). For the same population and time, an N of 302 V/V™ program-only students achieved similar improvement in following oral directions. For example, the average pretest score in following oral directions was at the 37th percentile. After an average of 82 hours of instruction, the post-test results were at the 63rd percentile ($p<.0001$).

Lindamood-Bell™ school projects using the V/V™ program show gains similar to those seen in Lindamood-Bell™ clinics. For example, for the 1999-2000 school year, 96 students in the Pueblo School District, Colorado, received V/V™ program-only instruction for an average of 62 hours. They performed at the 9th percentile in reading comprehension (GORT-3) on the pretest but at the 25th percentile on the post-test ($p<.0001$). They showed similar statistically significant results in following oral directions ($p<.0001$). Thirty-two students at the Corwin Middle School in Colorado, many of whom spoke English as a second language, progressed from the 9th to the 25th percentile ($p<.0091$) in reading comprehension (GORT-3) after 41 hours of V/V™ instruction. The same middle school children demonstrated similar gains in following oral directions, improving from the 16th to the 50th percentile ($p<.0001$).

Additional studies replicate the Lindamood-Bell™ clinical findings. A 1995 controlled study in the Long Beach, California, public schools involved an entire fourth-grade class for four months. Comparisons between the experimental group and the control group, which received no V/V™ stimulation, showed that the experimental group made significant improvement in following oral directions and reading comprehension. For example, although both groups were at approximately the 50th percentile in word recognition, both groups were at the low end of the normal range in reading comprehension—the 27th and 28th percentiles, respectively. Pre- and post-testing on the GORT-3 reading comprehension test showed that the control group improved from the 27th to the 34th percentile, whereas the experimental group, after approximately 40 hours of V/V™ program instruction, improved from the 28th to the 45th percentile ($p< .036$).

In a federal project study at Window Rock Elementary School on the Navajo Indian Reservation, Kimbrough (1991) studied the effects of the V/V™ program on language comprehension on a sample population of fourth- and fifth-graders. The criterion for student selection was a standard score of 3 or below (5 is average) from the Iowa Tests of Basic Skills (ITBS) Reading Comprehension subtest. The measured gains were based on National Curve Equivalent Scores (NCES), and not grade-level equivalent scores. The project students received V/V™ program instruction in small groups, for approximately 30 minutes a day for 5 weeks, for a total of 12 hours of intervention. The average gain in reading comprehension was 6.6 points on the NCES compared to the national average gain of 3 points. Kimbrough states, "In the past, my students have always averaged a gain of 2 to 3 NCES points. After doing V/V™ for 5 weeks, my students doubled their scores compared to years past."

Research from Truch (1996) reports using the V/V™ program with 66 subjects for 80 hours of instruction. Subjects were of different ages and ability levels. Overall, 60% were in the age group of 6-12, another 25% were between the ages of 13 and 17, and the remaining 15% were adults ages 18 and over. The majority met the traditional criteria for learning disabilities, and some met the criteria for attention deficit disorder. The average age was 21 years. After 80 hours of V/V™ instruction, the gains in comprehension on the GORT-3 were highly significant, with an average gain of four grade levels in reading comprehension. Word reading was not a factor in the initial weak reading comprehension score, and the influence of vocabulary as a covariant failed to reach statistical significance.

The Chance Program at Graceland College in Iowa used the V/V™ program in the 1988-89 school year study with 16 college students referred for reading comprehension problems and possible dropout potential. Following V/V™ instruction, their ranking on the Descriptive Tests of Language Skills of the College Board, Reading Comprehension subtest, improved from a mean percentile of 29.8 to 51.6 ($p < .05$), placing them well within the normal range of processing. On the Nelson-Denny Reading Comprehension Test, their mean percentile ranking improved from 13.3 to 33.1, again placing the students within the normal range of function, this time showing a significance at $p < .001$.

The number of students at Lindamood-Bell™ clinics who are specifically labeled autistic has increased only recently. Prior to the current understanding of autism and a subsequent increase in the number of children diagnosed with this disorder, some of the "V/V students" were probably severe enough to have had the label of high-functioning autism or Asperger's syndrome applied to their symptoms. Those students are included in the Lindamood-Bell™ clinical data and were referred to clinically as having a "severe V/V" profile. The V/V™ stimulation has been productive for developing language processing in individuals with that "severe V/V" label. However, while individual gains have been encouraging, modification of the V/V™ program for younger or more severely impaired autistic students is currently being studied.

HANNAH: SYMBOL IMAGERY AND DYSLEXIA

Although the focus of this chapter is on the relationship of imagery to the right side of the language processing spectrum, it is also important to understand imagery and the left side. Contrast aids perception. Briefly, symbol imagery—the ability to visualize the identity, number, and order of letters within words—is a neurological, sensory-cognitive function critical to literacy development. The research documenting difficulty in segmenting phonemes within spoken syllables has been extensive. This sensory processing problem has been called lack of auditory conceptual function, phonological awareness, and phoneme awareness by various researchers (Calfee, Lindamood, & Lindamood, 1973; Liberman & Shankweiler, 1985; Lundberg, Frost, & Peterson, 1988; Torgesen, Wagner, & Rashotte, 1996; Wagner, Torgesen, & Rashotte, 1994). However, the awareness of the segmental structure of words requires symbol imagery ability in order to process the internal parts.

The ability to image letters in words makes phonological processing concrete. The sensory-system function that moves phonological information to a concrete level is the ability to attach meaning to imaged letters so that they form words that also have meanings. When this function is not available rapidly and easily, dyslexia, in mild to severe forms, may occur. Recent research has noted that abnormalities in phonological processing are invariably present in dyslexia; however, deficits in visual processing are also commonly seen (Eden, 1999).

The relationship between imagery and reading skills has been considered important by a number of researchers for many years. The difference between good and poor readers on auditory discrimination tasks may arise not only from deficient auditory skills in poor readers, as is commonly thought, but also from the ability, as evidenced in good readers, of imaging written language symbols to improve their ability to discriminate sounds (Ehri, 1980).

A measure of phonemic awareness with an instrument as precise as the Lindamood Auditory Conceptualization (LAC) test is a contribution to the field of reading and to an understanding of the role of phonological processing. A new measure of symbol imagery appears to be making a similar contribution. The Symbol Imagery test (Bell, 1999) documents the correlation between the ability to image letters within words and a student's function in phonemic awareness, word attack, word recognition, and spelling. For example, analyzing testings of 330 students on a range of standardized reading and spelling tests demonstrated that symbol imagery ability correlated with phoneme awareness at a .70 level, with word attack at .81, with word recognition at .85, with spelling at .84, and with passage reading at .82. The data further suggested that symbol imagery correlates higher than phoneme awareness to word attack, word recognition, spelling, and paragraph reading. For example, phoneme awareness, as measured on the LAC test, correlated with word attack at .72, with word recognition at .67, with spelling at .59, and with passage reading at .61.

Although the information on symbol imagery is an important contribution to understanding the sensory mechanism involved in the acquisition of literacy skills, it is also important to note that not all individuals have this function available to them. For example, Jacob, a 14-year-old dyslexic had undiagnosed difficulties with symbol imagery. Jacob was exceptionally bright, got A's on term papers that he dictated orally, had exceptionally high oral language comprehension, and "everyone wanted to work with him because he truly contributed to others' understanding." A few weeks after he began treatment to develop articulatory feedback to assist him in perceiving sounds within words, he reached a plateau in applying his phonological processing to reading and spelling. His mother a pediatrician, wrote:

> "Jacob was finally moving forward, but something was still missing. After a couple of weeks, Kimberly called me and said she was planning on adding symbol imagery to Jacob's program. I honestly

didn't know what that was until Jacob came home and asked, 'Mom, do you picture letters in your head, because I never have.' So, that's why the lists of sight words were a joke throughout school. He was 14 years old and didn't have a single sight word. That was why he had to sound out a word twice if it appeared again in the same sentence. Amidst all the files of information (imagery) crammed into his extensive memory, literature, people, events, geometry, there was not one single letter!"

Symbol imagery is processing parts and results in the ability to process words rapidly and automatically. To return to Hannah, she was like Jacob in that her weakness in this imaging skill caused a resultant weakness in reading and spelling words. As her symbol imagery was developed and applied to decoding and encoding single through multisyllable words, she began to self-correct rapidly and automatically during the reading and spelling tasks. Her reading fluency developed, as did her orthographic spelling skills.

Hannah's improvement is consistent with the clinical work at Lindamood-Bell™, which verifies the interrelationship of imagery to print decoding and encoding. The 1997-98 Lindamood-Bell™ clinical data for children in the 10- to 13-year age range who were trained in only the Seeing Stars™ Symbol Imagery program (see Lindamood & Lindamood, Chapter 23, this volume) showed significant mean percentile improvement for all standardized tests, with the greatest improvements in word attack, paragraph accuracy, and paragraph reading (combining rate and accuracy). For example, in word attack the students' mean percentile improved from 32 to 68 ($p<.0001$). In paragraph accuracy, their mean percentile improved from 37 to 63 ($p<.0001$). In passage reading, their mean percentile improved from 25 to 50 ($p<.0001$).

A 1998-99 controlled study verified that dual coding with symbol imagery and language is applicable for reading and spelling words, as well as processing language concepts. The role of symbol imagery was researched in a Lindamood-Bell™ controlled study at an elementary school in Idaho, where only the stimulation of symbol imagery was examined. In second- and fifth-grade classrooms (an N of 32 and 26, respectively), the experimental group, receiving an average of 42.5 hours of small-group stimulation in the Seeing Stars Symbol Imagery program, had statistically significant gains in word attack, word recognition, and spelling. For example, in word attack, the second-grade experimental group had a mean standard score gain of 13.12, compared to the control group's mean standard score gain of 5.94 ($p>.01$). In word recognition, the experimental group had a standard score gain of 9.62, compared to the control group's mean standard score gain of 2.75 ($p<.01$). In spelling, the experimental group had a mean standard score gain of 9.56, compared to the control group's mean standard score gain of 3.25 ($p< .01$).

Comparison between the fifth-grade experimental group and control group showed similar gains by the group receiving Seeing Stars Symbol Imagery program instruction. In word attack, the experimental group had a mean standard score gain of 8.85, compared to the control group's mean standard score gain of 1.85 ($p<.05$). In word recognition, the experimental group had a mean standard score gain of 5.46, compared to the control group's mean standard score gain of .54 ($p= .08$). In spelling, the fifth-grade experimental group had a mean standard score gain of 4.92, compared to the control group's mean standard score gain of 3.25 ($p = .05$).

Symbol imagery is a sensory mechanism that places orthography for words in memory as well as enabling phonological processing at an automatic level. When individuals have an extensive sight word base and can quickly self-correct decoding errors, reading fluency is increased (Bell, 1997), and the left side of the language processing spectrum is intact.

A BRIEF HISTORICAL PERSPECTIVE OF IMAGERY

This chapter focuses on the relationship of imagery to parts-whole thinking and competence in language processing. Within this context, a brief examination of the historical perspective on imagery will be more illuminating. The following historical comments and research with imagery can be viewed from the perspective of parts-whole, symbol, and concept imagery theory.

Einstein wasn't alone in his reference to imagery as a primary sensory-cognitive function. References begin as far back as 348 BC, when Aristotle, in his contemplations on the ability to reason, theorized that *man cannot think without mental imagery.* His summation of memory concludes, "Thus, we have explained that memory or remembering is a state induced by mental images related as a likeness to that of which it is an image." Together with the statements from Aristotle and Einstein, there is compelling evidence and historical perspective that imagery is a primary factor in cognition, ranging from reading and spelling words to language comprehension and critical thinking.

A few hundred years before Aristotle, Simonides (556-468 BC) taught imagery as a system to improve memory. The great Greek and Roman orators used the system of imagery to enable them to speak for hours without written notes. This critical role of imagery comprised the classical art of memory for thousands of years, and there was direct stimulation of imagery as a primary sensory function for memory and thinking. Then, modifications of Plato's thoughts, neo-Platonic ideas, began to gradually remove imagery from prominence. In the 11th and 12th centuries, memory systems again became useful for purposes of remembering and making memorable the central Christian ideas. Statements such as Thomas Aquinas's, "Man's mind cannot understand thoughts without images of them" were responsible for renewed interest in imagery as a cognitive function.

In more modern times, Jean Piaget (1936, cited by Bleasdale, 1983) wrote that "knowledge, structures, or schemata are acquired when the infant actively manipulates, touches, and interacts with the environment. As objects are manipulated, sensory-motor schemata are developed and changed to accommodate new information. Over time, schemata become internalized in the form of imaged thought." Perhaps weakness on the right side of the language processing spectrum is caused by an inability to take the last step in Piaget's thinking. Perhaps the breakdown is not in the sensory-motor stimulation of manipulating objects, but rather a breakdown at the sensory level of imagery—*internalizing the schemata in the form of imaged thought.* Perhaps the sensory function of creating images is not developed to a sufficient enough level so as to be able to create imagery from either kinesthetic or language experiences.

Seeming to answer the above question, Piaget further stated, "It is clear that imaginal representations are not formed with the same facility in each case, and that there is therefore a hierarchy of image levels, which may correspond to stages of development. The evolution of images is a kind of intermediate between that of the perceptions and that of the intelligence."

Proceeding chronologically to some of the more interesting research and commentary, Arnheim (1966) wrote, "Thinking is concerned with the objects and events of the world we know…when the objects are not physically present, they are represented indirectly by what we remember and know about them. In what shape do memory and knowledge deliver the needed facts? In the shape of memory images, we answer most simply. Experiences deposit images." But, for the child or adult for whom imagery is not fast, automatic, vivid, or conceptual, these experiences may not happen easily or automatically.

Arnheim quoted the psychologist Edward B. Titchener, "My mind, in its ordinary operations, is a fairly complete picture gallery, not of finished paintings, but of impressionist notes. Whenever I read or hear that somebody has done something modestly, or gravely, or proudly or humbly, or courteously, I see a visual hint of the modesty or pride or humility." The visual hint Titchner describes is a higher level of imaging that begins with imaging the concrete and moves to imaging the abstract.

Continuing in the 1960s, Paivio (1969) wrote extensively on the role of imagery in cognition. "As every psychologist knows, imagery once played a prominent role in the interpretation of associative meaning, mediation, and memory. It was widely regarded as the mental representative of meaning—or of concrete meaning at least. William James (1890), for example, suggested that the static meaning of concrete words consists of sensory images awakened."

The 1970s brought further illumination from Paivio (1971). He had been attempting to demonstrate the way in which imagery can affect the acquisition, transformation, or retrieval of different classes of information. His dual coding theory, discussed earlier, defined imagery as one of two types of cognitive code, the other code being a verbal one. Paivio suggested that linguistic competence and performance are based on a substrate of imagery. Imagery includes not only static representations but also dynamic representations of action sequences and relationships between objects and events. Pribram (1971) stated, "Recently the importance of the Image concept has started to be recognized: cognitive psychologists analyzing the process of verbal learning have been faced with a variety of Imaging processes which demand neurological underpinnings…. Neurological research, as well as insights derived from the information-processing sciences, have helped make understandable the machinery which gives rise to this elusive ghost-making process." He further hypothesized that "all thinking has, in addition to sign and symbol manipulation, a holographic component."

Also in the 1970s, Kosslyn (1976) conducted a developmental study on the effects and role of imagery in retrieving information from long-term memory. In two blocks of trials, first-graders, fourth-graders, and adults were asked to determine whether various animals are characterized by various properties, first upon the consultation of a visual image and then without imagery. He reported that imagery provided more opportunity for retrieval.

Additional evidence surfaced during the 1980s. For example, Linden and Wittrock (1981) stated, "Reading comprehension is the generation of meaning for written language… We found that reading comprehension can be facilitated by several different procedures that emphasize attention to the text and to the construction of verbal or imaginal elaborations." In a study comparing fourth-graders with a control group of students given equal time to learn with the same reading teacher, he noted, "the generation of verbal and imaginal relations or associations between the text and experience increased comprehension approximately by fifty percent."

Further research by Oliver (1982) was based on three experiments to determine if an instructional set for visual imagery would facilitate reading comprehension in elementary school children. He concluded, "These findings indicate that teachers should try to help children develop the metacognitive skill of visual imagery as a strategy for improving comprehension… Visualization enhances comprehension."

Kosslyn (1983) noted, "A number of great thinkers, most notably Albert Einstein, professed to rely heavily on imagery in their work. Consider these words of Einstein: 'The psychical entities which seem to serve as elements of thoughts are certain signs and more or less clear images which can be voluntarily reproduced… this combinatory play seems to be the essential feature in productive thought—before there is any connection with logical construction of words or other kinds of signs which can be communicated to others.'"

Long, Winograd, and Bridge (1989) further summarized, "Our results suggest that imagery may be involved in the reading process in a number of ways. First, imagery may increase the capacity of working memory during reading by assimilating details and propositions into chunks, which are carried along during reading. Second, imagery seems to be involved in making comparisons or analogies—that is, in matching schematic and textual information. Third, imagery seems to function as an organizational tool for coding and storing meaning gained from the reading."

As is evident, theories and research on the relationship of imagery to thinking have been held and proven repeatedly throughout history. The 1990s continued to produce supportive research to uphold the role of imagery in cognition and reading. For example, Bower and Morrow (1990) observed, "Readers or listeners construct mental models of the situation a writer or speaker is describing. This is the basis of language comprehension."

Another researcher, Sadoski (1992), continues, "Imaginative processes, including imagery and emotional responses, are necessary to breathe life into the reading experience." In researching dual coding theory, reading theory, and reading efficiency, Sadoski noted that imagery is directly related to reading comprehension, reading recall, and verbal expression. He validated Paivio's dual coding theory in numerous studies involving imagery, comprehensiveness, and recall by carefully proving that the more reading concepts are imaged, the better they are comprehended, the longer they are recalled, and the more interesting they are to the reader.

Kosslyn and Koenig (1992) reported that the best clues about what different parts of the brain are doing during reading come from Positron Emission Tomography (PET) studies. These PET studies indicated that even reading single words is a complex activity, which involves several different parts of the brain. In particular, they reported that reading has a visual component and an associate memory component. The visual component clearly appears to involve the preprocessing and pattern activation subsystem, given the locus of the activation, and the associative memory component appears to involve the categorical property look-up subsystem (imagery).

SUMMARY

It is seemingly simple to think of imagery as a primary sensory system function necessary for efficient language processing skills. However, the premise includes two important considerations: (1) the integration of imagery to language, nonverbal and verbal stimuli, is necessary for cognition, and (2) there are two subtypes of imagery—symbol and concept imagery—for parts-wholes processing. The imagery subtypes move from left to right on the language processing spectrum. Symbol imagery is a primary sensory mechanism for reading and spelling words. Concept imagery is a primary sensory mechanism for language comprehension, expression, and conceptual thinking.

Labels such as dyslexia, hyperlexia, and autism reflect weakness on the spectrum. Concept imagery is a primary weakness for hyperlexia; however, more research is needed to know the precise role concept imagery plays in autism. Conceptual thinking is a processing deficit for individuals on the autistic spectrum, hence it is important to look for a primary sensory weakness. While the behavioral complexity involved in conceptual thinking suggests that the mechanism of the process does not involve a single sensory or cognitive process, the inability to create mental representations that rapidly and automatically bring parts to whole is very likely a primary contributing factor in autism.

The V/V™ program was developed on the basis of clinical observation and experience, and without the knowledge of Paivio's dual coding theory on the duality of processing verbal and nonverbal stimuli for cognition. However, the V/V™ program accommodates Paivio's theory of duality. Similarly, it stimulates concept imagery. As the program develops an individual's ability to image gestalts, the therapist can apply the imagery to developing numerous other skills in the individual, such as conceptual thinking, critical thinking, problem solving, oral and written language comprehension and expression, pragmatics, floor time, and play. There are, however, further challenges ahead for program refinement. Although the V/V™ has produced documented changes in processing ability, the program may need modification to work most effectively with high-functioning autistic individuals as well as with more severely involved autistic children. The research and process of modifying V/V™ to this level is underway.

Important knowledge has been gained about the imagery connection to parts-wholes processing; however, there are still challenges to be met. For example, tests of imagery need to be further developed to document the relationship of language processing behaviors to imagery. The brain processing ability of children with the label of hyperlexia, Asperger's syndrome, and autism needs to be measured before and after imagery stimulation.

If the greatest thinkers of our time attribute their strength in cognitive ability to imagery, it is reasonable to think that weakness in cognitive ability is conversely related to weakness in imagery. Oliver Sacks said that language is the symbolic currency for which we exchange meaning. Understanding the role imagery plays in symbolizing meaning may contribute to our continuing effort to bring children from darkness into the light. ■

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