PIECES OF THE PUZZLE
HOW CATEGORIZATION, PART-WHOLE UNDERSTANDING, AND COMMUNICATIVE INTENT CONTRIBUTE TO PHONOLOGICAL AWARENESS

by

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Cognitive Linguistic Theory posits that language is usage-based and dependent upon shared cognitive processes. As such, language development is partially reliant upon understanding the communicative intent of speakers as well as overall cognitive development. Children diagnosed with a Specific Language Impairment (SLI) do not have an identifiable sensory, motor, or cognitive cause for their language difficulties yet remain at risk for additional language delays. One such delay is with phonological awareness development, an ability that typically becomes observable in 4-year-olds and relies heavily on dynamic categorization and understanding of part-whole relationships. Furthermore, learning that objects have composite parts and properties is often facilitated by an established joint attention between speaker and listener. The interplay between attention, categorization, and part-whole skills in young children with SLI warrants investigation in order to better understand SLI’s underlying causes and possible therapeutic improvements.
Introduction

The world bombards us with a constant flow of data. This barrage begins even before birth, challenging our senses with the constant task of processing and organizing information. Car noises from the street must be distinguished from words coming out of the television. Tables are recognized as entities separate from the plates that sit on them. Moreover, there is data embedded within data: Shapes and colors are abstract properties of plates, and sentences are made up of words that are made up of syllables.

The scope of our data perception defines the world in which we live. We cannot discern the atoms and electrons that make up a tablecloth, but most people can see the patterns of the stitching. We cannot hear the extreme high-pitch of a dog whistle, but have the capacity to recognize words that start with the same sound. Our cognitive abilities enable us to break the world into smaller pieces, dynamically categorize these parts based on salient features, and reconstruct these components as the same or new entities. As the world bombards us - and in essence is – a continuous stream of data, the abilities to attend to, segment, and make sense of this information in the context of a whole is critical to our everyday functioning.

Our brain has developed strategies to handle this otherwise overwhelming sensory input. One such method is the ability to categorize data; without it we would have to remember each individual property of each entity that we encountered. It enables us to utilize patterns of information and make accurate inferences about objects that we encounter, and this ability has been identified very early on. Cohen & Strauss (1979) displayed a blinking light to infants 18, 24, and 30 week-olds; when infants looked at the blinking light, a picture of a female face in various orientations was shown adjacent to the light. Based on the
time that the infants spent looking at the picture, Cohen & Strauss concluded that the 30-week old infants were differentiating appropriate categories with respect to the human face. The ability to categorize is a foundational cognitive process for capabilities such as processing visual information and – to be discussed in the following sections – developing language.

There is no accord as to the how we actually categorize information, and there is also debate as to how categorization changes throughout cognitive development. Younger (2003) argues that infants initially apply analytical processing by looking at correlated attributes versus taking a holistic approach focusing on global similarity. Mandler (2003) contends that perceptual and conceptual categories appear at a very early age, and that development does not necessarily move from one form of categorization to another. Whereas adults do attend to statistical information such as similarity, prototypes, and prominent information, this alone is insufficient to account for mature concept formation (Gelman & Koenig, 2003). Thus adult concepts must have some sort of “theory” component to their categories, and Gelman & Koenig also argue for the idea that theory-based categories exist by preschool age.

In one attempt to explain adult processes Medin & Shoben (1988) highlight the cultivation of individual theories. They presented adjective-noun pairs to experimental subjects such as “straight banana” and “straight boomerang”. A straight banana was judged as a better example of a banana that a straight boomerang was of a boomerang. Medin and Shoben posited that this was a result of people’s general understanding (regardless of correctness) that the curvature of a boomerang is essential to it coming back, and “coming back” is a key component of what makes something a boomerang. The curvature of a banana
serves no real functional significance and in turn is not an important criterion when grading bananas.

Categorization processes have important ramifications for approaches to language development. According to Cognitive Linguistic Theory the faculty for language is not an autonomous one. Linguistic knowledge is represented in largely the same fashion as other conceptual structures, and the process for using this information is essentially the same across other knowledge domains. Moreover, linguistic and other knowledge is organized and retrieved in the same fashion. As a result, the cognitive abilities used for things such as reasoning and visual perception are very much similar to those utilized in linguistic tasks (Croft & Cruse, 2004). Even though phrases such as ‘linguistic knowledge’ may be used to describe certain phenomena, Cognitive Linguistic Theory does not suggest that this capacity is somehow separate from other knowledge bases. In fact it states quite the opposite: Linguistic capabilities and knowledge are deeply intertwined with the rest of our experience and understanding of the world.

If we apply this thinking to the categorization demands for infants’ visual perception (such as facial recognition) and the basis for understanding speech (discriminating various speech sounds into phonemes) then there should be some significant ‘overlap’ in the mental resources between the two. Creating categories based on facial structure or sound should involve some of the same general cognitive capacities, as shown in Figure 1 below.
Arguably the most basic form of categorization is categorical perception – applying meaningful qualitative differences to stimuli that are disproportionate to their quantitative differences. Two shades of green may be no different in wavelength than a shade of yellow, but we typically group the two shades of green together based upon the qualitative categories of green and yellow (Harnad, 1987). The same is true for how we group phonemes: In general, native English speakers a few years of age hear all productions of the /b/ phoneme as the same category, regardless of acoustic differences. However, at some point we cross a perceptual boundary and classify the sound as a /p/ (McLaughlin, 2006).

There are many aspects of language dependent on categorization skills, such as syntax structure, word retrieval, and literacy. If there is a developmental delay in any aspect of language and sensorimotor skills are intact, it seems prudent to also investigate general cognitive functions (and these tests are often conducted). A Specific Language Impairment (SLI) diagnosis refers to a child whose speech and/or language difficulties occur despite a favorable language-learning environment and the absence of any sensory, neurological, or physical impairment, as well as the absence of any behavioral or emotional disorders (Paul, 2007). The ‘speech and/or language’ difficulties are often identified by performance on standardized tests, generally by a test score that is at least -1.25 standard deviations with a corresponding performance IQ of 85 or higher (Leonard, 1998). A SLI may also be identified via a sample of the child’s spontaneous speech – for example, by analyzing their Mean Length Utterance. Leonard (1998) points out that although SLIs are rarely diagnosed solely by MLU, the combination of speech sample analysis with standardized tests produce a greater accord with clinical diagnoses than standard tests alone.
Although the criterion for SLI is exclusionary there is extensive research as to the possible underlying causes of the observed language difficulties. Paul (2007) provides a brief review of some of this research, which points to some children with SLI having problems with attention as well as non-verbal cognitive processes involving symbolic play, hypothesis formation, and mental rotation. Paul also notes that some criticism of these findings is that these results are far from definitive, and the tasks provided to these children are intertwined with linguistic components that may explain the poor performance. The “specificity” of SLI remains a topic of debate going back almost 200 years, albeit with some changing terminology. Leonard (1998) traces its origins back to Gall’s early 19th century work on children with language problems in the absence of characteristics of any other known disorders. In the early 20th century the term aphasia was used to describe language difficulties that were independent of any identifiable origin, and various terms were eventually applied to distinguish difficulties such as “expressive developmental aphasia” or “dysphasia”. Today, the most prevalent term used is SLI, although the terms developmental language disorder (both expressive and receptive) and developmental dysphasia are still common.

Paul (2007) provides an overview of the early language patterns in children with SLI (although remarking that some researchers argue against a true diagnosis of SLI before the age of 4). Language acquisition and development may follow the normal sequence in children with SLI; however, some areas may lag others at varying rates which often presents an asynchronous language profile. Children with SLI tend to have lower vocabularies at 2 years of age and communicate less frequently than peers of the same chronological age. Syntactically, children may not spontaneously combine words between 18 and 24 months,
have higher rates of ungrammatical sentences, and have difficulty with grammatical
morphemes. As Cognitive Linguistic Theory’s framework asserts that underlying cognitive
functions are shared between mental faculties, the continued study of the root of SLI profiles
is highly relevant to the field of cognitive linguistics.

If cognitive development is what enables language then the expectation is for
advances in young children’s cognitive processes to underlie advances in language
development. Consequently, a delay in language development should not occur in isolation;
the underlying cognitive delay should manifest itself in other non-verbal intensive tasks. In
part the challenge is in understanding the actual contributions of different cognitive process,
specifically because Cognitive Linguistic Theory states that these processes do not work in
isolation. Conversely, generative grammarians claim that SLIs should exist disjoint from any
other cognitive delays. If it turns out that they are disjoint, then a plausible explanation must
be provided under Cognitive Linguistic Theory.

Early language delays and disorders are sometimes indicative of future language risks
along the development spectrum. For instance, it is well documented that children with
language impairments are more susceptible to difficulties with phonological awareness as
compared to their peers (Gillon, 2000). Larrivee & Catts (1999) tested the reading ability of
kindergarteners with expressive phonological disorders. They found that children with
expressive phonological disorders and good reading outcomes significantly outperformed
their counterparts with poor reading outcomes on tests of phonological awareness.

Phonological awareness can be broken down into three parts: Syllable awareness,
onset-rime awareness, and phoneme awareness (Gillon, 2004). These encompass the explicit
ability to detect rhyme and alliteration, understand that words are made up of smaller units
(phonemes and syllables), combine individual phonemes into words, and recognize that smaller units of words can be represented as letters (Paul, 2006), as well as that words share the same parts as other words (Kahmi & Catts, 1989). This knowledge is crucial to developing literacy skills, as demonstrated in a longitudinal study by Catts, Fey, Zhang, & Tomblin (2001). 56% of second graders who rated as poor readers also exhibited a phonological awareness deficit as kindergarteners (versus just 11.8% of children rated as good readers). There are standardized as well as informal clinical tasks to evaluate Phonological Awareness for children as young as 3, and early PA interventions can lead to an improved understanding of syllabic concepts such as the relation between phonemes and graphemes, as well as sustained growth in literacy acumen (Gillon, 2006).

The following discussion will focus on the established relationship of language delays and disorders (specifically SLI) as a risk factor for phonological awareness, poor phonological awareness skills as a risk factor for literacy, and the evidence of successful intervention programs for children at risk for phonological awareness. It will analyze how various categorization skills and part-whole understanding are necessary for phonological awareness, as well as the role that communicative intent plays in these processes. This examination will then be used to study some of the existing clinical tasks for assessing and intervening in the phonological awareness of approximately 4-year-old children. These activities are part of a tertiary prevention framework put forth by Gillon (2006), targeting phoneme categorization, identification, and matching. As an extension of this, other non-language intensive exercises are presented that target the same cognitive processes. The purpose is not to criticize the processes and criteria by which SLI is diagnosed, but rather to
extend previous research and thinking with respect to what aspects of cognition might be related to SLI.

**Language Learning via Patterns**

From identifying single-words in speech streams to deriving idiomatic meaning, linguistic ability relies heavily on schematic and catalogued knowledge. Pulvermuller (2006) provides a view from neuroscience as to how the first words are learned. Intuitively, a key driver of language development might be single-word repetition of a speaker while pointing to an exemplar (such as ‘ball’ and pointing to a ball), and the infant then ‘echoing’ this word back. However, only a small amount of children’s lexicon is based on single-word repetition; the rest of their vocabulary is acquired via the correlation learning principle. Words are detected from repeated sound sequences, and infants quickly begin to distinguish them from the more “accidental” sound sequences that occur across word boundaries. These sounds occur within the context of other sensorimotor experience that lends potential meaning to words.

To group similar sounds into categories and words there needs to be some sort of detectable pattern for each phoneme. Conversely, in order to have pattern recognition one must be able to categorize (at least) some aspect of objects or experiences. Where it is difficult to separate the two skills into separate processes, the need for these abilities in language development is well established. In his usage-based account of language acquisition, Tomasello (2006) focuses on children’s whole, meaningful utterances. Children must extract words and their functions from heard expressions in order to abstract meaningful grammatical constructions. Over time children build up a series of these abstract
constructions and are able to place different words into available “slots”. It is the recognition of these patterns of language use and which words are appropriate substitutions that serve as the base for grammatical development.

Fauconnier and Turner (2002) discuss the capacity of phrases to have the same meaning in different contexts. Someone living only “a stone’s throw” away has a useful meaning even if their house is a mile to the East. Also, a star in a galaxy might only be “a stone’s throw” away from another star if the distance between them – as compared to other stars in a galaxy – is relatively close. Such speech is meaningful because of a complex “blending” process that enables the appropriate mapping of elements of one domain to members of another. One point to take away here is that language must be highly efficient to be useful, and in order for efficiency to be maintained patterns of reuse must be developed. Another is that human language cannot be explained merely by a set of general rules, which is (further) illustrated by a discussion on idioms.

An idiom is a grammatical unit larger than a word that is in some respect idiosyncratic (Croft & Cruse, 2004). Take the phrase ‘pull a fast one’. English speakers (that are either native speakers or supremely fluent) can readily say ‘Boy, Irwin pulled a fast one on Allan’. However, they will not say ‘Boy, was that one was fast that Irwin pulled on Allan’ or ‘Boy, the fast one was pulled by Irwin on Allan’. The idiom cannot be modified with the general rules of English and still retain its meaning (or in this case have any real meaning). The meaning of this phrase also cannot be predicted from knowing the individual conventions of each of the elements. Direct experience with a language (as well as possibly the culture) enables idioms to be used successfully. These facets go against the idea that language is generated and processed by some rule-based, isolated language module.
Language is usage-based, contextual, and dependent upon experiences, and the following sections discuss how categorization processes are also dependent in much the same fashion.

**Early Category Development**

One of the first steps of native language acquisition is to sense out the language's individual sounds. This includes recognizing the prosody, intonation and pauses in speech patterns that help identify phonemes, morphemes, and words. Categorization abilities are necessary in order to recognize this underlying structure: In order to detect regularities one must be able to repeatedly detect a pattern (Jusczyk, 2003). The eventual understanding that words are made up of different parts - and that these parts can be used to build and modify other lexical items - enables us to develop the rich, everyday language characteristic of contemporary human culture. Young children grasp this elemental concept in the first few years, making such grammatical mistakes as “comed” when adding the English regular past tense suffix ‘-ed’ to an irregular verb (Tomasello, 2005). In this instance they have identified the part of speech indicative of a past event and have used it to modify their speech. Patterns of language development occur in much the same rate and fashion across different cultures and also normally evolve in parallel with other sensorimotor and cognitive developments (e.g. the Piagetian principles of Imitation, Means-End, and Symbolic Play) (McLaughlin, 2006). These findings suggest that language development is tied to the overall development of general human cognitive processes.

One measure of infants’ categorization abilities is when they “respond in an equivalent manner to discriminably different stimuli” (Quinn, 2003, pp. 52). Using novelty-preference procedures, basic-level categories such as horses and cats are formed by infants as
young as 3 to 4 months old such (Eimas & Quinn, 1994), and also higher-level categories such as mammals and furniture (Behl-Chadha, Eimas, & Quinn, 1995). It is posited that base level categories are formed on specific values of shared features, while higher level categories are formed by the presence or absence of certain salient features (Quinn, 2002). If these early categories are the basis for future adult categories, then the mechanisms by which infants initially parse their environmental data should provide a form of perceptual category scaffolding: Future knowledge should be easily incorporated into these categories to build a (further) organized knowledge structure of the world.

There is some debate as to whether or not these categorizations are the basis of adult categorizations or whether there is a later “recategorization” process that happens (Younger, 2003). Under this latter proposal, features are at first processed independently; then processed between objects; and eventually features are processed between categories. There is also some evidence that “correlation-based categories appear in synchrony with changes in complex speech perception tasks” (Younger, 2003, pp. 91). Lalonde and Werker (1995) tested 40 8- to 10-month old infants on three separate tasks involving nonnative consonant discrimination, object search, and visual categorization. As adults have been shown to have difficulty distinguishing those phonetic contrasts that do not have meaning in their native language, and 6-8 month olds do not have this same difficulty, Lalonde and Werker were looking for other corresponding cognitive developments that occurred at the same time as this “reorganization in speech perception” (Lalonde & Werker, 1995, pp. 461).

Based on previous research, about half of 8- to 10-month olds should (still) be sensitive to nonnative speech tasks. Performance on the non-speech tasks also were expected to have about a 50% success rate, and if there was synchronicity in the performance results
across the three tasks, this would be taken as support for the idea that cross-languages changes in speech perception are influenced by nonlinguistic processes. These included a nonnative speech contrast, a correlated attribution categorization task, and a delayed-response search object task. The infants that were not able to discriminate the nonnative speech task displayed longer looking times in both the uncorrelated and novel stimuli in the attribute categorization and delayed-response search tasks, respectively. The results supported a developmental model of simultaneous changes in performance on all three tasks.

A separate study by Morgan and Saffran (1995) looked at infant’s abilities to process both sequential (segmental) and suprasegmental (rhythmic) information. Their results suggested that by 9 months of age children do not rely on just sequential regularities, but that they integrate rhythmic and sequential data in segmenting out units from multisyllabic strings. A Younger study (1992) showed that at 7-months of age children were more likely to respond to a novel feature (e.g. on a drawing of a face), whereas 10-month olds were more likely to use shared features among faces as the basis for categorization. The idea that changes in “integrative abilities” (Younger, 2005) occur in both speech and perception tasks in similar chronological fashion supports the idea that the cognitive processes are – at a minimum – operating in parallel and may well actually be shared. Whether or not the initial categorical development in infants is being replaced by a “recategorization” is not of immediate concern for the present discussion. What is important is that information processing in the visual and speech domains both show similar developmental changes at the same time.

In preschool age children evidence points to perhaps another important change in categorization skills. There is a transition from grouping based on perceptual features (such
as shape) to grouping based on concepts (such as grouping on functionality). In word extension tasks children are taught a new word and provided an instance (a standard object) that represents this new lexical item (Genter & Namy 1999). The other object(s) that children extend the word to ideally provide insight as to the features being used for categorization. This also has importance with respect to dynamic construal of categories (Smith & Samuelsson, 1997) as the children are required to generate novel categories “on-line”.

Landau, Smith & Jones (1998) notes that some research shows that early naming is dominated by form over function, in particular with respect to shape. They attributed a possible explanation to the objects’ appearance being more salient than the functional properties, and conducted a study where children and adults were told the name of a novel object. In the No-Function condition a standard object was labeled, and no information was given about the function. In the Function condition a standard object was labeled and its use was both explained and demonstrated. The two different standard objects (used in both conditions) had functionality based on each respective material (one was to wipe up water and the other was to support push pins like a bulletin board). In order to test each standard, nine objects were shown in the following fashion: a replica of the standard and two subsets of four objects, each containing two Same-Shape (different material) and two Same-Material (different shape) elements. With the standard object still in view, each of the nine test objects were withdrawn from the box and asked “Is this a Rif\Dax?” (The standard object’s name.)

The 3-year-olds in the experiment strongly generalized the name based on shape in both the Function and No-Function conditions. 5-year-olds had a strong tendency to
generalize on shape in the No-Function tasks, and a weak tendency based on shape in the Function tasks. Adults generalized on shape in the No-Function condition but generalized based on material in the Function condition. These results can be interpreted that shape was a more salient property than material, as seen in the No-Function task. Also, adults were able to shift/override their attention to the functional property (material) whereas the shift in 5-year-olds was unreliable and in 3-year-olds essentially non-existent.

Imai, Genter, & Uchida (1994) presented 3- and 5-year olds and adults with a standard picture (say an apple) along with three other images: An apple tree (which would represent a thematic choice), a ball (shape choice), and a banana (category choice). They were asked either “Find the one that goes with this one” or “This is a dax. Show me another dax.” In the first condition (the no-word condition) all of the age groups more frequently made the thematic selection. In the word condition the adults were still more likely to choose the taxonomic/category match (although there was a strong shift away from the taxonomic tendency), whereas the 3- and 5-year olds were more likely to make a match based on shape. This was interpreted as children having certain expectations about words, namely that they are more likely to extend nouns based on perceptual features. However, the 5-year-olds showed a marked shift towards the taxonomic match in the word condition as compared to their 3-year-old counterparts. Additional experiments showed that children’s taxonomic tendencies increased when they had a better understanding (more information/experience) of the category, which suggests this shape-to-taxonomic matching is driven in part by increased domain knowledge.

Gentner and Namy (1999) addressed some of these findings when discussing a structure-mapping process for categorization development. They focused on the potential
issue that word learning could direct children to focus on common perceptual features instead of the more complex, deeper functionality of objects. Even though initial word extensions are perceptually based, increasing the volume of mental comparisons eventually gives rise to insights dealing with aspects such as function. The end result is that the common relational structure becomes more salient over the perceptual features.

Gentner and Namy (1999) looked at preschooler’s comparison of perceptually and conceptually similar objects and whether the comparison of multiple category instances led to children’s acquisition of category knowledge. 80 four-year olds were given a standard object with a novel name. They were then asked to choose another instance of the standard object from two other objects - one represented a perceptual match and the other a categorical match, and the perceptual matches had been deemed “more similar” to the standard object in an adult survey. The children were also asked to perform the same task when they were presented with 2 initial standard objects that were more similar to the (potential) perceptual that the category match. The children chose the category match at a higher rate in the second task than in the first, and also chose the category match more than half of the time in the second task. This was taken to demonstrate that the (more) comparisons of items is a key driver in children arriving at an understanding of categories on a conceptual level.

The above studies suggest developmental shifts in the way that children respond to certain tasks, but some of the methods warrant further analysis. Landau, Smith & Jones (1998) taught children a new word for an object by holding it up and saying “This is a dax”. To then ask children to extend this word to new objects seems (very) inconsistent with natural language learning. In the comparison learning example they gave a quick
demonstration and explanation of the word which provides specific functional meaning and context (although it is still not quite the way that words are generally learned). Because of this, it would be surprising not to expect different outcomes between the trials. Whether or not these differences truly represent the typical development shift in children is subject to further scrutiny.

Tomasello (2005) outlines how word-learning is not a sort of “mapping” of words onto objects. The overwhelming majority of word-learning and word-learning situations do not take the form of pointing or naming (also noted earlier in Pulvermuller, 2002). Words are “experienced” in the flow of social discourse and interactions, and it is a rarity that an object will be pointed to – with no contextual cues – and named. Even without this specific instruction children still learn words at a remarkable rate, with some estimates as high as 9 per day for preschoolers (Carey, 1978). Tomasello proposes a social-pragmatic theory of word learning, where there are precursors such as properly segmenting speech (in the case of the non-hearing impaired individual) and conceptualizing entities, but a child’s ability to understand the communicative intentions of others is indispensable.

In his theory of frame semantics, Fillmore (1985) argues that the meanings of words are driven by their context and the relevant knowledge of the word, and that listeners are responsible for constructing – from a speaker’s utterances - a full understanding. Words such as big or little have no real definition in isolation because there can be small stars and big mosquitoes. Understanding words such as ‘buy’ entails knowledge of transactions and sellers. One might argue that experiments involving words such as apples and bananas are devoid of the same kinds of complexity. However, children likely have certain expectations
of these objects, such as they can be bought at a grocery store, teachers like apples, monkeys eat bananas, and apples belong in the refrigerator.

When learning new words children often are supported by the word’s context. This scaffolding could well be a repeatable scene (also known as a ‘script’) such as bath-time or riding in a car, and these familiar, recurring scenes are thought to facilitate language learning (Tomasello, 2005; McLaughlin, 2006). Children must also have some form of joint attention with a speaker, as well as understand the speaker’s communicative intention in order to decode what the speaker is referring to. When novel word functionality was demonstrated and explained in the Landau, Smith & Jones (1998) experiment, joint attention as well as communicative intention must have been established and understood for the children to relate the function to the new object. However, it seems questionable as to what the children really thought the communicative intent was, or how long they held the joint attention frame for.

When the sample object was put down, it seems possible that the 5-year-old children who did choose functionality matches for the comparison objects could have just been ‘holding’ the joint attention frame longer as that is what they were being instructed (via the communicative intent) to do: They (continued to) understand that function was the salient feature in this task, perhaps not revealing anything about a developmental shift in categorizing objects.

Akhtar, Carpenter, & Tomasello’s (1996) study that had children play with novel objects is a less problematic experimental design. A child, an experimenter, and the child’s mother played with 3 novel objects. The child’s mother left the room and a fourth object was subsequently introduced and played with, and the mother’s absence (mainly relating to the fact that she could not see the new object) was explicitly noted. The mother returned and exclaimed “Oh look! A gazzar! A gazzar!” 24-month-old children learned the word
‘gazzar’ for the fourth object as they were able to utilize the adult’s perspective of novelty in order to understand the mother’s communicative intention: She would only be excited and exclaim ‘gazzar’ for a new object in this scenario. Having the child interact with and experience the objects as part of a ‘more natural’ scene seems more likely to elicit behavior and results that mimic those found in the course of the child’s everyday development.

**Whole-part Development**

Not only do children have to learn new objects and their names, they also learn the parts and properties of these things. Objects that we encounter through vision or touch, or music or words that we hear are often made up of other perceptually distinguishable parts. Reifel & Greenfield (1983) investigated this development of part-whole relations, which might start as a child grabbing parts of a face (e.g. an ear) or pointing (perhaps to a dog’s tail). Children have to utilize part-whole relationships in a variety of ways, such as putting together puzzles or answering questions like “Does that doll have all her clothes?” Children are usually using blocks representatively by the age of four and this block play can help illuminate a child’s part-whole understanding. A block may stand for a house, or multiple blocks may comprise the house - “this block is the door” or “this block is the window” (Reifel & Greenfield, 1983).

Reifel & Greenfield’s (1983) experiment looked at the development of children’s block play and its relation to language. 20 4-year-olds and 20 7-year-olds were read *Little Red Riding Hood* and then instructed to “Use the blocks to show me the story we just read”. In the resulting houses that were built, 4-year-olds included an average of 2.17 house parts and 7-year olds included an average of 3.15 parts (as judged by two observers). Furthermore,
three 4-year olds used just one block to represent the house, whereas no 7-year olds had a house made from a single block. When children labeled parts of their houses, the 4-year olds averaged 1.85 parts whereas the 7-year-olds had 2.56. Comparing the construction as a whole to the children’s verbal understanding (the labeling) showed that the children had some knowledge of the house parts that they were not spontaneously expressing via language. This was interpreted to indicate that the understanding of part-whole relationships is more developed than the language used to express it.

Markman (1990) presents some ideas as to how children progress from learning words for whole objects followed by lexicon for parts and properties. In the Whole Object assumption children learn new words by assuming a novel term refers to a whole entity and not parts or substances of this entity. The Mutual Exclusivity constraint provides a framework for learning the parts or properties of these entities as it serves to override the Whole Object assumption. According to this constraint there is one term for a recognizable entity: If a novel word is heard in reference to an object, and the child already has a word for the object, then the child knows that the novel word must be in reference to a part or property of the object. Of course there are obvious exceptions as the family pet can be referred to as ‘Rover’ or ‘dog’. However, the thought is that children perhaps apply this principle as a general hypothesis and this facilitates word learning.

Tomasello (2005) argues strongly against constraint-based approaches such as the Whole object or Mutual exclusivity assumptions. If child word learning happens simply by hearing them in association with an object or activity, then children would need some additional information beyond the sound of the word and the perceived scene; otherwise they would have no way of knowing what a novel expression is referring to. Constraint theories
propose that children have a certain *a priori* knowledge that limits the hypothesis space in order to give them a “head start” in solving these problems of referential indeterminacy. According to Markman’s theory, a child associates a novel word with a whole object. If an action word is used in the context of an unknown object, then how it is that children could apply the new word to the action (which Tomasello & Akhtar (1996) showed that they could)? Markman implies that The Whole Object constraint would take over in this situation and the novel word should be applied to the object.

Tomasello’s social-pragmatic theory of word learning emphasizes the wealth of interactive information in a child’s language learning environment. The constraining aspects of word learning are a child’s structured social world (scripts, social games, routines) and their ability to attend to and participate – via joint attention and intention-reading - in this world. Social interaction routines are to some extent culturally specific, but each culture has them. In American society, things like diaper changing, bathing, and car trips provide the repetitive framework that Tomasello contends is necessary to acquiring natural language. Furthermore, children’s joint attention in these frames is what allows them to develop language. The idea that language development can only take place if there is some “common ground” is what differentiates social-pragmatic theory from those such as Markman’s: Children do not attempt to map words to the world via some sort of reflexive cognitive task. They determine a speaker’s overall communicative intention with respect to an utterance, and then try to identify the “specific functional role” that this word plays in it. This common ground of interaction is what “constrains the hypothesis space”, limiting the interpretations to what the speaker is trying to communicate. This social-pragmatic theory also provides an
explanation of why children develop language when they do: It happens when they are able
to share communicative attention with other people.

Saylor, Sabbagh, & Baldwin (2002) investigated the use of parent’s language when
teaching children parts of an object. Parents tend to use novel words that refer to parts of
objects in the context of the whole, such as “See this cup? This is the rim.” Saylor, et al,
explored this juxtaposition of the novel term with the familiar whole object. One key
problem they identified was that a part could not be removed from the whole and displayed
separately (such as just showing a picture of a beak), as then this “part” has lost its “whole”
reference, and may become a whole object itself. To address these issues they presented
pictures where the majority of the object was one color and the salient part was another
color. This test was administered to 3- and 4- year old children and they were pre-screened
to verify that they could produce the colors red, blue, green, yellow, orange, and purple.

12 pictures of familiar objects were presented with a salient part, and half of these
salient parts were familiar (such as a wheel on a car) and half were novel (such as a thorax on
a butterfly). The questions took one of the following four forms: “See this butterfly? What
is the color of the thorax?” (juxtaposition), “See this? What color is the thorax?” (no
and “See this thing? What color is the thorax?” (frame control). In the tests relating to
familiar objects the children’s responses were at a ceiling across the four questions,
suggesting that the presence or absence of juxtaposition did not matter for known parts.

In the tests involving novel parts the patterns of response did not differ in the delay
and frame control when compared to the non-juxtaposition condition. However, when the
juxtaposition condition was compared to the non-juxtaposition condition, children gave
significantly more part responses. Saylor, et al. concluded that the success of generating the part names was not solely the result of mutual exclusivity. This was seen in the results of the control questions: The facilitation of the retrieval of the name for the whole object did not trigger mutual exclusivity and generate part interpretations.

Saylor, et al. hypothesized that some pragmatic element might be related to success of the juxtaposition condition. They conducted another set of experiments that differed from the first by providing the juxtaposition via a gestural modality. This was accomplished by tracing a circle around the object with a finger (representing the whole), and then a somewhat referentially ambiguous pointing (a few inches above) to the part. There were also two comparison formats: One was a gesture no-juxtaposition condition which had only the referentially ambiguous pointing (when referring to the part), and the other had two, identical referentially ambiguous pointing gestures (one for the whole and one for the part). Children in the gesture-juxtaposition were more likely to name the part than in the gesture-no juxtaposition or the two-gesture format. The results of these two studies were taken as evidence that juxtaposition had facilitated child learning of part-whole relationships over things such as mutual exclusivity or general cognitive processing. Juxtaposition is effective because the children use this information to “draw online inferences about the speaker’s intended meaning” (Saylor, et al. (2002), pp. 1001), which according to Tomasello’s theory is crucial for a child’s word learning.

The block-building and juxtaposition studies highlight the interaction between part-whole relationship and language. The first suggests that part-whole cognition is more advanced than children’s spontaneous expressions indicate. The second shows how language can be used to facilitate part-whole learning, as well as how part-whole juxtaposition can
trigger mutual exclusivity and word learning. Part-whole understanding also has ramifications for phonological awareness as children must become cognizant of the different parts of words and the relations of these parts to word-meaning.

The ability to categorize and the ability to detect part-whole relationships are clearly related. Grouping objects together – particularly in young children where the tendency is on perceptual features versus functionality – might very well involve identifying which parts of an objects match or contrast other parts of objects. Gentner, Loewenstein, & Hung (2007) looked at children’s abilities to detect part-whole relationships in objects where they did not know the category. They showed 3-, 4-, and 5-year-old children a picture of a novel entity instructing them, “Look, this one has a fricket,” and then asking which of two alternatives “Also had a fricket”. The alternatives varied in similarity, sometimes having the exact same shape (high similarity) and sometimes having different shapes (low similarity), and the entities were either representative of inanimate objects or animals. Furthermore, each of the comparison animals had multiple internal “parts” (that were not frickets, such as eyes and ears), whereas the comparison objects had 1 part (the fricket) or 0 parts. Children were more likely to choose correctly when the entities were similar to the alternatives than when they were different. The older that the children were corresponded to an increase in performance, making age a main effect. The 3-year-old children performed at chance for the low-similarity objects and animals, and reliably above chance on the high-similarity objects. 4-year-olds were able perform above chance on the high-similarity but not the low-similarity animals, and above chance for both the high and low similarity objects. The 5-year olds performed above chance for all types.
The experimenter did not give a name for the standard object - ruling out mutual exclusivity for naming part of the item – did not gesture or point to the part in question, and the objects were of novel shapes so that base-level categorization would not factor in. There is still some possible some scaffolding in the tasks, however, as the use of possessive syntax such as “It has a” has been shown to help elicit correct part-whole responses in an experimental setting (Saylor & Sabbagh, 2004). Structure-mapping theory suggests (Gentner & Nam, 1999) that entity similarity facilitates alignment and allows for the child to correctly choose the right part. An additional study was conducted with 3- and 4-year-old children to ensure that the correct selection could be attributed to structure-mapping and not merely to the presence or absence of a part. The entities were presented in the same format, except that in the comparison entities none of them was absent an internal part: it had either the matching part or a non-matching part. The results were analogous to the initial experiment whereby the 4-year-olds were reliably able to use comparison processes to match parts on novel entities.

**Phonological Awareness Development**

The explicit understanding that words are comprised of individual parts (sounds) is known as phonological awareness (Gillon, 2006), and there are three general stages of this development: identifying that words have a syllabic structure; that words have an onset followed by a rime unit; and that words are comprised of individual speech sounds\(\text{phonemes}\) (Gillon, 2006). This awareness is essential to literacy development in alphabetic languages such as English, where shapes (letters) represent sounds and these shapes\(\text{sounds}\) are combined to form new words (Paul, 2007). Some of the cognitive skills necessary for these
tasks involve analyzing whole words into parts as well as categorizing the words and their parts. It also requires that children ‘mix and match’ parts of words to create new ones and modify existing ones. This awareness facilitates literacy development as children are able to take these individual sounds and match them to a letter(s), and can also piece these sounds and letters together to both recognize and produce printed words.

As discussed earlier, categorical perception enables children to group spoken sounds that they hear into meaningful units of their language. Phonological awareness requires more of a conscious understanding of this grouping as children must explicitly identify these phonemes from a continuous stream of speech. Furthermore, in order to have an efficient method of learning to read they must develop categories of words that start with the same sounds/letters. The process of categorical perception implies that some of the more subtle acoustic differences are insignificant to our understanding of language. While categorical perception is also not unique to human speech processing, infants clearly “start” with the ability for categorizing speech sounds (Jusczyk, 2003). Each of these individual category groupings is what is known as a phoneme (McLaughlin, 2006), and in standard spoken English, all of the varying utterances are grouped into 41 phonemes (Gillon, 2006).

A child has to initially organize the different sounds along with the various pronunciations from different speakers. There is considerable variance in the rate of speech, stress, and emotional pattern between speakers and even within an individual speaker (Eimas, Miller, & Jusczyk, 1987). Thus, the demands of categorization are immediately necessary for phoneme recognition. Each new sound has to be added to a new category and/or the existing categories boundaries have to be reshaped. Infants also become quickly attuned to the particular stressing of words as well as patterns of pausing particular to their native
language(s). These skills enable children to begin processing words at about 7.5 months of age (Jusczyk and Aslin, 1995), and at 10.5 months can identify word forms that do not fall into the typical stressing pattern that they are accustomed to. At about six months of age, infants exposed to Spanish demonstrated the same phonemic category boundaries as those displayed in English (Lasky et al., 1976). At 8 to 9 months infants learn about distributional speech patterns and retain frequently heard words, and between 6 and 12 months they start to lose their ability to discriminate particular nonnative speech sounds (Jusczyk, Cutler, & Redanz, 1993). Is the “loss” of this capacity permanent and representative of some structural change that we undergo in development? Or, is it indicative of a cognitive process such as attention that can be altered and recaptured? There is some evidence towards the later as people can learn the prevoiced-voiced distinction that is absent in American-English speakers (Eimas, Miller, & Jusczyk, 1987). Furthermore, the success of speech therapy for children with phonological deficits seems to indicate the ability to direct conscious attention to certain learned aspects of speech.

Overall language development is influenced by many factors, including culture, intellectual ability, and socioeconomic status (Paul, 2006). Phonological awareness development itself is only one of the factors that contribute to written language competency, but its importance to reading and spelling acquisition is well-established (Gillon, 2004). Lonigan, Burgess, Anthony, & Parker (1998) conducted a study of 356 United States children from 2- to 5-years of age from various economic backgrounds. (Lonigan, et al., actually used the term “phonological sensitivity” to describe the areas investigated; however, they these areas were the same ones that have been referred to as phonological awareness in this paper). They were administered 4 tasks: Rhyme oddity detection (in a series of 3
pictured words which one did not rhyme), alliteration oddity detection (in a series of 3 pictured words, which one did not start with the same sound), blending (e.g. given pictures of a “cow” and a “boy, what word was formed if they were put together), and elision (first the child says “batman”, and then asked to say the word without the “man” part).

Two additional tasks were also given to a subset of the children to help determine if the previous four tasks measured phonological sensitivity or (just) the actual demands of the oddity tests. One was rhyme matching, which used the same materials as the rhyme oddity task. The children were shown a picture and then asked to choose the one picture from an additional pair that rhymed with the first picture. The second task was a category oddity detection task, where a child was presented 3 pictures and asked which one was not the same as the others (such as 2 pictures of different dogs and a cow).

The results of the study found that phonological awareness accelerated and became more stable with age. The growth rate was slower, however, in the lower-income sample than in the middle-income sample. Across all age groups children performed better on blending and deleting tasks at the whole word level than at the syllable level, and performed better at the syllable level than at the phoneme level. Between the ages of 3 and 4 there was a substantial increase in the abilities for rhyme oddity, blending, and elision. This is consistent with other research that shows an increase in performance with age, and that awareness for larger language units develops prior to smaller ones (Treiman & Zukowksi, 1991). Furthermore, in the Lonigan, et al. study, it was only from 4 years of age where stable phonological awareness emerged. Dodd & Gillon (2001) also report that in normally developing 4-year-old children, phonological awareness is limited to syllable segmentation and the emergence of rhyme awareness.
Lonigan, et al., argue that the results of the non-phonological oddity task indicate that general cognitive skills “unrelated” to phonological sensitivity skills are exactly that: Unrelated. However, choosing “base-level” categories of animals from pictures does not seem analogous to matching based on rhyming and initial sounds. Separating a dog from a cow does not explicitly ask the child to identify any specific, contrasting parts of an object that are arguably of lower-salience than the base-level category, and then to dynamically form a new category based on these parts. A more in-depth discussion is presented later in the paper when proposing an experiment to investigate the cognitive processes at work in phonological awareness tasks.

Understanding the sound structures of words ideally leads to enhanced reading comprehension, spelling, and recognizing the words in isolation. One model of spelling (Treiman & Bourassa, 2000) requires segmenting a word into phonemes and then applying grapheme knowledge of each of these sounds. Goswami and Bryant (1992) propose a method of reading and spelling by analogy: Children employ their knowledge of words in order to spell new ones. If the know how to spell ‘dog’, then they can segment it at the onset-rime level (d-og, instead of at the phoneme level) when presented with the task of spelling ‘fog’. The efficiency advantages gained via this pattern recognition become more pronounced when learning longer and longer words. Furthermore, inefficient word recognition is thought to be a leading deterrent to reading comprehension (Stanovich, 1991).

**Specific Language Impairments**

Crosbie and Dodd (2002) discuss three main theories that have been developed for SLIs. One is that of a specific linguistic deficit based on Chomsky’s theory of innate
language knowledge, which is the basis of the aforementioned generative grammarian’s thinking. A second approach suggests limitations in children’s general information processing capacity that results in subsequent poor language performance. The third is that there are information-processing deficits when responding to rapid auditory information or in the storing of phonological information.

Dodd & Gillon (1997) investigated children with phonological disorders that also met the diagnostic criteria for a Specific Language Impairment. They hypothesized that the phonological problems might be the result of an underlying impairment in rule abstraction, which is an ability closely related to pattern recognition. Preschool age children with phonological disorders may have speech that is difficult to understand due to errors in pronunciation and also are at risk of future reading delays. Dodd & Gillon (1997) administered a non-linguistic rule-governed task to three groups: Poor readers whose language met classifications for SLI, normal readers of the same chronological age, and children of the same “reading-age”. A pack of 50 cards was used with two pictures per card. Each picture pair was of the same object (such as an apple) and differed in size and color. When the examiner showed the child the card, the child had to guess and point to which picture the examiner was “thinking” of.

At first the examiner was thinking only of red objects. When the child correctly guessed eight times in a row the examiner shifted to thinking only of blue objects. After another eight consecutive correct answers, the examiner thought of only the big objects. Whereas the poor readers showed no performance lag when shifting from red to blue objects (salient aspects within the same category of color), they did perform below the control groups when switching from color to size (a shift in salience). Dodd and Gillon posit this
performance stems from a possible lack of flexibility when applying either irregular of complex rules, which also could explain their poor reading performance. Connell & Stone (1994) have also reported similar findings that children with SLI have difficulty abstracting nonverbal rules.

In general, studies as to the roots of SLI have not produced clear answers. Some claim that several areas of nonverbal cognition are affected in children identified with SLI. Kahmi, Catts, Koenig & Lewis, 1984 looked at 6-year-old children with and without language impairment that were matched by mental age (via the Columbia Mental Maturity scale). In one task various jars were presented, and a certain color of the jar indicated there was always a (visible) ball of yarn inside. The subjects had to learn the rule that corresponded to a ball of yarn being inside of the jar. Children without language impairment scored significantly better than the group with language impairment. In another task children had to categorize a new animal as a “zonk” based on several pictures of “zonks” and “non-zonks”. Zonks were classified by only one characteristic – a curly tail versus a straight tail – and children were presented pictures and asked whether or not it was a zonk. After 8 consecutive correct answers children were shown a mix of the original pictures as well as additional pictures, asked which ones were zonks, and then asked how they made their determination. In this task the two groups performed similarly.

**Early Identification of Phonological Awareness Deficits**

Children with speech and language impairments are at risk for phonological awareness (Larrivee & Catts, 1999; Gillon, 2000). As previously discussed, phonological awareness partially depends on categorization and part-whole identification. Furthermore,
some of the informal clinical tasks that are used to evaluate phonological awareness also depend heavily upon these skills. Perhaps some children at risk for phonological awareness also have trouble with some aspects of categorization and part-whole relationships. Moreover, children with SLIs who perform below peers on early phonological awareness tests could potentially have categorization and part-whole relationship issues underlying their language difficulties. If this thinking was demonstrated to be accurate then this would open the door for additional therapeutic techniques.

In addition to numerous standardized tests for phonological awareness there are several informal methods that speech pathologists utilize in the clinical setting. The standardized Preschool and Primary Inventory of Phonological Awareness test is designed for children as young as 3 and assesses their ability to detect and manipulate words at the phone, syllable, and onset-rime level. The Phonological Abilities Test is for children as young as 4 and rates their abilities for rhyme detection and production, word completion, and phoneme deletion. Informal clinical methods may include the following: presenting a series of pictures and asking the child to identify the one that does not rhyme with the others (such as choosing ‘horse’ from the pictures ‘horse’, ‘cat’, and ‘hat’); match rhyming words; identify the word from a series of words that starts with a different sound; match words that start with the same sound; blend syllables to make words; and delete syllables from words (Gillon, 2006). For each of the clinical methods listed below, there is a counterpart task to investigate related cognitive areas. These types of non-language intensive tasks require similar skills as the language-specific ones.
Table 1

<table>
<thead>
<tr>
<th>Clinical Task</th>
<th>Non-linguistic Counterpart Cognitive Task</th>
<th>Cognitive Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detect the word from a series of 3 pictures that does not rhyme with the other 2</td>
<td>Given three objects, choose the one with a different “part” than the other two (such as a different nose)</td>
<td>Part-whole and dynamic categorization: Can the child organize/discrim objects based on abstract properties? Can they group objects in ways they may not have grouped them before?</td>
</tr>
<tr>
<td>Match pictures of words that rhyme</td>
<td>Match objects based on parts. Choose two movies that have the same character in them.</td>
<td>Same as above</td>
</tr>
<tr>
<td>Blend syllables to make words</td>
<td>Have the pieces of 2-3 simple puzzles mixed together. The pieces of one puzzle can be combined with the others, but this forms an “incorrect” image.</td>
<td>Part-whole relationships: Can the child understand that objects/words can be formed from individual parts?</td>
</tr>
<tr>
<td>Given a series of pictures, identify the one that starts with a different sound than the others</td>
<td>Identify an object from just a picture/physical representation of a “part” (e.g. picture of someone’s leg, a piece of dog hair)</td>
<td>Part-whole relationships – can a child take “part” of an entity and “complete” it (be it a word or a mental image)</td>
</tr>
</tbody>
</table>

Detect the word from a series of 3 pictures that does not rhyme with the other 2

Asking a child to distinguish words that will ideally indicate how well they can identify the rime unit of a word, providing a gauge of their phonological awareness. In order to accomplish this task the subject must understand that the word sounds are similar enough to constitute a ‘match’, or dissimilar enough not to fit with other members of a group. Words also have an onset sound that is likely to be different from other words that it rhymes with, as well as meaning and context that may be similar or in contrast to the other words. Hence matching pictures based on a rime unit does not demand isolated skills only utilized for phonological tasks: The cognitive resources are similar to those used when grouping (any) objects together into appropriate categories. If we strip away the auditory component of the task then we are essentially asking the conceptual question “Which member does not belong given criteria X”?  

Whereas there is no concrete answer as to how the brain organizes and retrieves data, these clinical activities seem to require that children group data in a novel – or at least ‘non-
standard’ arrangement. Grouping objects that rhyme would presumably not be seen as a common task in everyday activities. In general, if a child sees a buffet-style table of food, one could assume the objects are recognized/sorted into food and non-food items (such as plates, forks, and glasses) to determine what is available for dinner. This food could then be further parsed into what it was the child did or did not like, which would then result in what the child eats for dinner. It does not seem likely that the child would group all of the objects on the table that rhymed with one another.

The table of food example above highlights that categorization is a seemingly ubiquitous and constant mental process: It does not only occur when an explicit sorting task is presented. After choosing their food, the child may then be faced with selecting a place to sit. If the dinner is at their house then possibly they have an assigned seat. However, perhaps it is a holiday meal and there are grandparents and cousins there. The child might then have to remember where grandparents have preferred to sit in the past, and also what cousins they do or do not want to be seated next to. If the meal is actually at a relative’s house, then there might by different information that the child incorporates into determining “Which chairs can I sit in for Thanksgiving Dinner?”

How categories are persisted and accessed in the brain and also how new categories are formed “on-demand” to situational criteria is the subject of much study. The dynamic construal of categorization theory put forth by Smith and Samuelsson (1997) provides a framework that describes how categorization can work fluidly and respond to changing demands. Croft & Cruse (2004) describe categorization as identifying a particular entity or experience as an instantiation of a more abstract concept. Furthermore, this abstract concept includes other (actual and potential) examples. In the previous example the Thanksgiving
Dinner is the instantiation of the abstract concept “appropriate seating for me”, and other examples of this concept could include regular family dinners or lunchtime in the school cafeteria.

Much of the debate around categorization has focused on the minimal qualities for an element to belong to a category. According to the dynamic construal theory, concepts are not ‘concrete’ and cognition does not consist of a series of identical and repeatable cognitive processes. Each cognitive process is in and of itself unique, as all of the preceding cognitive operations are considered as (part of the) inputs. Previous research has often focused on the constant concepts that underlie our thinking and are the basis for categories, and Smith and Samuelson (1997) argue that this thinking has resulted in a series of theoretical and experimental failures.

The classical model of conceptual categories takes this constant concept approach as its central point, defining categories via a set of necessary and sufficient features (Croft & Cruse, 2004). Whereas this model might initially seem intuitively credible, investigation uncovers several flaws. For instance, defining attribute lists for such everyday categories as a dog or a game cannot be accomplished (Smith & Medin, 1981). These issues can easily be underscored by trying to define what makes an object a ‘door’. Does a door have to have a handle? Handles fall off of doors all of the time, but they certainly are still considered doors. Does it have to open somewhere? If one goes to a department store and sees an inventory of doors stacked on a shelf, they are certainly still doors, yet they provide no entrance way or closing off of an area. It seems a futile task to try and build a category of ‘door’ that holds all doors and also manages to exclude all non-doors.
Furthermore, the idea of necessary and sufficient features does not account for the phenomena of graded centrality, which allows for some members of a category to be judged as ‘better’ members than others: In Britons, for example, ‘apple’ scores higher as a fruit than does a ‘date’ (Croft & Cruse, 2004). If there is a necessary attribute list for a category, why are some members of a category ‘better’ than others? Rosch (1973) was one psychologist who proposed a model of probabilistic theories for categorization that centered on correlated features that also failed (Smith & Samuelsson, 1997). One notable reason is people believe that categories can be defined by necessary and sufficient features, and these can run contrary to probabilistic feature representations. Medin & Ortony (1989) discuss how categorization can be based on relatively “inaccessible” features; whales would not appear to be similar to other mammals, but if one “thinks” about what makes something a mammal then one will probably accept whales as a mammal. Rips (1989) showed that if people were told that a creature had bird DNA – even if it shared more perceptual characteristics with insects – they categorized it as a bird. To account for this behavior, so-called theory-based approaches to categorization were developed that revolved around personal beliefs. There are some similar problems with these so-called naive theories, such as what type of information is included in a personal theory (Smith & Samuelsson, 1997).

Medin & Ortony (1989) argue that there may be underlying stable concepts but the outputs are (what appear to be) unstable, and these outputs should be viewed as “artifacts” of the processes acting upon the concepts. When making similarity judgments, both the “surface” aspects (such as color, shape, etc.) and the “deeper” aspects of cognition (such as what makes something a mammal) are involved. Furthermore, there is an important relationship between these two sets of aspects: When determining likeness the initial
structure is provided by the accessible surface features, and this is integrated with the (eventually acquired) deeper conceptual knowledge. Surface properties serve as a guide to the deeper knowledge base, as well as functioning as a constraint on the predicates that are used to construct our mental representations. Medin & Ortony note that although tennis balls “do not have ears” this is not a relevant predicate in our mental representation of a tennis ball. The surface aspects such as color, shape, and texture are what build the initial set of related knowledge about a tennis ball. These superficial properties are casually linked to people’s personal theories or beliefs about what an entity is, and that the “deeper” one goes the more stability ought to be found. People have a stable concept of something like a whale even though the varying answers to different questions might appear to make this knowledge unstable.

Smith and Samuelsson (1997) contend that an extension of Medin & Ortony’s work is needed to explain the variability in concept and category tasks that is seen across development. They also dispute that the (previously discussed) work of Imai et al. (1994) is a compelling argument for “a developmental shift from one kind of concept to another” (Smith & Samuelsson, 1997, p. 169). In the Imai experiment, when they were asked to name an object that went with the novel “dinosaur talk” name there was a shift towards the thematic choice in the 5-year-olds as compared the 3-year-olds (who showed a stronger preference for a shape-based object. Smith and Samuelsson contend that while such research by Imai, et al. does show a definitive shift, children’s categories – like adult’s - are contextually variable, and they are contextually variable in ways that differ from adults.

Smith & Samuelsson’s (1997) dynamic categorization framework proposes to account for contextual and developmental shifts, postulating that the driving forces in
categorization are past history, recent history, and current input. The argument is based on what they recognize as three “fundamental truths” about cognitive processes. The first is that perceiving and remembering are dependent upon the context. Secondly, perceiving and remembering are also dependent on just-past activity. The priming effect is an example of such: The primer item – the just-past activity – has an effect on the processing rate of the second (target) item. The third truth is that acts of perceiving and remembering actually change the processes themselves. Perris, Myers, & Clifton (1990) taught six-month-old children to reach in the dark for objects in response to different sounds. When the infants were between the ages of 18-30 months they were brought back and placed in the dark with control children not part of the original experiment. The children that were part of the initial experiment resumed reaching for objects in response to sound, whereas the control children did not.

The Perris experiment is an example of a learned, seemingly stable pattern of behavior. Our accrued experiences provide a source of stability as we respond to statistical regularities. Although work by Rosch (1973) that attributes categorization to correlated features is not sufficient, incorporation of statistical regularities is evident in experimental data. Sera, Troyer, & Smith (1988) showed objects such as sneakers, buttons, and plates to two-year old children that varied in size. They were then asked which ones were big and which ones were little. The boundary for these categorizations most likely fell at the child’s own experienced size: For example, shoes larger than the child’s own approximate shoe size were labeled as big. This demonstrates that children are adept at comparing object dimensions to the dimensions that play a regular and particular role in their everyday lives.
There are also studies cited above that suggest children’s early ability to detect patterns (Jusczyk, 2003; Tomasello, 2005; Younger, 2003).

Smith & Samuelsson offer than categories are “the on-line product of complex processes of perceiving and remembering” (Smith & Samuelsson, 2003, p. 181), and as such are dynamic, adaptive, and inventive. When faced with a categorization task a decision is made based on the immediate context, continuity with just-previous past, and a history of the individual acts of knowing. As each act of knowing is a future input to perceiving and remembering, this provides a mechanism for the developmental shift. We can apply this theory to the Thanksgiving Dinner example discussed earlier. The history of individual acts of knowing would be all of the other times the child had to choose a seat, be it at school, a family dinner, a restaurant, etc. The immediate context is the moment the child has to make the seating decision: Picture them hesitating as they start from the buffet table with a plate full of food to go and sit down. The just-previous past could be any remarks they heard as they were selecting their food. Maybe someone remarked how a certain cousin had wet himself, or how one of the grandparents had a cold. All of these inputs will result in the making of a seating choice. The child is\has developed a stable concept of family dinners and seating arrangements. However, each different situation may result in a different seat choice creating an “unstable output”. Smith and Samuelsson provide their own example: People have a relatively stable concept of a frog. However, hearing the word “pond” before “frog” will result in a different mental representation than hearing the word “restaurant” before “frog”.

Having a child pick two words that rhyme from the one that does not requires the child to create a (temporary) category including Words A and B but not Word C. Poor
performance on such tasks could point to a problem with categorization in general and not an isolated problem with phonemes. Say a child has to choose the word that does not rhyme from a picture of a frog, a dog, and a cat. The child’s knowledge of a dog, a frog, and a cat is only helpful in as much as they are able to generate the word that represents each concept. Other information is perhaps detrimental to the child’s success, as a cat would appear to have much more in common with a dog than a frog has with a dog. Cats and dogs both have four legs that enable them to run and walk, whereas frogs have two shorter front legs and a substantially different mode of locomotion. Cats and dogs have fur, whiskers, and teeth, and are often seen on the street in neighborhoods, whereas frogs have no perceivable body hair or teeth and require a wet environment. However, the child’s attention needs to be directed to the rhyme unit, as the boundary that is needed for this new conceptual category does not pertain to any other characteristics.

In terms of Smith & Samuelsson’s account, the child’s long-term knowledge would be all of the things they know about the cat, the frog, and the dog (mentioned in the preceding paragraph). The just-past knowledge would be the pictures presented in the task. The immediate context would be the task of having to group the pictures by rhyme (although the latter two could technically be flipped depending on how the experiment was presented). This particular task could be made more challenging if the dog and the cat were of the same color and, as much as possible, the same shape. As discussed above (Landau, Smith & Jones (1998), Imai, et al. (1994), Gentner & Namy (1999)) children between the ages of 2-4 have a tendency to group on perceptual features with a strong inclination towards shape. It is only at around ages 4-5 that there starts to be a shift based on function (when presented with a “goes with” question). If 4-year olds who performed poorly on this rhyming task were also
asked administered a word extension task similar to the Genter & Namy (1999) experiment, it would be interesting to see if they had less of a tendency than other 4-year olds to make the shape-to-category shift.

*Match pictures of words that rhyme*

The cognitive demands are similar to the preceding section, except that a child is asked to match two words instead of excluding one. (Of course, the child could execute essentially the same strategies on both tasks). An interesting aspect of the rhyming tests is the content of the pictures that are presented. Say a child was asked to choose words that rhyme with cake, and the choices were: Rake, snake, and cookie. Does this category match of ‘food’ interfere with creating the category based on rhyme? If at-risk children for delayed phonological awareness had a lower performance when presented with matching tasks involving ‘category interference’, then this might lend support to the idea that categorization skills are linked to being at-risk for phonological awareness delays. The argument would be that the categorization that was more salient and established in everyday life (the food category in the example above) was somehow hindering the child’s ability to dynamically create new categories.

*Blend syllables to make words*

Recognizing that syllables and phonemes constitute words falls partially under the realm of Gestalt psychology, particularly with respect to areas of proximity and bounding. Each word must be recognized as a whole unit (bound) distinct from the other sounds immediately preceding and following. Furthermore, each part of the word needs to be parsed
out. Although categorical perception organizes phonemes very early on, children’s explicit knowledge of language begins first with larger units followed by the smaller ones (Lonigan, Burgess, Anthony, & Parker; Treiman & Zukowksi, 1991). Once children learn that there are different parts to words then they should be able to abstract syllables from these words. The non-linguistic demands for syllable blending require that children understand part-whole relationships. There are many examples that pertain 4 year-olds: Pictures of a family could have a mother, family, brother, and sister; a typical drawing of a face has eyes, nose, and a mouth; a car has wheels, seats, and doors. A particular non-linguistic task that incorporates categorization and part-whole demands would have children group age-appropriate animals that all had paws, sharp teeth, or lived underwater.

Another non-linguistic task would be to take simple models of a few animals – a cat, a dog and a sheep. These models have several parts (legs, tail, and head) that can be put onto the body of the appropriate animal. Furthermore, all of these appendages fit onto the body of the other animals. If all of these appendages were mixed together, the body of one of the animals – for instance, the sheep – can be presented, and the child asked to “build” the sheep from the appendages. This would help gauge the child’s general cognitive ability to construct an object from component parts, much like they are asked to construct words from component parts in syllable blending.

_Given a series of pictures, identify the one that starts with a different sound than the others_

This task has non-linguistic demands similar to blending syllables in that it deals with part-whole relationships. Children are required to segment the initial sound from a word and then compare it with the initial sound segmented from another. A non-linguistic task could
Consist of presenting a cartoon picture to a child and then showing several similar-looking cartoons that had minor differences. Then, they could be asked to find the cartoon that had the same kind of ears or the same kind of nose.

Another interesting aspect of identifying words that start with a sound is that of “filling-in”. If you ask a child to name words that start with a /b/ sound, they may have trouble coming up with things such as “bat” or “ball” because they cannot mentally “fill-in” the rest of the world. To examine this non-linguistically, they would be presented parts of something, such as the door of a car or the tail of a dog and asked what object this was “from”. This type of activity would test a child’s ability to “fill-in” the rest of the mental concept. This is related to whole-part relationships in that the child is able to recognize component parts of something outside of their normal context.

**Intervention for Early Phonological Awareness**

Gillon (2004) suggests that due to the wide range of phonological awareness performance in children 3- or 4-years of age, it is not appropriate to diagnose these children with a phonological awareness deficit. Instead, the current level of phonological awareness should be observed and evaluated, as well as monitoring where the child is acquiring phonological awareness skills (be it at home, school, etc.). The results of the evaluation should determine whether or not a child is acquiring the necessary skills for a strong reading and writing foundation. If it is determined that these skills are lacking then children will not be diagnosed with a deficit, but will be recommended activities to stimulate and facilitate this development. Furthermore, baselines of phonological awareness should be established in order to evaluate the intervention’s efficacy, and this phonological awareness evaluation
should comprise just one part of a comprehensive evaluation of language development as a whole. As vital as it is, phonological awareness intervention must also be viewed in the broad context of literacy and language development as it is just one of many factors (Gillon, 2004).

Warrick, Rubin, and Rowe-Walsh (1993) examined kindergarten children with SLI who received intervention for phonological awareness. 28 children with at least an average range score on a subject of the *Wechsler Preschool and Primary Scale of Intelligence* that measures non-verbal intelligence (Wechsler, 1967), as well as poor performance on the standardized *Kindergarten Language Screening Test* (Gauthier and Madison, 1978) and poor performance on at least one other standardized test were divided into 2 groups. One group received training in phonological awareness and another did not. A third group of children without any markedly poor areas of language development were used as a control. The phonological awareness intervention was 8 weeks long with 2 20-minute sessions per week, and the activities included clapping and counting syllables in animals and children’s names, repeating and prolonging the initial phoneme of a word, and rhyme recognition. The language-delayed group that received the training reached performance levels to where there were no significant differences remaining in phoneme-awareness tasks between them and the control group, whereas the group that did not receive intervention continued to struggle. Moreover, 1-year later the group that received the training continued to outperform the other language-delayed group in phoneme awareness tasks, and also performed better on specific reading tasks. Further work by van Kleeck, Gillan, and McFadden (1998) showed that 4-year old children could also benefit from intervention of this kind. However, in their study
the children did not make significant gains in rhyme awareness as compared to the control group, whereas there were gains made in phoneme awareness.

Gillon (2006) proposes a preventative framework for 3- and 4-year old children that meet the following clinical criteria: They have been classified as having a specific speech and/or language impairment – such as delayed or disordered expressive phonological impairment, childhood apraxia of speech, or an expressive or receptive language impairment – identifying them as at risk for literacy difficulties, and they will or are currently receiving regular SLP interventions. The purpose of the preventative framework is to “stimulate” phonological awareness development. As research suggests (Gillon, 2006) that syllable and rhyme awareness are more effectively developed via general speech and language stimulation, phoneme awareness is the primary area to be targeted. As such, the most appropriate tasks involve blending and segmentation at the onset-rime level, as well as phoneme matching, identity, and categorization.

The goal of phonological intervention is to increase reading and writing proficiency. “The pattern of interaction that has emerged from the research is that a general awareness that words can be broken into smaller parts is a necessary base on which to build successful word recognition and spelling skills” (Gillon, 2006). Children exhibiting deficits in phonological awareness often have other specific language impairments, particularly with respect to syllable and word pronunciation. When intervention activities are focused only on speech production, there is not a corresponding increase in phonological awareness and literacy skills; however, focusing intervention on phoneme level skills does translate to improvements in speech production, phonetic awareness and related literacy activities (Gillon, 2002).
Evidence such as this supports the idea that phonological awareness is a foundational skill upon which many other areas of communication can be built. The ability to identify the separate parts and properties of objects in the physical world appears strikingly comparable to the skills needed for phonological awareness. In some cases, a SLI involving phonological awareness may be more of a general cognitive delay in recognizing the part-whole relationships of entities and/or categorization abilities. For instance, if children tend to make the jump from perceptual to conceptual categorization at around 4 years of age (Golinkoff, Shuff-Bailey, Olguin, & Ruan, 1995; Imai, 1994) and are also changing their categorization tendencies based on increased comparison (Gentner and Namy, 1999), then if children are displaying deficiencies in phonological awareness-related tasks is there also a corresponding delay in these shifts?

**Further Investigation and Application**

Cognitive Linguistic Theory provides a framework for language acquisition and development via shared mental processes. In cases where children are diagnosed with a Specific Language Impairment there is no discernible sensory or cognitive impairment, and this paradox remains an ongoing question for research. What has been discussed in the preceding pages is seen as evidence for another avenue to investigate the Cognitive-Linguistic – SLI conundrum. Prior research has established a developmental path from phonological awareness to literacy, as phoneme and rhyme awareness are reliable indicators of future reading successes or delays. It also appears that phonological awareness is partially dependent upon dynamic categorization and part-whole recognition, and children with language impairments are identified as at risk for phonological awareness. One opportunity
to investigate the cognitive underpinnings of Specific Language Impairments is the combination of dynamic categorization and part-whole recognition skills.

As language is linked to many of the brain’s domains and processes this proposal recognizes that – at best – it will only provide a small piece of the puzzle. All SLIs will not simply be explained by these two particular cognitive routines, but they could possibly make intervention techniques more effective. If categorization and part-whole tasks do prove more difficult for children with SLIs that have also been recommend activities to stimulate phonological awareness, the therapeutic techniques could be directed at categorization and part-whole awareness tasks in both the linguistic and non-linguistic realm.

The hypothesis is that 4-year-old children with a Specific Language Disorder who also perform poorly in a phonological awareness evaluation will perform differently in particular non-linguistic intensive tasks involving categorization and part-whole relationships as compared to children without an SLI and/or any indications of phonological awareness delay. As phonological awareness tasks involve identifying the parts of a whole object (a word) and then dynamically categorizing them into groups, experiments can be designed to see how children perform in a non-linguistic intensive experiment. A potential experiment is outlined below, involving four groups of 4-year-old children, ideally between the ages of 4 years, 6 months and 4 years, 11 months, as phonological awareness typically starts to become more stable at this time. The groups are as follows:

- **Group 1**: Children diagnosed with SLI and poor performance on phonological awareness (PA) tasks
- **Group 2**: Children diagnosed with SLI but without corresponding difficulty on PA tasks
• Group 3: Children without SLI and with poor performance on PA tasks
• Group 4: Children without SLI and without any difficulty on PA tasks

The experimental procedure is as follows: Have the children and the examiner play with some toys - a car, a house, a ball, and some connector blocks. Be sure to take each toy and point out a specific feature. “I can bounce this ball – can you do it? Be sure to perform the action (such as bouncing), as the experiment needs to rely on linguistic information as little as possible. Also, make sure that the children are engaged and that there is explicit joint attention established when demonstrating the features. The children should play and act out the specific function with the toys as well as playing in general. The following features should be explicitly pointed out and performed by the examiner:

• Blue Car: That the doors on the car actually open
• Red Ball: The ball can bounce
• White Doll House: The doors on the house can be opened up
• Assorted color jumbo connector\Lego blocks: The blocks snap together

After the child has played with the toys for a bit and the above features demonstrated, tell the child that we have “One more toy to play with. But I need to you tell me which one of these toys” gesturing to the existing toys “that it goes with”. This new toy is a multi-colored Jack-in-the-box. The examiner should point out that “This Jack-in-the-box opens up” and have the child open and close the lid. Then ask them “Which toy does it go with?” and also ask them why they made their choice. The child ‘should’ choose the car or the house because they all have parts that open. They may choose the Lego blocks because of the different colors and some of the blocks may have the same (square shape).
This task is analogous to asking children to match rhyming words or words that start with the same letter. In both cases a feature is made salient by the examiner (the starting sound, the rhyming sound, or a feature of a toy), and then the child is asked to categorize the objects based on the aforementioned feature. As described in the hypothesis, children in Group 1 (SLI and PA delay) are expected to choose the house or the car with a decidedly lower frequency than children in Group 4 (no SLI and no PA delay). Group 1 should also choose the house or car with less frequency that the children on Group 3 (no SLI but with a PA delay): Children in Group 3 may have an affected categorization or part-whole processes, but they may not be pronounced (enough) to show up in other areas of language. Furthermore, there PA delay could be caused by a lack of (sufficient) exposure to language (perhaps they are not talked to extensively at home, were not frequently read to, etc).

Children in Group 1 should also make the car or house choice less frequently than the children in Group 2 (SLI but no PA delay) as the Group 2 children are not exhibiting any causes for concern in their phonological awareness.

Experiments in general and specifically those involving young children bring inherent concerns about the experimental design. These include but are not limited to the subjects’ difficulties with following instructions, a motivation or willingness to cooperate, and that the design mimics and elicits the responses that occur in a truly natural setting. The language used to instruct children must be easy (and clear) for them to understand and when incorporating children with SLI any language-dependent tasks are going add further to validity concerns. In the above design an immediate obstacle is evident with the phrase “Which toy does it go with?” It raises the question of ecological validity as this phrase
seems to be an atypical way in which to address 4-year-olds regarding their toys. As such it may be especially unclear to children with SLI.

An alternative experimental design might include more toys for the child to play with followed by a “clean-up” session. The examiner could lead the “putting away” into a series of three bins, with all of the toys that “open” going into one bin, all of the toys that are “square” going into another bin, and all of the toys that are “multi-colored” going into a third bin. The final toy could then be introduced, played with, and put away, and the child then asked why they chose the specific bin. This would arguably be a more familiar process relying less on linguistic knowledge and more on the (assumed to be) familiar script of putting toys away where they belong. The children would be required to make a judgment and explanation of where the final toy went, ideally providing insight into their categorization method.

The proposed experiment also combines part-whole identification with dynamic categorization. Isolated categorization and part-whole tasks should be conducted to provide a performance baseline and ensure construct validity. For instance, the children could be asked to match a picture of a dog to another dog (from pictures of a cow and a dog) or match a picture of a flower to another flower (from pictures of a flower and a tree). This would show whether children with SLI and those children without were performing at a similar level on categorization tasks that expected to be familiar. They could also be asked to point out the ears on pictures of dogs, elephants, and cows or point to leaves on images of trees and flowers to establish that they can identify the parts of objects.

Part of the hypothesis is that phonological awareness involves paying attention to features that are of a lower salience. In order to ensure construct validity with respect to
measuring the requirements of phonological awareness, some measure of salience needs to be established. The children could first play with the toys without an explicit identification as to the individual features. They could then be asked to put the toys away into appropriate bins - the way that they grouped them would arguably show which characteristics were typically more salient for grouping. The same children could then later play with the toys and have the features explicitly pointed out, as mentioned in the original experimental design. How each group (normally developing children, children with SLI, etc.) performed on the different sets of tasks would show their behavioral change from one set of categorization tasks to the next. These could then be compared to the ‘expected’ trajectory of categorization shifts for this age group, based upon the aforementioned research of Imai, et al. (1994), and Gentner and Namy (1999).

If children are asked to perform too many tasks this raises concerns around children ‘learning’ what is wanted from them instead of behaving naturally and also becoming bored with the tasks and therefore uncooperative. Consequently, the time that children are expected to remain under examination needs to be carefully considered. Also, the motivation of children to complete the tasks can be problematic. Unlike adults who sign up for experiments and (presumably) agree be cooperative, 4-year-old children may have no reason to “put toys away” in a new environment. A rewards system can be generated to entice the children to participate, but introducing compensation can arguably skew the results as this can interfere with a child’s typical behavior.

The chart below lists activities used in Language Therapy to treat phonological awareness, the cognitive skills necessary to perform the task, and proposed activities that are less language-intensive that have similar cognitive demands.
Table 2

<table>
<thead>
<tr>
<th>SLP Activity</th>
<th>Cognitive Skills</th>
<th>Counterpart Cognitive Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop rhyming skills</td>
<td>Categorization\Part-Whole</td>
<td>Match animals with similar functions, such as animals that people ride or animals that you might see in the neighborhood</td>
</tr>
<tr>
<td>Clap out syllables</td>
<td>Part-Whole</td>
<td>Identify parts that are shared by cars, trucks, and boats</td>
</tr>
<tr>
<td>Find words that start with same sound and write letters</td>
<td>Categorization, Part-Whole</td>
<td>Group household objects by “unusual” categories, such as things that stick to walls or things to sit on</td>
</tr>
<tr>
<td>Find a sound family and find words in same family of words</td>
<td>Categorization/Part-Whole</td>
<td>Present a series of pictures that represent “things in the garbage” like banana peels and empty wrappers and see if they can guess the category\theme. Then have children pick out (from other pictures) objects that belong to that category.</td>
</tr>
</tbody>
</table>

The Counterpart Cognitive Activities that are mentioned above are designed to challenge some of the same cognitive areas as the linguistic tasks. It has been argued that part of the issue with phonological awareness is children have to pay attention to “new” features of the words and start to group these entities in heretofore novel categories. As a result, the cognitive tasks need to focus on properties of objects that are not regarded as the “easy” ones and/or ask children to group objects in ways that are atypical. For example, asking children to pick out toy animals that are brown seems less effective for the targeted skills than having them tell you all of the animals that can people ride (such as bulls, elephants, and horses) or all of the animals that they might see in their neighborhood. Also, asking them what items it the house can stick to the wall may make the “stickiness” more salient than normal and then challenge them to dynamically construe a category.
If the Hypothesis is Unsupported

If no corresponding categorical and part-whole deficits in non-linguistic tasks become evident, then perhaps domains that share cognitive processes do not progress in lockstep with one another. For example, the ability to recognize a face as a gestalt and also each of its individual parts may have received more explicit instruction that language. A parent might have spent time with a child asking things like “Where are Daddy’s eyes?” or “Where is your nose?” An equivalent amount of time may not have been spent asking children what words rhyme with another, or pointing out what letters each word starts with.

Along these same lines, phonological awareness and corresponding deficits could be an exposure issue. Gentner and Namy (1999) have suggested that more meaningful categorization in part relies upon (more) comparison of objects. Perhaps (some) children with phonological awareness deficits have had a smaller volume of words spoken to them than the typical child, or just need a higher volume of words that the average child hears. The quantity of language that is necessary to make deeper comparisons and relations between the lexicon and its component parts is likely to vary from child to child.

In addition, visual processing is typically assigned many more resources in the brain than audio processing. This might account for the fact the visual categorization skills appear at a faster rate that audio categorization skills do. Another reason may be that visual or physical features are more salient in early life. A child may sneeze or have a runny nose, their ear might hurt or they might get something in their eye. These localized sensations may highlight the different components of a face. In comparison, are there equivalent, daily experiences in early childhood that highlight the number of syllables in a word or the initial sound in a word?
As language and cognitive development are dynamic processes with many overlapping parts, it is not surprising that there are difficulties teasing out what processes are responsible for what capabilities, or what immature processes might be causing observable delays. With this in mind, experiments must be carefully designed and tweaked in order to try and elicit reliable responses to particular areas of investigation. Perhaps the difficulty in abstracting the causes and effects of mental processes on language development is one of the biggest arguments supporting Cognitive Linguistic Theory and its claim that language is not an autonomous faculty but one that cultivates and expands via our usage and experiences.
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