THE EFFICACY OF A TRAINING PROGRAM TO TEACH KINDERGARTENERS LEXICAL AMBIGUITY DETECTION

by

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Abstract

THE EFFICACY OF A TRAINING PROGRAM TO TEACH KINDERGARTENERS LEXICAL AMBIGUITY DETECTION

by

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Adviser: Helen S. Cairns, Ph.D.

Lexical ambiguity detection is the ability to recognize that some words and sentences have more than one meaning, (e.g. "The *glasses* fell on the floor and broke"). Lexical ambiguity detection skills and reading comprehension have been linked in past research (Cairns, Waltzman, & Schlisselberg, 2004). Additionally, certain types of ambiguity detection are necessary to understand "sarcasm, idiomatic expression, deceit and humor" (Rinaldi, 2000), which is a difficult skill for some children (Wiig, 1989), especially those with Specific Language Impairment (SLI) (Leonard, 2002; Rinaldi, 2000).

The present study focused on the effects of lexical ambiguity detection training of typically developing children in kindergarten. Children were asked to identify not only noun/noun homophones (e.g., *bat*) (Peters & Zaidel, 1980), but also noun/verb homophones (e.g., *rock*), which have never been studied. Furthermore, this study is the first to compare homophone detection ability with the ability to detect lexically ambiguous sentences using the same homophone pairs.

Thirty-four kindergarteners (5;5 to 6;6) participated. Each child met individually with the experimenter to complete several pre-tests. Then the children met with the experimenter twice a week for four weeks in small groups. Half of the children received homophone and lexical ambiguity training (experimental group), and the other half received vocabulary training using words that do not have dual meanings (control group).

Finally, each child met with the experimenter to complete three post-tests similar to those given during the pre-testing.

Results showed that training does improve kindergarteners' abilities to detect homophones and lexical ambiguities. Furthermore, the knowledge of both meanings of a homophone is not sufficient to report both meanings of a sentence that contains that homophone. Future research may show that children with SLI might also benefit from such training and improvement of lexical ambiguity detection skills in pre-readers, especially those at risk for reading difficulty, could enhance the acquisition of reading.

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CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

Specific Aims

This research study aimed to show that kindergarten children can be taught to detect lexical ambiguities at a younger age than would be anticipated in typical development. This type of training could be incorporated into everyday public school curricula as part of a reading readiness program. We anticipate that research will show such training could lead to improvement in reading abilities of children at risk for reading difficulty as well as typically developing children. In addition to possible improvement of reading skills in young children, ambiguity detection training may help children with Specific Language Impairment (SLI) process ambiguous utterances. Children with SLI often have difficulty with figurative and abstract language, which underlies higher order language skills, and they are often at risk for reading disorders. Additionally, the proposed ambiguity detection training could improve phonological memory, based on the relationship between ambiguity detection and phonological memory. Phonological memory skills have been attributed to vocabulary acquisition (Gathercole & Baddeley, 1990), language comprehension (Smith, Mann & Shankweiler, 1986), and reading development (Wagner & Torgesen, 1987). This suggests that typically developing children and children with SLI would benefit from training. This research will contribute to our understanding of linguistic development and open doors to future research of possible treatments for reading difficulty that can be used in a classroom setting.

CHAPTER II

REVIEW OF THE LITERATURE

Lexical ambiguity detection is the ability to report that a lexically ambiguous sentence has two meanings. For example, "The children saw a *bat* lying by the fence," could mean that the children saw a baseball bat by the fence, or they saw a flying bat near the fence. Lexical ambiguity detection, also referred to as *ambiguity detection* throughout this paper, has been linked to reading comprehension abilities (Zipke, 2007). It is also important for understanding puns and jokes, judging grammaticality, understanding dialects, and decoding deeper meanings from specific word choices, among many other linguistic abilities (Edwards & Kirkpatrick, 1999). The ability to report sentential ambiguity is considered a metalinguistic skill, (Wankoff, 1983; Zipke, 2007) as well as a psycholinguistic processing skill (Cairns, Waltzman, & Schlisselberg, 2004), both of which are related to reading abilities. Many metalinguistic and linguistic abilities have been shown to improve after training (Roth, 1984), and there is some evidence that training results in an increase in reading abilities (Lundberg, Frost, & Peterson, 1988; Schneider, Kuspert, Roth, Vise, & Marx, 1997; Rivers & Lombardino, 1998; Yuill, 1998; Zipke, 2007; Zipke, Ehri, & Cairns, in prep).

This review of the literature will focus on the following areas of research:

1. Metalinguistic awareness
2. Homophone detection
3. Ambiguous sentence detection
4. Sentence processing, specifically ambiguous sentences, and its ties to reading comprehension and other skills
5. Training studies that have focused on enhancing linguistic, metalinguistic, and psycholinguistic processing abilities

Metalinguistic Awareness

Metalinguistic awareness is "the ability to reflect upon and manipulate the structural features of spoken language, treating language itself as an object of thought, as opposed to simply using the language system to comprehend and produce sentences," (Tunmer & Herriman, 1984). In other words, metalinguistic awareness is the ability to use language to talk about language and its many components (Gombert, 1992). Children do not acquire language and the ability to think about language at the same time. This ability requires a shift from attending to the content (i.e. message meaning) to the form, (i.e. linguistic expression) (Lundberg, 1978). Initially, children focus on the semantic content of spoken language, and eventually they are able to separate form from meaning (van Kleek, 1982). There "is a transition from Piaget's preoperational stage characterized by centralized thought to concrete operations marked by decentration, an ability to decontextualize thinking" (van Kleek, 1982). Children begin with the ability to focus on only one aspect of a situation, and then they are able to decenter their attention (van Kleek, 1982; Wankoff, 1983). This transition seems to appear by about age seven

(Edwards & Kirkpatrick, 1999), coincidentally around the same time children are beginning to read.

Edwards and Kirkpatrick (1999) determined that a developmental order exists in the ability of children to simultaneously attend to a meaningful linguistic context while making judgments about the form of language. Ninety children ages 4;0 to 12;11 were divided into nine age groups, and ten adults were tested as a control group. A recording of a story that replaced 20 lexical items with nonsense lexical items was read to each group. The lexical items were replaced with phonotactically legal and illegal sequences of phonemes in structure or content positions within the sentences. Each subject pushed a button when s/he heard a nonsense word. Detection of a nonsense word was taken to be a metalinguistic task. Analyses of correct responses and reaction times revealed a developmental progression to children's metalinguistic abilities, with a major shift in metalinguistic ability around the ages of 7;0 and 8;0. The 4- to 7-year-olds had fewer correct responses and slower reaction times compared to the 8- to 12-year-olds. The adults outperformed all age groups, indicating a continuation of metalinguistic development after age 12;0.

Metalinguistic skills include, but are not limited to, phonological awareness, morphological awareness, semantic awareness, syntactic awareness, grammaticality judgments (Gombert, 1992; Hakes, 1980; Schlisselberg, 1988; Cairns, Schlisselberg, Waltzman, & McDaniel, 2006), and homophone and ambiguity detection (Cairns, Waltzman, & Schlisselberg, 2004; Zipke, 2007; Zipke, Ehri, & Cairns, in prep). Metalinguistic awareness as a whole is important for correcting slips of the tongue, understanding different forms of speech (e.g., dialect differences), making puns and understanding riddles, judging grammaticality, and decoding deeper meanings from

specific word choices, among many other linguistic abilities (Edwards & Kirkpatrick, 1999). Extensive research has focused on metalinguistic skills, specifically phonological awareness, and the important role they play in reading acquisition (e.g., decoding and comprehension) (Tunmer & Bowey, 1984; Edwards & Kirkpatrick, 1999; Hodgson, 2001; Kamhi & Catts, 2005), although it is still not clear which aspects of metalinguistic awareness are most crucial to the reading process (Zipke, 2007). Thus far, research has shown different metalinguistic skills to correspond to different aspects of reading (Yuill, 1996; Yuill, 1998; Zipke, 2007; Zipke, Ehri, & Cairns, in prep). For example, phonological awareness is related to decoding, and ambiguity detection is related to reading comprehension (Zipke, 2007).

Phonological awareness allows a listener to segment a continuous utterance into a series of exclusive phonemic segments. This skill is essential to make the grapheme/phoneme correspondence, which underlies the ability to decode words, essentially the basis of reading ability (e.g. van Kleek, 1994; Cairns, 1996). It is also apparently the first metalinguistic skill introduced to children through rhyme and alliteration, specifically nursery rhymes and children's songs (Peters & Zaidel, 1980). Liberman and colleagues successfully trained children as young as four years of age in syllable segmentation (e.g., tap once for *but*, twice for *butter*, and three times for *butterfly*), but only children over six years old could learn phoneme segmentation, (e.g., tap once for /u/, twice for *boo,* and three times for *boot*) (Liberman, Shankweiler, Fischer, & Carter, 1974). These findings imply that children over the age of six are able to begin reading acquisition through the use of grapheme/phoneme associations.

Many metalinguistic skills rest upon the idea that form and content can vary independently (Cairns, 1996). Developmentally, children begin with the ability to focus

on only one aspect of a situation, considered Piaget's "preoperational" stage, which is characterized by centralized thought. They then move onto Piaget's "concrete operations" stage, which is characterized by the ability to decenter their attention (van Kleek, 1982; Wankoff, 1983). "Decentering is the ability to evaluate a perceptual array from two different dimensions simultaneously," (Wankoff & Cairns, in prep). Decentering underlies the ability to conserve. For example, if water is poured from a short, wide glass into a tall, narrow glass, one must "attend simultaneously to the height and width of the glass" (Wankoff & Cairns, in prep) to understand the equality of the amounts (Hakes, 1980; Wankoff, 1983). A child in the preoperational stage would only focus on the height or the width, not both, and would not be able to identify the equality of the amounts. A child who has progressed into the "concrete operations" stage would be able to decenter his or her attention, consider several aspects of a situation simultaneously, and report the equality of the amounts of water. The child is able to focus on the relationship between the dimensions (e.g., height and width) and consider the pre- and post-transformational states of the liquid, which ultimately allows him/her to not only judge the equality of amounts, but also explain the equality (Hakes, 1980; Wankoff, 1983).

This ability to decenter seems to influence the ability to consider form and meaning simultaneously, which is the basis of ambiguity detection. A child in the "concrete operations" stage is able to go beyond automatic language processing and become more flexible linguistically. The child can shift attention from linguistic meaning (content) and consider aspects of the utterance itself (form) to make judgments about the utterance (e.g., sentential appropriateness, grammaticality, presence of multiple interpretations, sentential ambiguity) (Hakes, 1980; Schlisselberg, 1988; Wankoff, 1983).

Such "sophisticated metalinguistic judgment is a deliberate, decontextualized analysis of language" (Wankoff, 1983).

Homophone Detection

A metalinguistic skill associated with reading acquisition, but much less studied than phonological awareness, is homophone detection. Homonymy, or the total similarity of the sound of two words, is rarely explicitly brought to a child's attention. This may be because it is less common than rhyme or alliteration (phonological awareness), because it is considered too confusing, or because total phonological similarity (homonymy) does not focus on single phonological units or partial similarity, as do rhyme and alliteration (Peters & Zaidel, 1980).

Peters and Zaidel (1980) considered the point at which a child can separate the sound of a word (its form) from its meaning using a homophone detection task. Thirty children ranging in ages from 3;3 to 6;3 were divided into three groups (mean ages 3;10, 4;9, and 5;8). Children were individually presented with pictures of homophone pairs and specifically chosen distracter pictures. The distracter pictures were categories of semantic, rhyme, or alliteration relationships. For example, the homophone "bat" was pictured with either a mitt or a spider (semantic), a hat (rhyme) or a person's back (alliteration). First, the children participated in a "prenaming" task to ensure that all pictures (homonyms and distracters) were associated with the desired label. The two meanings of the nine homophone pairs were presented separately on eighteen 2 x 2 grids along with three distracter pictures. The child was asked to point to *x* for all four pictures on the eighteen grids and was given verbal prompts as necessary. Following the prenaming, three new homophone pairs were presented on three grids as training for the

homonym naming task. Each grid depicted both meanings of the homophone and two distracter pictures. Each child was asked to point to two pictures that sounded exactly the same and given feedback. After the practice grids were presented, nine grids depicting the two meanings of nine homophones (previously presented during the prenaming) were presented in a "first pass" homonym naming task. The children were asked to point to the pictures representing the words that sounded exactly the same, and then they were asked, "*What's the word?"* Verbal prompts were given if the child pointed to the wrong picture, the wrong label, or did not give a response. Following the "first pass, " the eighteen "prenaming" grids were presented again. Finally, the same nine homophone pairs were presented as a "repeat set." The order of presentation and the placement of the homonym pictures in each grid were different from that of the first pass. The "repeat set" used different distracter pictures (represented in the prenaming) and new (never presented before) pictures for each meaning of the homophones to see if the children transferred learning from the first pass.

Final scores of the participants in Peters and Zaidel's (1980) study revealed better performance linked to age. Specifically, children over the age of 4;4 (the youngest participants of the middle group) scored significantly better than the younger participants. The authors attribute the success to the cognitive (i.e., searching strategies) and linguistic abilities (i.e., lexical and phonological) of the oldest participants. The youngest group (average age 3;10) had difficulty with both cognitive and linguistic abilities, specifically separating sound from symbol and then manipulating the sound in comparison to the other words. They seemed to use semantic association as their criterion for similarity. The middle group (average age 4;9) of participants was learning to deal with both aspects, with difficulty in one or the other or both cognitive and linguistic functions.

They were able to make phonological manipulations (in contrast to the youngest group), and their mistakes often were rhyme and alliteration, including options that they invented. The oldest group (average age 5;8) seemed to have well-developed searching strategies and only rare linguistic difficulty. The authors conclude that due to the improved ability to recognize homophones between the ages of four and six, the age of five is a "natural biological (rather than purely cultural) starting point for learning to read" (Peters & Zaidel, 1980, p. 206).

Zipke (2007) administered a homophone identification task to third graders before and after training to determine if training could improve their abilities. Findings showed that the group who received metalinguistic training performed better on the homophone detection task compared to the group that did not receive training. The experimenter read a list of ten homophones and asked each child to describe as many definitions of the word that he/she knew. The children were prompted once to give more definitions before the next word was read. Half of the children served as an experimental group who received training, and the other half of the children served as a control group. Both groups met with the experimenter four times. The experimental group received metalinguistic training that covered words and sentences with more than one meaning, and the control group received standard reading comprehension instruction. All children were then retested with the homophone definition task. Children in the experimental group significantly improved more than the control group on the homophone definition task.

Ambiguity Detection

An ambiguous sentence is a single form that can carry more than one meaning. In contrast, a paraphrased sentence would be an example of a sentence that has two forms

and only one meaning. The idea that homophone detection and ambiguity detection are somehow linked to reading acquisition is much more recent than the already established phonological awareness link to reading, but each has been studied. Fowles and Glanz (1976), Hirsh-Pasek, Gleitman, and Gleitman (1978), Yuill (1996; 1998), Zipke (2007), and Zipke, Ehri, and Cairns (in prep) demonstrated that the ability to detect humor in jokes and puns that are based on ambiguities are correlated with reading ability. Wankoff (1983) correlated reading success in children in kindergarten to third grade with ambiguity detection ability. Cairns, Waltzman and Schlisselberg (2004) found that pre-readers who could detect ambiguities were determined to be better readers one year later. Zipke (2007) et al. (in prep) trained third grade children in homonym and sentential ambiguity detection and found that the children performed better in reading comprehension than did a control group who did not receive training.

Shultz and Pilon (1973) tested children between the ages of 6 and 15 on detecting several types of ambiguous sentences to determine if a developmental order exists. One hundred and twelve children in grades 1, 4, 7, and 10 (i.e. ages 6, 9, 12, and 15, respectively) were tested. Twenty-four ambiguous sentences were presented via tape recorder along with 24 unambiguous sentences. The children were asked to describe or paraphrase the meaning(s) of each sentence. Then the experimenter revealed two pictures for each sentence (ambiguous or unambiguous) and the child was asked to choose which picture(s) matched the sentence. If only one was chosen, the child had to justify his/her choice. Shultz and Pilon (1973) determined that ability to detect different types of ambiguous sentences developed at different rates. Lexical ambiguity detection seemed to develop first, with the largest improvement occurring between ages six and nine. Structural ambiguity detection did not appear until age twelve. These results imply

a primacy of lexical processing over syntactic processing. Wankoff and Cairns (in prep) note that both lexical and syntactic processing operations are used in listening comprehension as well as reading comprehension. Zipke and colleagues (Zipke, 2006; Zipke, Ehri, & Cairns, in prep) suggest that ambiguity detection facilitates comprehension, which in turn promotes reading ability, in contrast to phonological awareness, which aids in decoding. Both metalinguistic skills are equally important for reading ability, but each contributes differently to reading acquisition.

Similar to the findings of Shultz and Pilon (1973), Wankoff (1983) found that lexical ambiguity detection a) seems to develop sooner than structural ambiguity detection, b) is related to conservation abilities, and c) has a strong relationship to reading comprehension. Children in kindergarten through third grade were presented with lexically and structurally ambiguous sentences. The child was asked if the sentence had more than one meaning. If s/he said "no," a verbal prompt was given, and if necessary, a pictorial prompt was then provided depicting both meanings of the sentence. Finally, the sentence was repeated and the child was again asked if the sentence had more than one meaning. The kindergarten children almost never detected the lexical ambiguity, the first graders perceived the ambiguity less than half of the time, but the second and third graders performed almost perfectly. The only difference between the second and third graders was that the second graders needed more prompts before coming to the correct conclusions. Performance on the structural ambiguities was much worse, again like the findings of Shultz and Pilon (1973). The children in the third grade were the only age group who were able to detect half of the structural ambiguities. The children in kindergarten, first grade and second grade performed even worse. In addition, lexical ambiguity detection scores significantly correlated with scores on a conservation test.

The scores on the structural ambiguity detection task correlated with the conservation task scores, but not as strongly as the lexical ambiguity detection scores. Furthermore, both the ability to detect structural and lexically ambiguous sentences had strong relationships to reading measures from the *Woodcock Reading Mastery Test*, (Woodcock, 1987) including letter and word identification, word attack, and word and passage comprehension. The strongest correlation was found between lexical ambiguity detection scores and passage comprehension scores. Thus, children begin to detect lexically ambiguous sentences around the same time formal reading instruction begins, and lexical ambiguity detection is related to conservation and reading comprehension.

Cairns et al. (2004) proposed that the ability to reprocess structurally and lexically ambiguous sentences quickly and efficiently reflects processing operations used in reading. Although previous research had suggested that reading ability and ambiguity detection are related, (Hirsh-Pasek, Gleitman, & Gleitman, 1978, Wankoff, 1983; Wankoff & Cairns, in prep), it was not clear whether reading ability was predicted by the ability to detect sentential ambiguity or a cause of it. A preliminary study followed by two experiments confirmed the hypothesis proposed by Cairns et al. (2004) that ambiguity detection is a precursor and predictor of early reading comprehension.

The preliminary study tested ten 4-year-old and eight 5-year-old native English speakers in preschool. These ages were chosen based on previous research that suggested children do not begin to understand that some words (homophones) have more than one meaning until after the age of 4;4 (Peters & Zaidel, 1980). The children were given an ambiguity detection task using sixteen lexically or structurally ambiguous sentences and eight filler sentences that did not contain ambiguities. A pretest was given to ensure that all children were familiar with both possible meanings of the words. For testing, the

experimenter read the sentence, asked what it meant, and then asked if there were any other possible meanings. If the child could not answer, a verbal, then pictorial prompt was provided. Scores were given based on the amount of prompting necessary to elicit the correct response. Only three of the 4-year-olds and six of the 5-year-olds completed the experiment, and most children were not able to detect the ambiguity with or without prompts. This suggests that preschoolers do not have the ability to detect sentence ambiguity.

In Cairns et al.'s second experiment, forty-four pre-readers in first grade (ages 6;0-7;3) were tested in the same manner as the previous experiment with the same lexical items and more consistent sentence structures to control for complexity. For example, the preliminary study presented sentences such as "The children were told to stop because nails were making too many scratches on the furniture," and "The waitress became upset when the glasses fell on the floor and broke." They changed the sentences to "The man's nails were very sharp, and "The glasses fell on the floor and broke." The 6-year-olds scored significantly higher than the preschoolers on the lexical items, but scored almost as poorly on the structural ambiguities. These results suggest that lexical ambiguity detection develops prior to structural ambiguity detection. Similarly, Shultz and Pilon (1973) tested groups of first, fourth, seventh, and tenth graders and found that all age groups performed better on detecting lexically ambiguous sentences compared to several types of structurally ambiguous sentences.

Cairns et al. retested thirty-six of the participants from their second experiment in the same manner when they entered the second and third grades one year later. Performance on the lexical, but not structural, ambiguity detection was significantly better for the children in second grade. Again, this is consistent with the findings of

Shultz and Pilon (1973) that the ability to detect structural ambiguities does not fully appear until age 12. The school administered the *Slingerland Reading Readiness Test* (Slingerland, 1977) in the first grade and the *Gates-MacGinitie Reading Test* (MacGinitie, MacGinitie, Maria, & Dreyer, 2000) in the second and third grades. Regression analyses demonstrated that performance on the lexical ambiguity detection task at the beginning of first grade, when the children were pre-readers, predicted reading ability in the second grade as effectively as did the *Slingerland*. Furthermore, performance on both the lexical and structural ambiguity detection tasks during the second grade predicted reading ability in the third grade. Additionally, spontaneous detections were a seemingly more accurate predictor of reading ability overall. Thus, the ability to detect sentential ambiguities seems to be a precursor of reading ability.

Ambiguity detection, humor comprehension, and reading acquisition

In addition to linking ambiguity detection skills to reading skills, certain types of ambiguity detection are necessary to understand higher-level language, such as "sarcasm, idiomatic expression, deceit and humor," (Rinaldi, 2000). Children with language impairment often have difficulty with such figurative and abstract language (Rinaldi, 2000). Comprehension of higher-level language is important for academic success and reading in both typically developing children and children with language impairment.

Humor comprehension specifically has been used as a gauge of language awareness (Mahoney & Mann, 1992). Linguistic jokes and riddles that rest on ambiguity, which seem to be the most popular category of humor for children between the ages of six and twelve, are no longer funny to children over the age of twelve when the answers are modified to eliminate the ambiguity (Schultz, 1974). Shultz (1974) tested 15 boys and 15 girls from each of four grade levels: 1, 3, 5, and 7. The children were asked to rate the funniness of 30 riddles that rested on one of five types of ambiguity: phonological (e.g., *Why did the cookie cry? Because its mother had been a wafer so long*), lexical (e.g., *Why did the farmer name his hog Ink? Because he kept running out of the pen)*, surface structure (e.g., *Tell me how long cows should be milked. They should be milked the same as short ones, of course)*, deep structure (e.g., *What animal can jump as high as a tree? All animals – trees cannot jump*), and "other than linguistic" ambiguity (e.g., *How far can a dog run into a forest? Only halfway. After that, he will be running out)*. All riddles were presented once with the original answer, once with a "resolution-removed answer" (e.g., *Why did the farmer name his hog Ink? Because he kept getting away)*, and once with an "incongruity-removed answer" (e.g. *Why did the farmer name his hog Ink? Because he was black.)* The youngest participants found all three types of

answers equally as funny. They had difficulty detecting the hidden meanings of the ambiguities of the original answers. The children of age 8;0 and older seemed to find the original answers the funniest of all three answers. None of the four groups distinguished between the resolution- and incongruity- removed answers. The oldest group (age 12;0) rated the funniness of the resolution- and incongruity- removed answers very low compared to the ratings by the younger groups. This may be because older children anticipate a problem to be solved when listening to a riddle, and the modifications made to the original solution left the riddle unanswered. The author suggests that the age of 8:0 may be the point of transition to "concrete operational thought."

Humor has also been associated with reading ability. Fowles and Glanz (1976) tested strong readers and poor readers from the first, second, and third grades on the retelling and explanation of several types of jokes, riddles and puns that were based on ambiguities. Results indicated that performance was not related to age, but the strong readers performed better than the poor readers. Similarly, Mahoney and Mann (1992) reported that second graders who were more advanced readers performed better at resolving phonemic and morphological riddles. These types of riddles use phonological manipulation by segmenting a word or by replacing a phoneme or morpheme (e.g. *Where do you take a hurt wasp? To the waspital.*) (Zipke, 2007). In addition, the ability to recall a riddle that was based on a lexical ambiguity was not indicative of the ability to explain its ambiguity (Fowles & Glanz, 1976).

In addition to children with reading difficulty, children with specific developmental language disorder (SDLD) were shown to have more difficulty understanding implied meanings using context compared to two normal control groups matched for age and language ability, respectively (Rinaldi, 2000). The presented

sentences had multiple meanings based on a homophone contained within the sentence (e.g., *Mrs. Blue was late for school; She said, "I'm sorry I'm late, the road was jammed solid this morning)*, a phrase (e.g., *There was a robbery yesterday, but luckily the man was caught red-handed),* or an idiom (e.g., *Mrs. Blue said, "I think Joanna got out of the wrong side of the bed this morning*.) The normal controls were also better at ruling out literal interpretations even when they did not know the non-literal meaning. These findings suggest that children with reading difficulties or language impairments could benefit from a successful ambiguity detection training paradigm.

Yuill (1996) was the first to associate recall of different types of riddles with reading comprehension. Children were asked to rate the funniness of a riddle, to re-tell the riddle, and finally, to explain the meaning of the riddle to the experimenter. The abilities of 8 – 11-year-olds to recall riddles that rested on metalinguistics (i.e. "contrasts the use and mention of terms for linguistic entities: *What word is loud, even when you say it softly? Loud"*) (Zipke, 2007) were significantly related to reading comprehension. In a follow-up study, Yuill (1998) tested a similar age group on several types of riddles. Rather than recall, which was deemed an outcome measure difficult to interpret, participants were asked a question and given two possible punch lines from which to choose. Riddles that rested on lexical and structural ambiguities, among several other types, were positively correlated with reading comprehension. Based on these findings, Zipke (2007) aimed to improve third graders' reading comprehension through training in interpretation of several types of riddles. The post-test reading comprehension scores of the experimental group were higher than those of a control group who did not receive training in riddle interpretation.

Some of these studies assume that ambiguity detection is a predictor of reading ability because it is a metalinguistic skill (Wankoff, 1983; Zipke, 2007). Consideration of ambiguity detection as a metalinguistic skill assumes that ambiguity detection is more than a communication tool, and that it demonstrates the ability to manipulate language. In contrast, Cairns et al. (2004) proposed that it is the lexical access and structural analysis skill that precede the metalinguistic processes that result in successful reading. Wankoff and Cairns (in prep) determined that successful reading is not based on the ability to detect lexical ambiguities, but rather "the ability to detect ambiguity is symptomatic of two characteristics of successful beginning readers." First, there is a psycholinguistic processing aspect to ambiguity detection that allows flexible and automatic lexical access of both meanings. Second, there is a metalinguistic component, or "ability to apply language knowledge to linguistic tasks," which enables the child to interact with text more effectively.

Sentence Processing

"Psycholinguists substantially agree that when an auditory sentence is processed, acoustic information is transformed into phonetic information and stored in working memory" (Cairns et al. 2004, p. 69). The internal lexicon provides the lexical information used to process the sentence and the parser determines the structure. If a word in the sentence has more than one possible meaning, all meanings are retrieved and one is selected, based upon contextual information, word frequency, or specific experience of the listener. This is true of the processing of ambiguous words by both adults (Swinney, 1979) and children (Swinney & Prather, 1989; Love, Swinney, Bagdasaryan & Prather, 1999).

In general, lexically ambiguous sentences are more easily reprocessed than structurally ambiguous sentences because all of the alternate word meanings are temporarily available, albeit probably briefly and subconsciously (Wankoff & Cairns, in prep). Structurally ambiguous sentences do not contain ambiguous words, but the sentence has two meanings due to the fact that there are two possible structures for the sentence, (e.g., "The woman tickled the baby with the bear"). In order to reprocess a structurally ambiguous sentence, the "preferences of the parser must be put aside so that a completely new structure… may be computed" (Cairns et al. 2004). The claim that ambiguity detection rests on psycholinguistic processing skills (Cairns et al. 2004) is derived from this general theory of sentence processing. Before a person can detect that an ambiguous sentence has two meanings, both of those meanings must be generated. The ability to construct two meanings of a sentence requires efficient and flexible processing abilities. The same processing skills required for auditory comprehension must be recruited for text comprehension in order for reading to be successful.

Training Studies

Controversy has existed about whether the acquisition of individual linguistic abilities can be accelerated to a rate faster than normal development. Many studies have shown that certain training can improve specific linguistic skills or advance the learning process within the zone of proximal development (Vygotsky, 1978). The zone of proximal development is defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers," (Vygotsky, 1978, p. 86). In other words, it is the difference between

what a child can do without intervention and what s/he can do with some form of intervention. The zone of proximal development determines which language skills can be enhanced through training at what point in development, and it differs for typically developing children and children with language impairment.

Using a toy manipulation task, Roth (1984) successfully trained eighteen children (3;6 – 4;6) to interpret four types of relative clauses that were still "beyond their developmental grasp" under otherwise ordinary circumstances. Lundberg et al. (1988) and Schneider et al. (1997) trained Scandinavian and German 6-year-olds, respectively, on phonological awareness before the children received any type of reading instruction. Rivers and Lombardino (1998) successfully trained first graders, who were at-risk for reading difficulty, with letter-sound correspondences and phonemic decoding (segmentation and blending skills) and compared their performance to matched children who did not receive any training. These results show that the reading skills of at-risk populations can improve with training. Yuill (1998) trained children ages 7;0 and 8;0 with different types of ambiguity tasks and a control group with phonemic awareness tasks. Both groups improved their reading comprehension scores, but the group that received ambiguity detection training improved significantly more than the control group. Zipke and colleagues (in prep) trained normal developing third graders to detect homophones, ambiguous sentences, and interpret riddles that were based on ambiguities. Children who received the training outperformed children in the control group on a reading comprehension task. These successful outcomes within different areas of language suggest that training is a reasonable means of enhancing or accelerating linguistic functions.

Roth (1984) successfully trained eighteen children (3;6-4;6) to interpret relative clause structures using a toy manipulation task. First, all children were pre-tested with twelve exemplar sentences to ensure that they could manipulate toys to act out two different situations contained within one sentence, without experimenter demonstration. The children were divided into three matched groups based on pre-test performance, sex, and age. Each group was randomly assigned to one of three groups: (1) explicit training group, (2) implicit training group, or (3) a control group who did not receive training.

The two training conditions were similar in design. Eight sentences were orally presented to each individual child within a group, which differed from the sentences used during the pre- and post-tests. After each sentence was presented, the experimenter acted out the sentence using two toys, and then the child was asked to do the same. Condition 1 (explicit) presented the sentences as an interrupted, or relative, form, and then in a conjoined form to illustrate that both forms mean the same. For example, "The lion that falls on the squirrel hits the hen" (relative) was first presented to the child as "The lion falls on the squirrel, and the lion hits the hen" (conjoined). The children met with the experimenter for training sessions that involved acting out the sentences to show what each sentence meant. The same relative clause sentences were used in condition 2 (implicit), but the conjoined forms were not presented. Condition 3 was used as a control condition. Children were scored as getting a sentence correct if they could act out both actions in any order and incorrect for anything else.

The two post-test sessions, identical to pre-testing, were conducted shortly after the final training session and again after two weeks without intervention. The child was asked to act out each of the twelve sentences used during pre-testing, without a demonstration from the experimenter. Intervention was shown to be effective based on

improved performance that was maintained two weeks after training. Children trained with conditions one and two demonstrated improved performance, but children in the control group did not improve. These findings demonstrate that children can learn aspects of language at an accelerated rate through training, and more than one training approach to teach such linguistic functions may exist.

Research has shown that crucial components in reading comprehension and acquisition are phonological awareness, processing speed, verbal information, verbal memory capacity, (Goswami & Bryant, 1990) and ambiguity detection (Cairns et al. 2004; Yuill, 1996; 1998; Zipke, 2007; Zipke et al. in prep), although the causal relationships are somewhat controversial. Phonological awareness, regarded as one of the vital metalinguistic skills for reading readiness, is defined as the ability to recognize, manipulate, and separate words into smaller units (Goswami & Bryant, 1990). It was not clear, based on conflicting results of previous research, whether phonological awareness preceded reading acquisition, was a result of it, or if the "relationship [was] reciprocal" (Liberman, Shankweiler, Liberman, Fowler, & Fischer, 1977.) Liberman et al. (1977) determined that phonological awareness, specifically perception of speech as an ordered sequence of phonemes, is a strong predictor of reading success. They tested a group of first graders with their phoneme segmentation task (e.g., tap once for /u/, twice for *boo,* and three times for *boot*) (Liberman et al. 1974) prior to any reading instruction at the beginning of the school year. The scores from the segmentation task were found to have a strong relationship with the children's reading scores at the end of the year. It is not surprising that phoneme segmentation ability would help children make a grapheme-phoneme connection, one of the essential tools in reading acquisition (Cairns, 1996). Based on apparent relationship between certain metalinguistic skills with reading skills,

numerous studies have (successfully) attempted to train children in efforts to ultimately improve or accelerate reading skills.

The training study conducted by Schneider et al. (1997) was designed to determine the effect of phonological awareness training on the reading abilities of German kindergarteners, expanding upon a similar paradigm used in a successful training study with Scandinavian children of the same educational level (Lundberg et al. 1988). Scandinavian children do not begin school (and formal reading training) until the age of seven, thus Lundberg et al. (1988) were able to provide phonological awareness training prior to school instruction, and compare their performance to a control group that did not receive training. The authors of this study of over 400 Danish children concluded that "1) phonological awareness can be developed before reading ability and independently of it, and 2) phonological awareness facilitates subsequent acquisition of literacy, thus providing unconfounded evidence for a causal link" (Lundberg et al. 1988.)

Schneider and colleagues (1997) used Lundberg's study as a model to test German children, who, like Scandinavian children, do not receive any formal reading instruction before elementary school (at the average age of six). The results of the study demonstrated the following: 1) German children could be trained in phonological awareness; 2) the training only improved phonological awareness and nothing more (e.g., intellect, letter knowledge, and other components of phonological processing); 3) the training had short-term effects on reading and spelling skills of the experimental group at the end of first grade, but the training did not have long-term effects at the end of second grade; and finally 4) differences in training paradigms caused different outcomes.

During the first of Schneider and colleagues' two studies, a control group (n = 166 children) and a training group (n = 205) were selected from eleven kindergarten

classes from one town in Germany. The training group was divided into two subgroups of children who were consistently trained (CT) and inconsistently trained (IT) during the months of training. The children were on average 5;7 at the start of the program. All children were pre- and post-tested with cognitive tasks to assess intelligence and phonological processing skills in general. The training program lasted from October to April, consisting of "15-20-minute sessions of metalinguistic exercises and games." A metalinguistic transfer test using new materials was given the following November (at the beginning of the first school year), and reading and spelling skills were assessed at the end of the first and second grades.

The authors compared the control group (C) (n = 157) to the training group that was consistently trained (CT) (n = 69) and to those that were inconsistently trained (IT) (n = 118). The authors concluded that although the German children were younger than the Danish children in Ludberg et al.'s (1988) study, the training resulted in improved phonological awareness. Significant differences were found between the CT group and the other two groups in end-sound subtests, word length, phoneme analysis, phoneme reversal, and vowel substitution, but not with the initial-phoneme subtest. The first grade measures of reading and spelling of the CT group were significantly better than the IT and the C groups (IT and C were not significantly different from each other), but improvements were not significant in the second grade. The inability to show long-term effects of the training was attributed to such factors as the quality of training and overall higher intelligence within the control group. (Lundberg and colleagues also failed to show long-term effects of their training with Danish children.)

For Schneider et al.'s second study, the training group was comprised of 191 children from eleven kindergartens, and the control group was comprised of 155 children

from seven kindergartens. The procedures, described in the first study, were repeated, but pretesting was conducted in December rather than September and training lasted from January to June. Minor modifications were made to the training sessions, including shortening the sessions to ten minutes a day to make it more convenient for the teachers to fit it in to the classroom schedules. Slightly different outcomes in Schneider et al.'s studies reflected the modifications made to the training program. For example, the authors note the influence of different teachers as trainers and overall average classroom intelligence. Overall, with training, phonological awareness was shown to develop before formal reading and spelling instruction (Lundberg et al. 1988; Schneider et al. 1997), but no conclusive evidence was found to determine that phonological awareness is the only metalinguistic skill necessary for reading ability.

The successes of such training paradigms demonstrate that metalinguistic and linguistic skills can be enhanced through training, and improvement of some metalinguistic skills affects reading abilities. The findings of Cairns and colleagues (2004) demonstrated that ambiguity detection also seems to be associated with reading ability. Furthermore, several studies have successfully trained children of different ages on homophone and ambiguity detection, which ultimately improved reading comprehension scores (Yuill, 1996; 1998; Zipke, 2007; Zipke et al. in prep).

Yuill (1998) successfully trained 18 seven- and eight-year-olds on metalinguistic tasks, specifically focusing on ambiguities, and found that reading comprehension skills improved. Children met with the experimenter for about 30 minutes once a week for seven weeks. The children made up jokes, read ambiguous texts, and played games with ambiguous words and sentences. A control group of 18 children matched for reading comprehension abilities met the same number of times and read stories and played

phonemic awareness games. The post-test reading comprehension scores of both groups improved, but the experimental group improved significantly more than the control group. Although this study seemed to develop a training system that could help children with reading difficulties by providing a flexible understanding of language, it may have instead "taught participants to evaluate their understanding of the text" (Zipke, 2007), which would account for the increase in reading comprehension scores. Zipke (2007) also pointed out that the training paradigm was not adequately described in Yuill's (1998) study, so the reader could not determine if carry-over was possible from the lab to a classroom setting.

Zipke (2007; Zipke et al. in prep) addressed these issues, among others in a metalinguistic training study. Forty-six third graders were tested on eight metalinguistic tasks to see if metalinguistic awareness is trainable and also to determine if there are any effects on reading skills. Children were randomly divided into two groups. One group served as a control group, and the second group received training. The children were pre- and post-tested on eight types of tasks: 1) homonym definition task, 2) ambiguous sentence detection task, 3) riddle resolution test, 4) heteronym pronunciation, 5) miscue self correction, 6) anomaly detection, 7) passage comprehension subtest, from the Woodcock Reading Mastery Tests- Revised (Woodcock, 1987; 1998) 8) Gates-MacGinitie Test of Reading Comprehension, Level 4, (GMRT 4) (MacGinitie, MacGinitie, Maria, & Dreyer, 2000).

Training consisted of four sessions of 45 minutes each. Instruction started at the word level and gradually increased to text passages. The experimenter used the first session to explain that some words have more than one meaning and strategies were taught that could be used to identify such words. The second session involved

ambiguous sentence instruction and detection. The experimenter read ambiguous sentences and displayed two corresponding illustrations to represent both meanings of the sentence. Then, the child was asked to display both meanings of ambiguous sentences with Colorforms (manipulable stickers). After the child completed the Colorforms displays of each sentence, the experimenter charted "*who does what to whom"* for both meanings of the sentence. The third session covered riddles that incorporated lexical and structural ambiguities. The children read text from Amelia Bedelia books during the final session. The control group met with the experimenter once a week for four weeks for shorter sessions for standard reading comprehension instruction. Results provided more evidence that metalinguistic abilities influence reading comprehension. Children in the experimental group improved significantly more than did the control group on the standardized reading comprehension test, as in Yuill's (1998) study, as well as the homonym definition task, and ambiguous sentence task.

The training studies all seem to suggest that metalinguistic training can be a very effective tool for reading acquisition and/or reading improvement with typically developing children. Rivers and Lombardino (1998) raised concerns about whether children at risk for reading difficulty or failure would show as much improvement through this type of training as has been observed in typically developing children. Although the training may improve performance on post-test measures, the at-risk populations may not be able to generalize the newly acquired skills to unfamiliar stimuli that they would encounter in everyday reading. Thus, Rivers and Lombardino (1998) examined the effects of training three first-graders at risk of reading failure with segmenting and blending skills compared to six children who were not given any training. Their findings demonstrated that children at risk for reading failure could in fact

benefit from training. Each of the three participants in the experimental group were matched to two participants in the control group for age, gender, grade, reading and spelling test scores, social economic status (SES), and were determined to be at the same risk for reading difficulty, based on performance of the *Early Reading Screening Instrument*. Each of the children who received the phonological awareness training of letter-sound correspondences and phonemic decoding performed significantly better on the pseudo-word (CVC) decoding tasks, designed to be unfamiliar to the subjects, than the control subjects with which they were compared. Although this study did demonstrate the potential of metalinguistic training with at-risk populations, more research is needed with larger samples of subjects.

In summary, past research has determined lexical ambiguity detection to be a psycholinguistic component and one of several metalinguistic skills related to reading acquisition. The ability to detect lexical ambiguities reflects not only an ability to "apply language knowledge to linguistic tasks," but also reflects flexible and automatic lexical access (Wankoff & Cairns, in prep). Furthermore, studies have demonstrated that children can be trained to accelerate linguistic (Roth, 1983), metalinguistic (Lundberg et al. 1988; Schneider et al. 1997), and psycholinguistic processing skills (Yuill, 1996; 1998; Zipke, 2007; Zipke et al. in prep), within the zone of proximal development, some of which have resulted in improved reading skills (Zipke, 2007; Zipke et al. in prep).

Overview

The present study focuses on the performance of kindergarten children before and after training in identifying two types of homophone pairs and in detecting lexically ambiguous sentences. This study is the first to compare homophone detection ability of

kindergarteners with the ability to detect lexically ambiguous sentences using the same noun/noun homophones, (e.g., "The children saw the *bat* in the yard"). This allows a comparison of performances on individual homophones and homophones embedded in a sentence. Separate studies have tested children's abilities to detect homophones (Peters & Zaidel, 1980) and lexically ambiguous sentences (Shultz & Pilon, 1973; Cairns et al., 2004; Zipke, 2007), but a study that compares individual performance on both tasks does not exist. Homophone detection is an important skill, but language, and ultimately reading, requires that children learn to integrate word meaning with the sentence context to derive a meaning for the sentence (Tunmer & Bowey, 1984). Children who can identify both homophone meanings may not necessarily be able to identify both meanings of a lexically ambiguous sentence that contains the same homophone. Cairns et al. (2004) predict that this should be the case because the detection of sentence ambiguity requires lexical processing involving more than the knowledge that a word has two meanings.

Children were trained to identify not only noun/noun homophones (e.g., *bat*) (Peters & Zaidel, 1980), but also noun/verb homophones (e.g., *rock*). Performance on detecting noun/verb homophones has never been studied. The English language contains more nouns than verbs, typically developing children usually acquire nouns earlier than verbs (Leonard et al. 1982; Leonard, 2002), and kindergarteners have a larger vocabulary inventory of nouns than verbs (Leonard, Camarata, Rowan, & Chapman, 1982). Children and adults with developmental and acquired impairments often exhibit differences in favor of nouns (Black & Chiat, 2002). There exist phonological and semantic differences, in addition to syntactic distinctions, between nouns and verbs in English. Verbs are usually shorter in duration, have fewer syllables, and have less stress patterns

than nouns (Black & Chiat, 2002), meaning nouns are more salient than verbs and are possibly easier to acquire. For these reasons, noun/verb homophones were tested to determine if kindergarteners had more difficulty detecting them compared to noun/noun homophones.

Children were trained to detect homophones and lexically ambiguous sentences to improve metalinguistic awareness and psycholinguistic processing skills. The goal was to take the first step in a research program that will show improved homophone and ambiguity detection abilities result in improved reading performance. Based on the findings of previous studies that focused on the development of homophone detection (Peters & Zaidel, 1980) and lexical ambiguity detection skills (Shultz & Pilon, 1973; Cairns et al., 2004; Zipke, 2007) of typically developing children, we assume that children in kindergarten have already entered the zone of proximal development for homophone detection and are about to enter the zone of proximal development for lexically ambiguous sentence detection. For these reasons, we have chosen typically developing children in kindergarten to determine not only if a homophone and lexical ambiguity detection training paradigm would work but also if this age group is the most receptive to training.

Hypotheses

First, it is predicted that children in the experimental group will score higher on the homophone detection tasks and lexical ambiguity detection task after homophone and lexical ambiguity detection training. Children in the control group will show little or no improvement on the tasks after vocabulary enhancement training. Next, children will demonstrate that they can understand the dual meaning of homophones without being

able to perceive the ambiguity of sentences containing those homophones. Finally, both groups will perform better on the noun-noun homophone detection task compared to the noun-verb homophone detection task (Leonard, Camarata, Rowan, & Chapman, 1982).

CHAPTER III

METHODS

Participants

Thirty-four normal-hearing children were recruited from kindergarten classes within one school. Students from only one school were recruited to ensure that all students received the same level and type of instruction, based on the individual school's curriculum. After receiving permission from the school administrators, the kindergarten teachers sent the children home with letters to the parents (see Appendix A). Participants were chosen based on a short questionnaire (see Appendix A) filled out by the parents to assess basic criteria (e.g., hearing of the child, languages spoken at home, and basic language development.) Parents signed consent forms, giving permission for their son or daughter to participate in the experiment. In addition, the parents attested to the child's assent to participate in the study (see Appendix A).

The children attended a public school in a middle class New Jersey neighborhood. They ranged in age from 5;5 to 6;6, with a mean age of 6;0 at the start of testing. Two girls were excluded after pre-testing. Both excluded participants were over 6;8, one was a native Spanish speaker, and the other chose to end the pre-test session early and not continue with the study. All participating children were determined to have normal hearing, based on a hearing screening administered by the school nurse at the start of the school year. All 32 participants were fluent speakers of English, and all but one child were monolingual. Children were determined to be typically developing based on parental report. At the time of testing, none of the children were receiving services for speech or language.

Four children had received early intervention services for minor articulation issues. Six children had tubes placed in their ears and removed before the age of 3;0. One child was eight weeks premature and another experienced febrile seizures between the ages of 18 and 30 months. All performed within normal limits of the PPVT III and were included in final analyses (see Appendix S, Tables S1a and S1b).

Materials and Procedures

All children met with the experimenter (MTS) individually before training began and again after training ended. The pre- and post-tests and the training sessions were administered by the experimenter at the children's school. Pre-testing consisted of The Peabody Picture Vocabulary Test III (PPVT), Picture Matching Task (PMT), Homophone Detection Task (HDT), and Lexical Ambiguity Detection Task (LADT), (see Appendix B, Table B1). This session lasted about 40 minutes. The 32 homophones used during pre-testing, training and post-testing were selected based on pilot data. The homophones used for the pre-test and training sessions were identical. The post-test session was similar to the pre-test session, but the homophones that were tested and used in sentences were different from pre-testing and training, and the PPVT III was not administered. This session lasted about 25 minutes.

The participants were instructed to inform the researcher of any discomfort or fatigue, and all participants were free to stop participating at any time. Stickers, stamps, and small toys from Oriental Trading Company, Inc. were used as prizes for the children to choose throughout the testing sessions. The child sat to the left of the experimenter in child-size chairs next to a child-size desk during individual pre- and post-test sessions. The children and the experimenter sat in a circle on the floor during training sessions.

The children were divided into two groups, which were determined to be equal based on average pre-test performance. Experimental and control groups performed similarly on all three pre-tests (noun/noun HDT, noun/verb HDT, and LADT) (see Appendix S, Tables S2, S3 and S4). The three pre-test scores of the experimental group did not differ significantly from the pre-test scores of the control group. Training and control groups did not differ on the pre-test noun-noun homophone detection task [$t(30)=1.92$, ns], noun-verb homophone detection task [$t(30)=.98$, ns], nor the ambiguity detection task [$t(30)=1.26$, ns]. In addition, the groups had similar PPVT scores (see Appendix S, Tables S1a and S1b), reading unit scores administered by the kindergarten teachers, age ranges, and equal numbers of boys and girls.

The experimental group received ambiguity detection training (in homophones and in sentences), and the control group received similar training using vocabulary without dual meanings. All research records were coded and kept in a locked file in the investigator's home to protect the privacy of the participants. Only researchers directly involved with the study had access to the research information in the records.

Pre-Test

Peabody Picture Vocabulary Test III

The individual pre-test session began with the PPVT III. In accordance with the standard instructions, the child sat to the left of the right-handed experimenter at a child-sized desk. The child was told to point to the picture that corresponded to the presented word. The test was scored with the number of errors. The next word was presented after the child made a final choice. If the child chose the correct picture, and then changed his/her mind to an incorrect picture, that plate was scored as an error. The plate was scored as correct if s/he chose an incorrect picture, but then changed his/her response to the correct picture. Stickers or stamps were offered after each section that consisted of twelve plates. Testing ended when the child made at least eight errors within a section.

Picture Matching Task (PMT)

Following the PPVT III, 32 plates of four pictures were presented in a predetermined random order to each child (see Appendices D and E). The picture matching was administered to ensure that the child knew each of the meanings of the16 homophones used during pre-testing (eight noun/noun homophones and eight noun/verb homophones). The 16 homophone pairs were separated onto two plates. One of the two meanings of all eight homophone pairs were presented before the second meaning was presented. In other words, the presentation of each half of the homophone pair was separated by eight other presentations. For example, during the pretest, “cellar” was the first plate presented, and “seller” was the ninth plate. The other three pictures on each plate were placed as semantic or phonemic distracters. For example, for the homophone ‘bat,’ one plate pictured 1) a baseball bat, 2) a catcher’s mitt, (semantic distracter) 3) a beach ball,

(phonemic distracter) and 4) a chair (irrelevant distracter). The other plate pictured 1) a flying bat, 2) a spider's web, 3) a beach ball, and 4) a chair. The homophones appeared in a different location on each plate. For example, the mammal "*bat*" appeared in the upper left grid box on one plate, and the baseball "*bat*" appeared in the lower left grid on the second plate. The noun/verb homophone pairs included four nouns and four verbs within the first eight plates. The other four nouns and four verbs were presented in the following eight plates. Half of the children were presented with the noun/noun homophones first, and the other half of the children was presented with the noun/verb homophones first. The children who were presented with the noun/noun homophone PMT first during pre-testing were presented with the noun/noun PMT first during post-testing also. This order of presentation continued throughout pre- and post-testing to ensure comparability between individual pre- and post-test performance.

The experimenter explained that the "game" (PMT) was practice because there may be new words that were unfamiliar to the child. Each child was presented with a plate and asked by the experimenter to point to a specific picture (the homophone). If the child pointed to the correct picture, the experimenter presented the next plate. If the child pointed to the wrong picture, the experimenter assisted the child to find the appropriate picture that corresponded with the spoken word. First, the experimenter named the incorrect picture. Then she said, "Can you show me another picture that shows [homophone]?" The child usually chose the correct picture after that cue. Sometimes, the child did not make an effort to choose another picture and said that s/he did not know which picture matched the word. The experimenter said, "Let's name the pictures together." After naming each picture, the experimenter said, "Now, can you point to [homophone]?" The child then pointed to the correct picture. This section was not

scored. The point of the exercise was to ensure that the children could label the pictures that corresponded to each meaning of each homophone correctly. Most children were able to point to the correct picture without prompts, and all children pointed to the correct picture if prompts were provided.

Homophone Detection Task (HDT)

Following the PMT, the child was presented with sixteen plates of four pictures. Each plate pictured one of the sixteen homophone pairs. Two of the pictures were homophones (e.g., a baseball bat and a flying bat), and two were distracters, (e.g., a baseball mitt and a spider's web) (see Appendices F and G). The distracters used for the HDT plates were previously presented during the PMT to ensure that the child was equally familiar with all pictures being presented. The placement of each of the homophones on the grid was different than the placement used during the PMT. Furthermore, the homophone pictures never appeared next to each other on the grid so that a distracter picture always appeared between the two homophones. The order of the presentation of the homophones was the same as the order used during the PMT. Children who were presented with the noun/noun homophones during the PMT first were also presented with the noun/noun homophones during HDT first for both pre- and post-testing.

The child was presented with a plate and asked if the names of two of the pictures sounded alike. If the child pointed to the correct pictures, the next plate was presented. If the child pointed to one or both incorrect distracter pictures, the experimenter asked the first verbal prompt, "Are there any two pictures that sound *exactly* alike?" If the child answered correctly, the next plate was presented. If the child answered "no," or pointed

to distracter pictures, the experimenter provided the second verbal prompt by going over the names of each of the four pictures. The experimenter named the pictures starting at the upper left grid box, going clockwise and then re-asked the question.

Overall, the most common mistake initially made by the children (before verbal prompts) was pointing to one of the homophone pictures and its distracter (e.g., baseball bat and catcher's mitt.) Often after a verbal prompt was given, the child would either 1) point to the correct pictures, or 2) s/he would point to the other homophone and its distracter, the two other pictures on the grid (e.g., flying bat and spider's web).

The child received four points if s/he answered correctly initially without any prompts from the experimenter. If the experimenter asked if there were any other pictures that sounded exactly alike, (first verbal prompt) and the child pointed to the correct pictures, s/he received 3 points. Two points were given if the experimenter named the pictures (second verbal prompt), and the child pointed to the correct pictures. If the homophones were not identified after both prompts, zero points were given for that plate. Noun/noun and noun/verb homophones were scored separately. The total scores for each set of homophones (noun/noun and noun/verb) could range from 0 to 32 points, (eight homophone pairs with a total possible four points for each.)

Lexical Ambiguity Detection Task (LADT)

The final task during pre-testing was the LADT. A total of sixteen sentences were randomly presented to each child. Half of the sentences contained one of the eight noun/noun homophones presented during the PMT and HDT, and the other eight sentences were unambiguous (see Appendix C). The experimenter read the directions on the score sheet.

The child was first presented with four practice sentences: two ambiguous and two unambiguous sentences. The experimenter read each practice sentence and asked the child if the sentence had one meaning or two meanings. The experimenter then placed two pictures in front of the child regardless of the child's answer. The experimenter asked the child to point to the picture(s) depicting the meaning of the sentence. If the sentence was unambiguous, one picture depicted the meaning, and the other picture was identical except for one detail. For example, the pictures for "The cup is on the table" showed a teacup on a table in one picture, and the other picture showed the table with nothing on it. The experimenter went over each picture that corresponded to each practice sentence. The experimenter went on to the next sentence when the child pointed to the correct picture(s) and could describe the meaning(s) of the sentences.

After the four practice sentences were completed, the experimenter explained that more sentences would be presented without pictures. After the sentence was read, the experimenter asked if the sentence had one meaning or two meanings.

If the sentence was unambiguous and the child said it had one meaning, the next sentence was presented. If the child said it had two meanings, the experimenter asked the child to explain the two meanings. The child would either change his/her mind to say that the sentence meant one thing, or s/he would describe two different sentences. For

example, for the unambiguous sentence "The lady asked the children to stop playing baseball," one child said that the lady told the kids not to play baseball (one meaning) and then said that the kids did not listen to her and played baseball anyway (second meaning). If the child gave such a response, the experimenter read the sentence again and asked if the sentence had one meaning or two. The child either changed his/her response to say that the sentence had one meaning, or remained with his/her original answer of two meanings. Once the child settled on an answer after the verbal cues, the next sentence was presented. Unambiguous sentences only served as fillers and were not scored.

When an ambiguous sentence was presented, the experimenter asked if the sentence had one meaning or two, (the same procedure used when the sentence was unambiguous). Regardless of whether the child said it had one or two meanings, the experimenter asked the child to describe what the [homophone] looked like. The reason for continuing with the questioning even after the child answered correctly was that many children guessed throughout the entire task with the same answer. They either said that every sentence had one meaning, (including the ambiguous sentences) or that every sentence had two meanings, (including the unambiguous sentences).

If the child could only describe one meaning of the sentence, the experimenter gave verbal cues to help him/her describe the other meaning of the sentence. If the child only described one meaning of the sentence, the experimenter presented the <u>first verbal prompt</u> by asking if there was any other kind of [homophone]. After the child's response, the experimenter reread the sentence and asked what the sentence meant. If the child could not describe the other meaning of the sentence, the experimenter provided the <u>second verbal prompt</u> by explaining the other possible meaning of the homophone. The experimenter then reread the sentence and asked what it meant. Even after this prompt

often the child was still sure that the homophone and/or the sentence only meant one thing. For example, for the ambiguous sentence "The children saw a bat lying by the fence," one child said that the sentence only had one meaning. The experimenter asked him what the "bat" looked like. He said that it looked "like a bat that you use to play baseball." The experimenter reminded the child of the other meaning of "bat," and the child agreed ("Oh yeah, like the ones you see at Halloween.") The experimenter then reread the sentence and asked the child what it meant. The child said that the children saw a baseball bat by the fence. If all prompts were given, and the child could not describe a second meaning of the sentence, the next sentence was presented.

Points were awarded for each sentence based on level of ambiguity detection with or without prompts. If the child spontaneously described both meanings of the sentence without prompts, s/he received four points. Three points were given if the child could explain both meanings of the sentence after the first verbal prompt was provided. Two points were given if the child reiterated both meanings of the sentence after both meanings of the homophone were provided by the experimenter. If the child did not express understanding of both meanings of the sentence after all prompts were given, s/he received zero points for that sentence. Children received a total score between 0 and 32 (eight ambiguous sentences with a total possible four points each.)

Training

After pre-testing was complete, the children were randomly placed in one of four small groups of seven to nine children. Two of the four groups received homophone detection and lexical ambiguity training, which were considered the experimental groups. The remaining two groups were considered the control groups. Their "training" was designed similarly to the experimental groups but involved vocabulary that did not have dual meanings. The average scores of the two experimental groups compared to the two control groups did not differ significantly for the pre-tests, PPVT III, (see Appendix S), and reading unit tests (that were given by the kindergarten teachers). Each group of sixteen had equal numbers of boys and girls (8:8).

The experimenter met with each group of children for 15-20-minute group sessions, twice a week for four weeks. One extra training session was held after the four weeks for children in the experimental groups who were absent for any of the sessions. The training for the experimental groups involved games with pictures designed to teach both meanings of the homophones. The training sessions primarily focused on the 16 homophones (eight noun/noun homophones and eight noun/verb homophones) and the eight lexically ambiguous sentences presented during pre-testing. At each session, the children played BINGO using game boards (designed by MTS) that pictured the homophones (see Appendices M, N, O, P, and Q), and talked about one of the eight lexically ambiguous sentences using illustrations that depicted both meanings.

The experimenter read stories to the control group and discussed with them the new vocabulary words introduced within the story. The children also played BINGO using game boards that pictured vocabulary words without dual meanings. During the "training" sessions of the control group, the homophones presented during pre-testing

were not reviewed, and new vocabulary words that were introduced through the stories and discussions did not have dual meanings.

All BINGO boards were 4 x 4 grids, totaling sixteen pictures. Children in all groups used red one-inch cardboard squares to cover the pictures during the game. The control groups used the same BINGO boards for the duration of the eight sessions. The training groups used BINGO boards that depicted the eight noun/noun homophones during sessions 1 and 3, and boards that depicted the eight noun/verb homophones during sessions 2 and 4 (see Table 1). The final four training sessions used BINGO boards that depicted four of the eight homophone pairs (eight pictures) and eight pictures of vocabulary that did not have dual meanings. Nine boards were made for both the noun/noun homophones and the noun/verb homophones. Four of the nine boards depicted four of the homophones, and the other five boards depicted the other four homophones. The children used the noun/noun homophone boards with the single-meaning vocabulary during sessions 5 and 7. They used the noun/verb homophone boards with the single-meaning vocabulary during sessions 6 and 8. Children used boards that depicted half of the homophones during one session, and then used boards that depicted the other half of the homophones during the other session. Again, this ensured that all children received the same exposure to all of the words. Attendance was taken at each session and board numbers were recorded.

Table 1 *Experimental Group Bingo Schedule*

	1	2	3	4	5	6	7	8
Exp 1	NN	NV	NN	NV	NN/voc 1-4	NV/voc 1-4	NN/voc 5-9	NV/voc 5-9
Exp 2	NN	NV	NN	NV	NN/voc 5-9	NV/voc 5-9	NN/voc 1-4	NV/voc 1-4

Exp 1 & Exp 2 refer to both halves of one experimental group (8-9 children total).
NN = Noun/Noun Bingo
NV = Noun/Verb Bingo
NN/voc = Noun/Noun Bingo with vocabulary without dual meanings
NV/voc = Noun/Verb Bingo with vocabulary without dual meanings
Boards 1-4 pictured 4 homophones, and boards 5-9 pictured 4 different homophones (8 homophones total).

The experimenter called out the words during the first two sessions of the control and training groups (see Appendix B, Table B2). After each homophone was called out during the training sessions, one child was chosen to describe the two pictures that corresponded to the homophone. Beginning with session #3, (after the children were exposed to both the noun/noun and noun/verb BINGO boards), the children in both the training and control groups were called on to call out the words on the boards. When a child called out a homophone in the training groups, s/he was responsible for describing the two meanings. If the child had difficulty, another child was called upon to 'help' him/her. Notes were taken throughout the sessions to ensure that all children participated equally. Several children in each group always volunteered to answer, whether or not they knew the correct answer, and others never volunteered. For these reasons, a child was not allowed to answer unless called upon by the experimenter.

Each child in each group was given his/her own BINGO board that depicted the same 16 pictures as every other board in an individualized layout (except for the final BINGO boards used with the training groups, see Appendices O and P). Before the game started, the group voted on a pattern that would be used to 'win' BINGO (e.g., all pictures in the left column, a diagonal row, etc.) The child 'won' when all of the words in that column or row were called out. The child then chose a prize and continued to mark

his/her board until all children in the group won BINGO. This kept all children in the group occupied until the last person in the group won, and ensured that all children had the same exposure to the same words. If all children within the group did not have equal opportunity to call out a word, extra "bonus" words from the BINGO board were called out and described by those children. Ultimately, the goal was to have all children exposed to the same number of words and actively involved in the learning.

After all children in the control group 'won' BINGO, the experimenter read part of a story (see Appendix B, Table B2) and new words were discussed. When everyone in the training group had won BINGO, the experimenter read one of the lexically ambiguous sentences. The children were asked if the sentence had one or two meanings. A vote was taken, and then the experimenter held up two pictures that depicted both meanings. Another vote was taken. One of the children who voted that the sentence meant two things was called on to explain to the others the two possible meanings of the sentence. After the explanation, a third vote was taken. By this vote, all children agreed that the sentence had two meanings. The experimenter took notes to record attendance, behavior, and participation. An attempt was made to ensure that each child was called upon to participate as frequently as the others in the group.

Post-Test

The procedures for the post-test sessions were similar to those used during the pre-test, except the PPVT III was not administered and new homophones and sentences were introduced. Eight new noun/noun homophones and eight new noun/verb homophones were introduced in the Picture Matching Task and the Homophone Detection Task (see Appendices I, J, K, and L). The order of presentation of the noun/noun or noun/verb homophones was based on pre-testing procedures, (i.e., children presented with the noun/noun PMT prior to the noun/verb PMT during pre-testing were presented with the noun/noun PMT first during post-testing). The sentences presented during the post-test Lexical Ambiguity Detection Task contained the new noun/noun homophones (see Appendix H).

Children met with the experimenter for an individual session that lasted approximately twenty-five minutes. The experimenter and child sat at the same desk and chairs used for pre-testing. Children were rewarded with stickers and stamps throughout post-testing. After each child completed the post-tests, s/he was given a prize packet at the end for participating. The packet included a certificate of completion, a book entitled *Does a Kangaroo Have a Mother, Too?* (Carle, 2000), and small toys and stickers.

CHAPTER IV

RESULTS

The tested hypotheses and obtained results are as follows:

1) Children in the experimental group will score higher on the homophone detection tasks and lexical ambiguity detection task after training. Children in the control group will show little or no improvement on the tasks after training.

Table 2 presents the pre- and post-test means for both groups on all three tasks. It shows that the effects of training were robust. For each of the three tasks, a 2 (Groups: Experimental and Control) x 2 (Test time: Pre- and Post-test) ANOVA was performed for a mix design with one between groups variable and one within groups variable. Results for each task will be addressed below:

Table 2

Comparisons of Mean (SD in parentheses) Performance of Training Group and Control Group on Pre- and Post-Test Noun-Noun Homophone Detection Task (NNHDT), Noun-Verb Homophone Detection Task (NV HDT), and Lexical Ambiguity Detection Task (LADT)

	Experimental Group	Control Group		*F*	Cohen's *d*	Partial Eta Squared
NN HDT (32 max)						
Pre-test	24.38 (5.39)	18.94 (9.94)	Group	9.11**	.68	.23
Post-test	31.00 (1.03)	23.13 (7.50)	Test time	31.66****	1.47	.51
Gain	6.62 (4.92)	4.19 (5.90)	Interaction	1.61 *ns*		.05
NV HDT (32 max)						
Pre-test	22.25 (7.63)	19.13 (10.16)	Group	4.87*	.37	.14
Post-test	31.13 (1.36)	23.44 (8.63)	Test time	30.44****	1.24	.50
Gain	8.88 (7.49)	4.31 (5.94)	Interaction	3.64 *ns**		.11
LADT (32 max)						
Pre-test	16.31 (8.54)	12.50 (8.59)	Group	19.78****	.44	.40
Post-test	28.13 (2.92)	10.25 (9.59)	Test time	12.84***	2.52	.30
Gain	11.81 (7.60)	-2.25 (7.49)	Interaction	27.77****		.48

*p<.05; **p<.01; ***p<.001; ****p<.0001; *ns** p=.066; *ns* = not statistically significant

Noun/noun Homophone Detection Task

Main effects of both Groups [F (1,30) = 9.11, p = .005] and Test time [F (1,30) = 31.66, p<.0001] were significant. The interaction, however, was not [F (1,30) =1.61, ns]. To test the effects of training, *t*-tests were performed. There was no difference between the groups at pre-test [*t* (30) = 1.92, ns], but a highly significant difference at post-test [*t* (30) = 4.16, p<.0001]. As predicted, the experimental group differed from pre- to post-test [*t* (15) = 5.38, p<.0001]. Surprisingly, the control group also improved from pre- to post-test [*t* (15) = 2.84, p = .012]. Despite the improvement, the children in the control group did not perform as well as the experimental group on the post-test noun/noun HDT (4/16 of the control and 15/16 of the experimental scored >30, the median of all 32 participants, Fisher Exact Test, p = .00017).

Table 3 presents an item analysis for the noun/noun homophones on the post-test, (see Appendix S, table S2 for a pre-test item analysis). Scores for each word ranged from 0 to 4. The experimental group performed better than the control group for each of the eight homophones. Post-test performance of the experimental group was consistent across items and nearly perfect. Individual participant pre- and post-test performance on the noun/noun HDT is shown in Figures 1 (control group) and 2 (experimental group), (see Appendix R for individual participant scores). Although there were individual differences on the pre-test, there were consistently high performance levels on the post-test for the experimental group. Also, the experimental group showed consistently higher performance on the post-test noun/noun HDT than on the pre-test. This was not true for the control group.

Table 3

Post-Test Score Per Word of Experimental and Control Groups

on Noun/Noun Homophone Detection Task (Highest Possible Score = 4)

Noun/Noun Homophones	Experiment Mean	Experiment Median	Experiment Range	Control Mean	Control Median	Control Range
Steak/Stake	3.94	4	3-4	2.81	3	0-4
Cold	3.94	4	3-4	3.75	4	2-4
Pipe	3.81	4	3-4	2.63	3.5	0-4
Horn	3.94	4	3-4	2.31	3.5	0-4
Night/Knight	3.94	4	3-4	3.44	4	0-4
Glasses	3.69	4	3-4	2.31	3.5	0-4
Bow	3.81	4	3-4	2.63	3	0-4
Flour/Flower	3.94	4	3-4	3.25	4	0-4
Total	31.00	31	29-32	23.13	24	6-31

Figure 1

Comparison of Control Group Individual Performance on Pre- and Post-test Noun/noun Homophone Detection Task (Total Possible Score = 32)

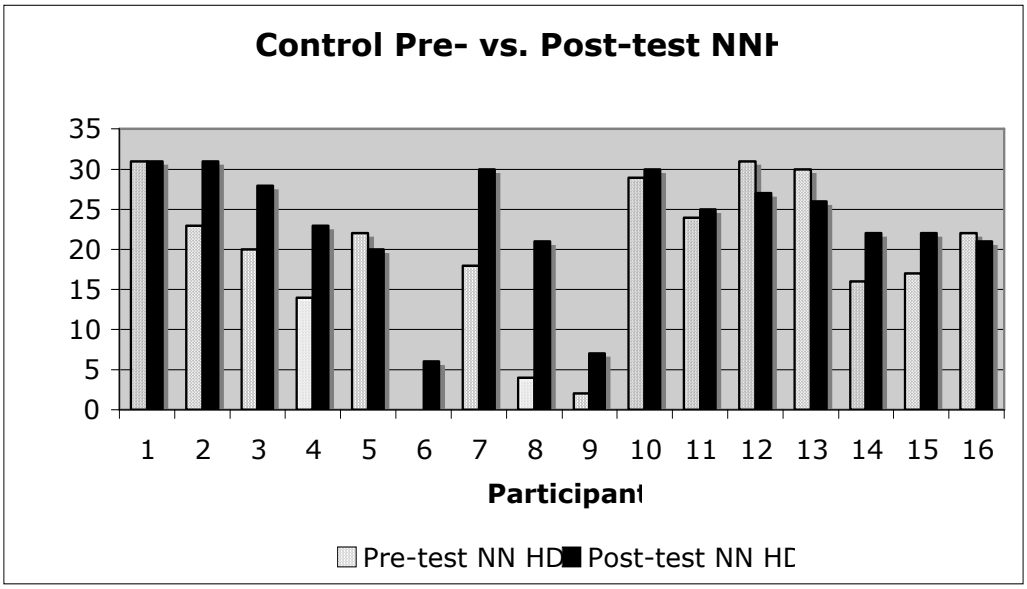
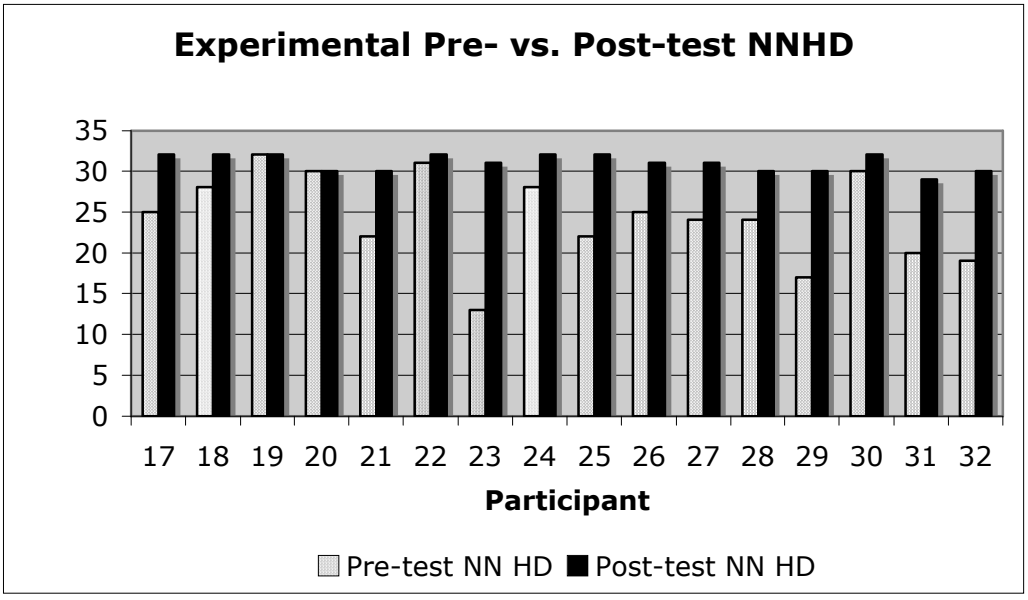


Figure 2

Comparison of Experimental Group Individual Performance on Pre- and Post-test Noun/noun Homophone Detection Task (Total Possible Score = 32)



Noun/verb Homophone Detection Task

Main effects of both Groups [F (1,30) = 4.87, p = .035] and Test time [F (1,30) = 30.44, p<.0001] were significant, but the interaction [F (1,30) = 3.64, p = .066] only approached significance. To explore the effects of training, *t*-tests were performed. There was no difference between the groups at pre-test [*t* (30) = .98, ns], but there was a significant difference at post-test [*t* (30) = 3.52, p=.003]. As predicted, the experimental group differed from pre- to post-test [*t* (15) = 4.74, p<.0001]. The control group also improved from pre- to post-test [*t* (15) = 2.90, p = .011]. Despite the improvement, the children in the control group did not perform as well as the experimental group on the post-test noun/verb HDT (4/16 of the control and 13/16 of the experimental scored >31, the median of all 32 participants, Fisher Exact Test, p = .004).

Table 4 presents an item analysis for the noun/verb homophones on the post-test, (see Appendix S, table S3 for a pre-test item analysis). The experimental group performed better than the control group for each of the eight homophones. Post-test performance of the experimental group was consistent across items and nearly perfect. Individual participant pre- and post-test performance on the noun/verb HDT is shown in Figures 3 (control group) and 4 (experimental group), (see Appendix R for individual participant scores). Although there were individual differences on the pre-test noun/verb HDT, there were consistently high performance levels on the post-test for the experimental group. Also, the experimental group showed consistently higher performance on the post-test noun/verb HDT than on the pre-test. This was not true for the control group.

Table 4

Post-Test Score Per Word of Experimental and Control Groups

on Noun/Verb Homophone Detection Task (Highest Possible Score = 4)

Noun/Verb Homophones	Experiment Mean	Experiment Median	Experiment Range	Control Mean	Control Median	Control Range
Ring	3.63	4	2-4	2.75	3.5	0-4
Clothes/Close	3.88	4	3-4	2.75	4	0-4
Wait/Weight	4.00	4	4	3.06	4	0-4
Meet/Meat	3.94	4	3-4	3.13	4	0-4
Punch	3.88	4	3-4	2.13	3	0-4
Blew/Blue	4.00	4	4	3.63	4	0-4
Tie	3.94	4	3-4	3.00	4	0-4
Sink	3.88	4	3-4	3.00	4	0-4
Total	31.13	32	28-32	23.44	25.5	7-32

Figure 3

Comparison of Control Group Individual Performance on Pre- and Post-test Noun/verb Homophone Detection Task (Total Possible Score = 32)

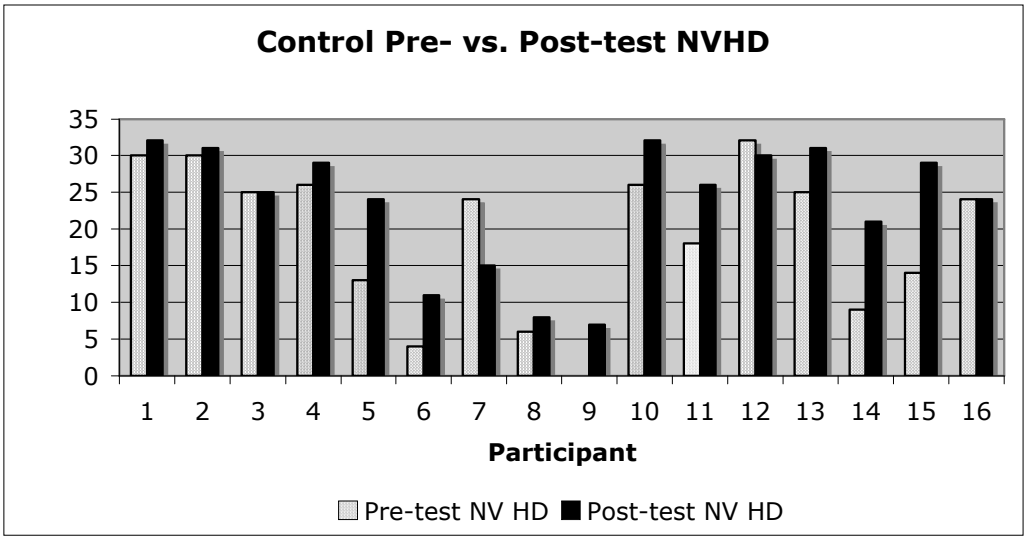
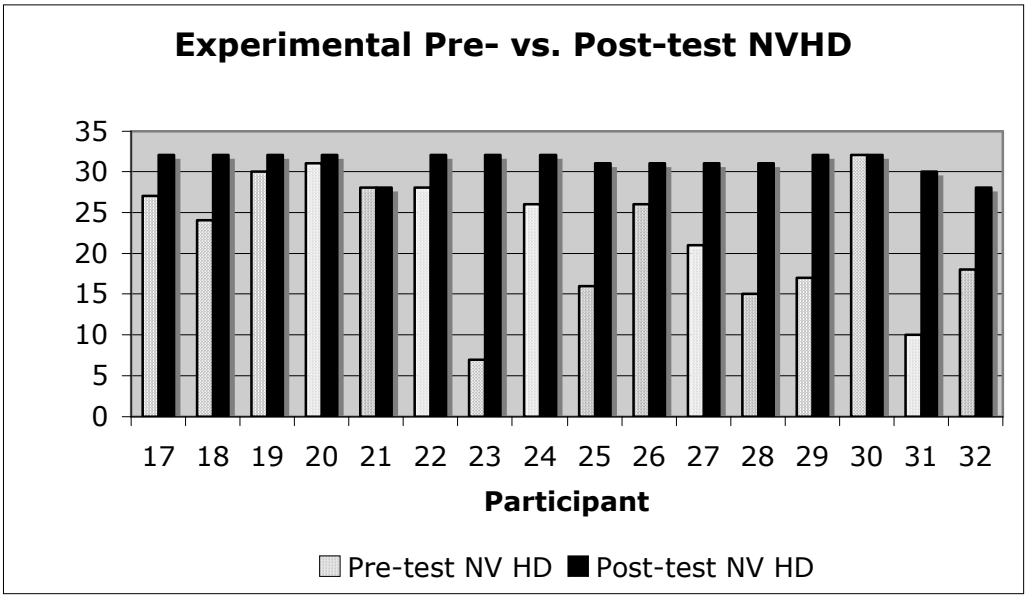


Figure 4

Comparison of Experimental Group Individual Performance on Pre- and Post-test Noun/verb Homophone Detection Task (Total Possible Score = 32)



Lexical Ambiguity Detection Task

Main effects of both Groups [F (1,30) = 19.78, p<.0001] and Test time [F (1,30) = 12.84, p=.001] were significant. The interaction was also highly significant [F (1,30) =27.76, p<.0001]. To explore the interaction, *t*-tests were performed. There was no difference between the groups at pre-test [*t* (30) = 1.26, *ns*], but there was a highly significant difference at post-test [*t* (30) = 7.13, p<.0001]. As predicted, the experimental group differed significantly from pre- to post-test [*t* (15) = 6.21, p<.0001]. The control group, on the other hand, showed no difference from pre- to post-test [*t* (15) = -1.20, *ns*].

Table 5 presents an item analysis for the lexically ambiguous sentences on the post-test, (see Appendix S, table S4 for a pre-test item analysis). The experimental group performed better than the control group for each of the eight sentences. Table 5 shows consistently high performance level of the experimental group across items and consistently lower performance level of the control group. Individual participant pre- and post-test performance on the LADT is shown in Figures 5 (control group) and 6 (experimental group), (see Appendix R for individual participant scores). Although there were individual differences on the pre-test LADT, there were consistently high performance levels on the post-test LADT for the experimental group. Also, the experimental group showed consistently higher performance on the post-test LADT than on the pre-test. This was not true for the control group.

Table 5

Post-Test Score Per Sentence of Experimental and Control Groups on Lexical Ambiguity Detection Task (Highest Possible Score = 4)

Ambiguous Sentences	Experiment Mean	Experiment Median	Experiment Range	Control Mean	Control Median	Control Range
Steak/Stake	3.19	3	2-4	0.94	0	0-4
Cold	3.69	4	2-4	1.38	1	0-4
Pipe	3.69	4	2-4	1.38	0	0-4
Horn	3.56	4	2-4	1.19	0	0-4
Night/Knight	3.75	4	3-4	1.75	2	0-4
Glasses	3.56	4	2-4	1.88	2	0-4
Bow	3.25	3	2-4	0.69	0	0-4
Flour/Flower	3.44	3.5	2-4	1.06	0	0-4
Total	28.13	28.5	21-32	10.25	7.5	0-27

Figure 5

Comparison of Control Group Individual Performance on Pre- and Post-test Lexical Ambiguity Detection Task (Total Possible Score = 32)

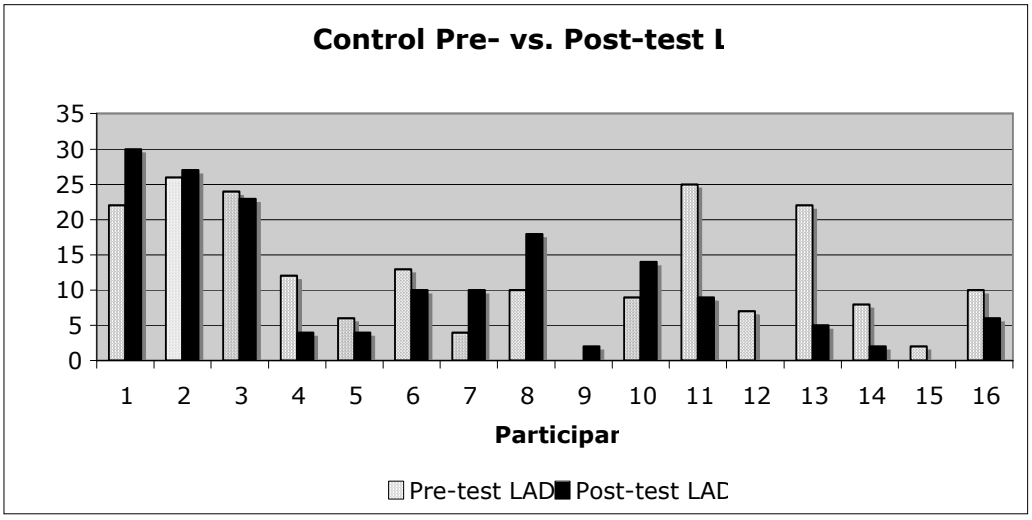
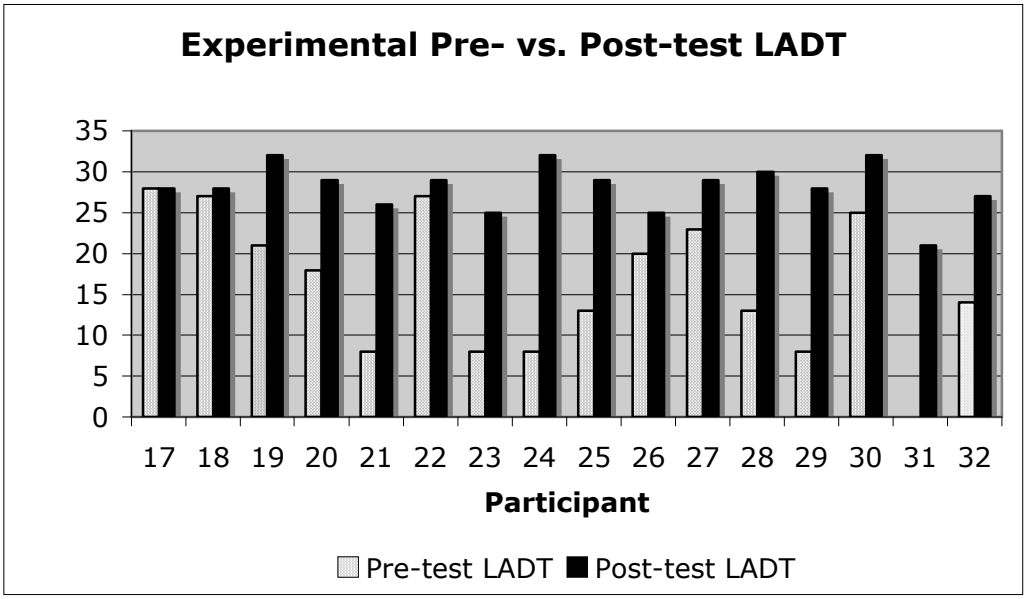


Figure 6

Comparison of Experimental Group Individual Performance on Pre- and Post-test Lexical Ambiguity Detection Task (Total Possible Score = 32)



2) *Children will demonstrate understanding of the dual meaning of homophones without being able to perceive the ambiguity of sentences containing those homophones.*

On average, children in both groups did indeed perform better on the homophone detection tasks compared to the lexical ambiguity detection task prior to training. Performance on each pre-test noun-noun homophone was compared to performance on the lexically ambiguous sentence containing that homophone (see Table 6 and Figure 7). On average, 46.5% of all 32 children during pre-testing demonstrated knowledge of a noun/noun homophone without demonstrating the ability to judge the ambiguity of the sentence containing that homophone; 38.28% of the children demonstrated knowledge of the noun/noun homophone and were able to judge the ambiguity of the sentence containing that homophone; and only 15.25% of the children detected the ambiguity of a sentence and could not demonstrate knowledge of the noun/noun homophone contained within the sentence. These results show that nearly half of the children were able to identify homophones but unable to perceive the ambiguity of sentences containing those homophones.

Table 6

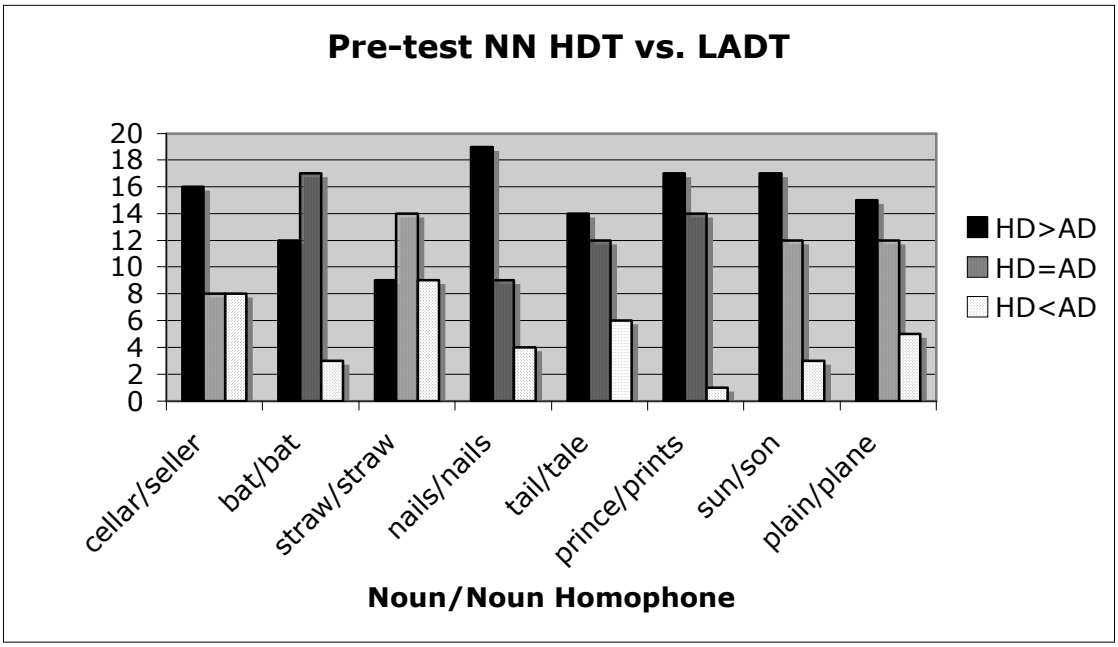
Number of Participants Who Performed Better on the Pre-test Noun/Noun Homophone Detection Task vs. Pre-test Lexical Ambiguity Detection Task

Homophone	HD > AD*	HD = AD*	HD < AD*	Total
Cellar/Seller	16 (50%)	8 (25%)	8 (25%)	32
Bat/Bat	12 (37.5%)	17 (53.13%)	3 (9.38%)	32
Straw/Straw	9 (28.13%)	14 (43.75%)	9 (28.13%)	32
Nails/Nails	19 (59.38%)	9 (28.13%)	4 (12.5%)	32
Tail/Tale	14 (43.75%)	12 (37.5%)	6 (18.75%)	32
Prince/Prints	17 (53.13%)	14 (43.75%)	1 (3.13%)	32
Sun/Son	17 (53.13%)	12 (37.5%)	3 (9.38%)	32
Plain/Plane	15 (46.88%)	12 (37.5%)	5 (15.63%)	32
AVERAGES	14.88 (46.5%)	12.25 (38.28%)	4.88 (15.25%)	32

Total refers to number of participants included in analyses.
*HD>AD refers to the number of participants who received a higher score on the noun/noun homophone detection task for that word compared to the corresponding ambiguous sentence in the lexical ambiguity detection task.
*HD = AD refers to the number of participants who received the same score on the noun/noun homophone detection task and the corresponding ambiguous sentence in the lexical ambiguity detection task for that word
*HD<AD refers to the number of participants who received a lower score on the noun/noun homophone detection task for that word compared to the corresponding ambiguous sentence in the lexical ambiguity detection task

Figure 7

Comparison of Performance of All Participants on the Pre-test Noun/noun Homophone Detection Task versus the Pre-test Lexical Ambiguity Detection Task



3) *Both groups will perform better on the noun-noun homophone detection tasks compared to the noun-verb HDT.*

The scores of both groups on the pre-test noun-noun homophone detection task compared to the pre-test noun-verb homophone detection task did not differ [t(31)=1.08, ns]. The scores did not differ on the post-test homophone detection tasks either [t(31)=.78, ns].

CHAPTER V

DISCUSSION

Overview

The results of this study provide strong evidence that lexical ambiguity detection training improves the abilities of kindergarteners to detect homophones and the dual meanings of sentential lexical ambiguities. Furthermore, findings suggest that homophone detection abilities underlie the ability to detect lexically ambiguous sentences (Peters & Zaidel, 1980; Shultz & Pilon, 1973), yet homophone detection is not sufficient for lexical ambiguity detection. Finally, noun/noun homophone pairs are no more easily detected than noun/verb homophone pairs, despite the differences found in the course of natural language development (Goldfield & Snow, 1997) and developmental and acquired language impairments (Black & Chiat, 2003).

The efficacy of a training program to teach kindergarteners homophone detection

Children in the experimental group significantly improved their scores on the post-test homophone detection tasks (HDTs). The control group did not receive the homophone detection training, yet the average of the control group's post-test noun/noun and noun/verb HDT scores were significantly higher than pre-test performance of the control group. It is important to note that although the control group's post-test HDT scores did improve, the experimental group improved more from pre- to post-test on the HDT. Homophone detection involves psycholinguistic processing, specifically lexical access and/or awareness, which in this case refers to the retrieval of both meanings of the word (homophone) from phonological memory. This implies that the training of the experimental group enhanced their lexical access skills beyond that of other influencing

variables. The children in the control group may have benefited from the vocabulary enhancement training or their classroom activities, but the experimental group's homophone detection training was the variable responsible for their significant improvement.

Children in the control group may have improved their post-test noun/noun and noun/verb HDTs scores for several reasons. The control group's training may have indirectly improved lexical access skills, lexical awareness, or phonological memory. Other possible reasons for the improvement of the control group's HDT scores could be the influence of related classroom language activities or familiarity with the task.

Peters and Zaidel (1980) noted that children in their homophone detection study performed better on passive detection versus active detection. Children of all three age groups in their study scored higher on the Peters and Zaidel (1980) "homonym task," which is similar to the present study's HDT, and considered passive detection. Children of both studies were required to point to two pictures that sounded alike. This required the coordination of several cognitive abilities including "the ability to 1) understand the task, 2) conduct an exhaustive search through the set of alternative pictures, 3) access the phonological representations of the critical words, 4) rehearse a label while searching for others to match with it, 5) phonologically match two labels once found, 6) cycle through alternative labels for a picture in cases of phonological mismatch," (Peters and Zaidel, 1980).

The vocabulary training administered to the control group may have enhanced the participants' cognitive abilities described by Peters and Zaidel (1980), lexical access skills, lexical awareness, or phonological memory, resulting in significant improvement on the post-test HDTs. The children played vocabulary BINGO, listened to stories, and

discussed words and themes within the stories. Perhaps vocabulary enhancement training carries over to all vocabulary, including homophones. Another possible reason for the improved HDT scores of the control group is that the children were five to six weeks older at the time of post-testing. Additionally, they were familiar with the form of the post-test. The meanings of each homophone were always placed on the diagonal of the grid of four pictures (see Appendix F for examples) to ensure that the pictures never appeared next to each other. Finally, one other possible variable that influenced the increased post-test HDT scores was that at the time of testing all kindergarten children were receiving language instruction related to verbs in their classrooms. Perhaps this instruction, or a combination of these variables, boosted the post-test HDT scores of the control group.

The efficacy of a training program to teach kindergarteners lexical ambiguity detection

Children in the experimental group significantly improved their scores on the lexical ambiguity detection task (LADT) compared to their pre-test performances. On average, children in the control group did not improve their post-test LADT scores compared to pre-test performance. In fact, their average score declined slightly, although not significantly. The significant improvement of the LADT scores of the experimental group and the lack of improvement of the LADT scores of the control group allows us to conclude that training improves the abilities of kindergarteners to detect and report the ambiguity of lexically ambiguous sentences.

This finding is important because it shows that children can learn to detect lexical ambiguity through a fairly simple training procedure. The training seemed to improve not only the lexical access skills of the children in the experimental group, as

demonstrated with the significant improvement of HDT scores, but also their metalinguistic skills, sentence processing skills, and phonological memory skills. According to sentence processing theories, lexical ambiguity detection involves lexical access of both meanings of the ambiguous word (as in homophone detection) as well as processing the sentence with both meanings of the ambiguous word, (Cairns et al. 2004). The children in this study had to generate one or both meanings of each sentence to determine if a sentence was ambiguous or unambiguous. Based on the theory of ambiguous sentence processing (Swinney, 1979; Swinney & Prather, 1989; Love, Swinney, Bagdasaryan & Prather, 1999), this implies that they had to process the sentence once with one meaning, and then reprocess the sentence with the second meaning, while holding the first meaning in working memory. Finally, they had to report the two meanings of the sentence, regardless of preference for one meaning. This involved the coordination of lexical access (homophone detection), sentence processing (processing one sentence with two different meanings), metalinguistic awareness (ability to report both meanings of the sentence despite preference for one over the other), and phonological working memory (vocabulary knowledge and acquisition and spoken language comprehension). The abilities of the children in the experimental group to report lexical ambiguity compared to the abilities of the control group during the post-test LADT indicates that lexical ambiguity detection training improves one, some or all of the following skills: lexical access, sentence processing, metalinguistic awareness, and phonological working memory.

The training is a simple design that could easily be incorporated into a classroom setting. All children in the experimental group benefited from the same training, even children who scored zero on the pre-tests. This indicates that children with different

levels of abilities from one classroom can receive the same training, making it easier for the teacher to administer.

Homophone detection vs. lexical ambiguity detection

Separate studies have shown homophone detection to appear earlier in development compared to lexical ambiguity detection (Peters and Zaidel, 1980; Shultz and Pilon, 1973). This study was the first to compare kindergarteners' homophone detection abilities to their lexical ambiguity detection abilities using the same words. The purpose was to determine if knowing both meanings of a homophone is sufficient to know that a sentence containing that word has two meanings. In many cases during the pre-tests, the children in the experimental and control groups were able to detect the dual meanings of homophones, but were not able to perceive the ambiguity of sentences containing those homophones.

It is not surprising that homophone detection would appear earlier in development, based on the fact that the ability to report two meanings of an ambiguous sentence ultimately relies on homophone detection. What is surprising, based on our findings, is that knowing both meanings of a word is not sufficient to also know that a sentence containing that word has two meanings. Children who struggled with describing the meanings of an ambiguous sentence were prompted during the LADT with both meanings of the homophone. When asked to describe both meanings after this prompt, many children in both groups during the pre-test and many children in the control group during the post-test were positive that the sentence could only mean one thing (i.e., their preferred meaning). As previously noted, homophone detection involves lexical access, phonological memory, and metalinguistic awareness. The ability to detect

lexically ambiguous sentences also involves lexical access, phonological memory, and metalinguistic awareness, in addition to sentence processing skills. The children of the experimental and control groups were able to access both meanings of the homophones during the pre-test HDTs. However, they could not judge the utterances of the pre-test LADT for the presence of multiple interpretations and process them with both meanings (Hakes, 1980; Schlisselberg, 1988; Wankoff, 1983; Cairns et al. 2004). The significant sentence processing demands placed on the child to process a lexically ambiguous sentence and report both meanings may be the reason that a child may know both meanings of a homophone but cannot generate and report both meanings of a sentence that incorporates the same homophone.

Performance on the noun/noun HDTs compared to the noun/verb HDTs

Typically developing children usually acquire nouns earlier than verbs (Leonard et al. 1982; Leonard, 2002), although individual variability exists. Children and adults with developmental and acquired impairments often exhibit differences in favor of nouns (Black & Chiat, 2002). Overall, the English language has a bigger inventory of nouns than of verbs. Children may know more nouns than verbs simply because it is relative to the ratio of nouns to verbs in the language. There exist phonological and semantic differences, in addition to syntactic distinctions, between nouns and verbs in English. Verbs are usually shorter in duration, have fewer syllables, and have less stress patterns than nouns (Black & Chiat, 2002), meaning nouns are more salient than verbs and are possibly easier to acquire.

For these reasons, all groups were predicted to perform better on the noun/noun homophone detection compared to the noun/verb HDT. This was not the case. Both

groups during pre- and post-testing revealed no differential performance with noun/noun homophones compared to noun/verb homophones. Several factors could explain the unexpected results.

Word frequency counts for homophones that are spelled the same (e.g., noun/noun: *bat, nails*; noun/verb: *rock*, *wave*) are not distinguished in word lists. To resolve this issue, homophones used in the present study were chosen based on pilot participant performance to ensure that all homophones were recognizable by kindergarten children. Only homophones that were spontaneously detected in the pilot study were used in the present study. The PPVT III was used to determine that each participant's vocabulary development was within a normal developmental range, according to the test's standards. The test, however, did not make a comparison of noun versus verb knowledge. In fact, the majority of the words tested in the PPVT III are nouns. On the other hand, all children at the time of testing and training were learning about verbs and their role in language in their classrooms as part of the kindergarten curriculum. Children reported to the experimenter their newly acquired knowledge about "action words" and gave examples of several tenses for each verb. The children's lessons within the classroom may have helped their noun-verb homophone detection scores.

The similar performance of both groups during pre- and post-testing on the noun/noun and noun/verb homophone detection tasks show that noun/verb homophones are processed by children in kindergarten with the same ease as noun/noun homophones. If a difference exists, it may be evident in younger participants between 4;4 (the youngest participants of Peter & Zaidel's (1980) study who could detect the meanings of homophones) and 5;5 (the youngest participants of the present study). This age range

would consist of children who could detect homophones but who would not have had any instruction on verb usage.

Future Research

This study indicates a successful training paradigm that can easily be incorporated into kindergarten classrooms, but it offers only a glimpse of the numerous benefits of lexical ambiguity detection training. Areas of future research could include use of the training paradigm with children of different ages, younger or older than the kindergarteners from this study. In order to determine if the control group's eight vocabulary enhancement sessions in this study affected post-test HDT performance, this study could be replicated with a second control group who meets with the same experimenter for some type of non-verbal training (e.g., art projects, math instruction, music lessons) between the pre- and post-test sessions. If the HDT scores of this second control group do not improve, but the HDT scores of the first control group do improve (as they did in this study), more reading time, discussion groups, and vocabulary enhancement games (i.e., control group vocabulary enhancement training) could be added to kindergarten curriculums for enhanced lexical access abilities. Additionally, a non-word repetition task, which has been determined to reveal phonological memory abilities, could be administered to both the experimental and control groups before and after training. Phonological memory is related to vocabulary acquisition and spoken language comprehension (Gathercole & Baddeley, 1990). Improved post-test scores of the experimental group would determine that ambiguity detection training improves phonological memory.

Cairns et al. (2004) determined that homophone and ambiguity detection abilities of kindergarteners predict first grade reading abilities, and ambiguity detection abilities in

second grade predict third grade reading performance. Furthermore, Zipke (2007; Zipke et al. in prep) has demonstrated that improved ambiguity detection abilities of third graders lead to improved reading comprehension. Based on these findings, Zipke concludes that homophone and ambiguity detection ability can be used to identify children at risk for reading difficulty, and ambiguity detection training can be used to enhance reading comprehension skills. Phonological awareness, on the other hand, is important for decoding (Zipke, 2007). A follow-up study of reading performance in the first and second grades of the training and control groups would determine if enhanced homophone detection and lexical ambiguity detection is in fact helpful for reading comprehension ability and performance. If this type of training does indeed improve reading comprehension performance, this training paradigm could be used in addition to current phonological awareness interventions with children who are at-risk for reading difficulty or failure.

Ambiguity detection abilities have been linked to understanding figurative and abstract language (Zipke, 2007), skills that are often difficult for children with Specific Language Impairment (SLI). A future study could administer ambiguity detection training to children with SLI to determine if the training benefits this population. The study could include pre- and post-training performance on figurative and abstract language comprehension. The pre- and post-tests could also include non-word repetition tasks to determine if phonological memory can improve in children with SLI. Enhanced phonological memory may enable this population to increase vocabulary knowledge and language use.

Many other possible future studies can be conducted to see the range and limits of this training paradigm. Other avenues to explore are the capabilities of the participants that are not evident in their responses in this study. A cross modal priming paradigm could be designed to probe whether participants are accessing both meanings of an ambiguous sentence even if they cannot report this. Many children in this study could detect both meanings of a homophone, but could not report both meanings of the sentence that contained the same homophone. A cross modal priming design would present an ambiguous sentence and a corresponding picture at the moment of ambiguity. The picture could be one of the two meanings of the sentence or unrelated to the sentence. If both meanings are accessed at the time of sentence presentation, pictures that depict the meanings should be expected, and the unrelated picture should be surprising. This can be measured with a behavioral response or event related potentials. These findings would enable us to determine if the training aids in developing lexical access or metalinguistic skills.

Conclusions and Implications

In conclusion, previous research has determined that a link between reading comprehension and ambiguity detection exists (Cairns et al. 2004; Zipke, 2007) and that ambiguity detection skills of third graders can improve through training (Zipke, 2007; Zipke et al. in prep). This study provides evidence that homophone and ambiguity detection abilities (like many other metalinguistic skills) of kindergarteners can be enhanced through training. Homophone detection requires metalinguistic awareness and the psycholinguistic processing skill of lexical access, which precedes the metalinguistic and sentence processing components of detecting lexically ambiguous sentences. Furthermore, homophone detection is not sufficient for ambiguous sentence detection.

The ability to construct two meanings of an ambiguous sentence requires efficient and flexible processing abilities. The children of the experimental group became more flexible linguistically and were able to judge utterances for the presence of multiple interpretations after training, compared to their peers who did not receive training. In addition, reading to kindergarteners, discussing unambiguous vocabulary and topics within the books, and playing word games, as was done with the control group of this study, seem to improve homophone detection abilities. These activities can easily be incorporated into or added to the kindergarten curriculum without much effort.

The implications of these results are quite profound. This study, combined with the results of previous research, demonstrates that homophone and ambiguity detection training should be incorporated into reading readiness programs with pre-readers in addition to already established phonological awareness instruction. In addition to typically developing populations, the training could assist children at risk for reading difficulty or failure, as well as children with SLI. The ambiguity detection training would

aid in improving the abilities of children with SLI to interpret abstract and figurative language.

Ambiguity detection is related to reading comprehension, and phonological awareness is related to decoding (Zipke, 2006; Zipke et al. in prep). Reading involves a range of metalinguistic skills, yet phonological awareness is currently the primary focus of reading readiness. The findings of this study warrant refocusing pre-reader instruction to incorporate more than rhyme and alliteration (i.e., phonological awareness). Inclusion of all metalinguistic skills involved in the many aspects of reading could prove to be an important tool in assessing reading readiness, accelerating early reading, and remediating problem readers.

APPENDIX A

Recruitment Letter, Letter to Kindergarten Teachers, Letter to Parents, Consent Form, Parent Questionnaire

Dear Mr. Superintendent and members of the Board of Education:

My name is Margaret Kamowski-Shakibai, and I am a doctoral candidate at the CUNY Graduate Center in the Speech and Hearing Sciences Department. I am writing you to request the opportunity to conduct my dissertation study with some of the children in your kindergarten classes. My research project is entitled "The Efficacy of a Training Program to Teach Kindergarteners to Detect Lexical Ambiguities." This study has been approved by both the Internal Review Board of the CUNY Graduate Center and the New York City Board of Education Proposal Review Committee. Please read the description of the study carefully to decide if your kindergarten classes can participate, and please feel free to contact me with any questions that you may have. As a product of Florham Park Schools, I would be delighted to conclude my academic career at the place in which it commenced.

Lexical ambiguity detection is the ability to recognize that some words, called homonyms, have more than one meaning (e.g. the mammal bat and a baseball bat.) I am interested in the children's abilities to detect that a sentence may have more than one meaning when it contains a homonym. For example, "The glasses fell on the floor and broke" could mean that the reading glasses or drinking glasses broke. This skill has been shown to be a predictor of later reading ability. I am interested in showing that lexical ambiguity detection can be taught and skills can improve through training. In later studies I hope to show that teaching children to detect ambiguity can improve their reading skills.

The study involves two individual sessions with each child and eight group sessions with other kindergarten children from the school. All parents will receive a letter explaining the study, and if they decide to allow their children to participate, they will be asked to sign a consent form, get assent from their child, and fill out a short questionnaire, (please see attached.) The first individual session will last about one hour, and the second will last about 20 minutes. Once all children have met with me individually, I will meet with them in small groups. The group sessions will last about 15-20 minutes, twice a week for four weeks. There will be a total of about 40 children participating in this study and they will be randomly divided into two groups. During these groups sessions we will play games and read stories. One group will practice ambiguity and homonym detection, and the other group will learn new vocabulary. These sessions will occur during the school day at a time chosen by you and the teachers to ensure that the children do not miss their regularly scheduled classroom activities. My goal is to disrupt the classes as little as possible. We will take breaks to ensure each child's comfort, and every child is always welcome to stop at any time throughout the study. With the parents' permission, I would like the results of language screenings or tests administered to the children by the school.

Each child will only receive one type of training. He/she will either learn about sentences that have more than one meaning or learn new vocabulary. This research will contribute to our understanding of how children can be taught to reflect on language. It may also allow the development of a training program that could lead to improvement in metalinguistic skills and subsequent enhancement of reading readiness, and would be easily incorporated into the kindergarten curriculum one day.

Each child's research records will be assigned a participant code and will be kept under locked file in my home to protect the children's privacy. Only researchers directly involved with the study will have access to the information in these records. Results of this study may be published but will not include any identifying information of the children or the school.

If you have any questions about this research, you may contact me at (xxx) xxx-xxxx or my advisor, (xxx) xxx-xxxx. Thank you for your consideration.

Sincerely,

Margaret T. Kamowski-Shakibai, M.Phil.

Dear Kindergarten Teachers,

My name is Margaret Kamowski-Shakibai, and I am a doctoral candidate at the CUNY Graduate Center in the Speech and Hearing Sciences Department. I am writing you to request the opportunity to conduct my dissertation study with some of the children in your kindergarten classes. My research project is entitled "The Efficacy of a Training Program to Teach Kindergarteners to Detect Lexical Ambiguities." This study has been approved by the Internal Review Board of the CUNY Graduate Center, the The Florham Park Board of Education, the superintendent, and your principal, but your approval and cooperation are essential to the study's success. Please read the description of the study carefully to decide if your classroom can participate, and please feel free to contact me with any questions that you may have.

Lexical ambiguity detection is the ability to recognize that some words, called homonyms, have more than one meaning (e.g. the mammal bat and a baseball bat.) I am interested in the children's abilities to detect that a sentence may have more than one meaning when it contains a homonym. For example, "The glasses fell on the floor and broke" could mean that the reading glasses or drinking glasses broke. This skill has been shown to be a predictor of later reading ability. I am interested in showing that lexical ambiguity detection can be taught and skills can improve through training. In later studies I hope to show that teaching children to detect ambiguity can improve their reading skills.

The study involves two individual sessions with each child and eight group sessions with other children from the class. The first individual session will last about one hour, and the second will last about 20 minutes. The group sessions will last about 15-20 minutes, twice a week for four weeks. There will be a total of about 40 children participating in this study, and they will be randomly divided into two groups. (Only children whose parents have signed consent forms will be placed in a group). These two groups will be broken up into smaller groups of about 5 children each. During these group sessions, which last about 15-20 minutes each, we will play games and read stories in an area of the room that you choose. One group will practice ambiguity and homonym detection, and the other group will learn new vocabulary. We will take breaks to ensure each child's comfort, and every child is always welcome to stop at any time throughout the study. My goal is to disrupt your class as little as possible. I am willing to work around your classroom schedule to choose the most convenient times and days during the week. You will not be asked to do anything extra for the duration of the study.

This research will contribute to our understanding of how children can be taught to reflect on language. It may also allow the development of a training program that could lead to improvement in metalinguistic skills and subsequent enhancement of reading readiness, and would be easily incorporated into the kindergarten curriculum one day.

Each child's research records will be assigned a participant code and will be kept under locked file in my home to protect the children's privacy. Only researchers directly involved with the study will have access to the information in these records. Results of this study may be published but will not include any identifying information of the children, you, or the school.

If you have any questions about this research, you may contact me at (xxx) xxx-xxxx. I do hope to have the opportunity to meet you and your class. Thank you for your consideration.

Sincerely,

Margaret T. Kamowski-Shakibai, M.Phil.

Dear Parents,

My name is Margaret Kamowski-Shakibai, a doctoral candidate at the City University of New York Graduate Center in the Speech and Hearing Sciences Department. I am currently in the proposal stages of my dissertation, entitled "The effects of training lexical ambiguity detection in kindergarteners." I hope to conduct my study with the kindergarteners at your child'school.

Lexical ambiguity detection is the ability to recognize that some words, called homonyms, have more than one meaning (e.g. the mammal bat and a baseball bat.) I am interested in the children's abilities to detect that a sentence may have more than one meaning when it contains a homonym. For example, "The glasses fell on the floor and broke" could mean that the reading glasses or drinking glasses broke. This skill has been shown to be a predictor of later reading ability. I am interested in showing that lexical ambiguity detection can be taught and skills can improve through training. In later studies I hope to show that teaching children to detect ambiguity can improve their reading skills.

The study begins with an individual session with your child at school. During the session, I will present pictures of ambiguous words and sentences to your child to determine if he/she can identify more than one of the meanings. Then, he/she will complete a short vocabulary identification task. After I have met with all of the participating children individually, I will meet with them in small groups. Each group will meet twice a week for four weeks for 15-20 minutes, during which we will play games and read stories. The games and stories will serve to review ambiguous words and sentences in one group and assist vocabulary development in the other. Children who have participated in similar paradigms have really enjoyed these activities! Finally, we will meet individually to re-present the original pictures and sentences.

If you would like your child to participate, please read the attached consent form, sign it, and return it to your child's teacher. I will then send you a short questionnaire to fill out.

Please call or email me if you have any questions or concerns. I appreciate your consideration of my study and hope that I will have the pleasure of meeting you and your child. As a product of your town's schools, I would be delighted to conclude my academic career at the place in which it commenced. Thank you very much!

Sincerely,

Margaret T. Kamowski-Shakibai, M.Phil.

CONSENT FORM

Dear Parents,

My name is Margaret Kamowski-Shakibai, and I am a doctoral candidate at the CUNY Graduate Center in the Speech and Hearing Sciences Department. My research project is entitled "The Efficacy of a Training Program to Teach Kindergarteners to Detect Lexical Ambiguities." Lexical ambiguity detection is the ability to recognize that some words, called homonyms, have more than one meaning (e.g., the animal bat and a baseball bat.) I am interested in the children's abilities to detect that a sentence may have more than one meaning when it contains a homonym. For example, "The glasses fell on the floor and broke" could mean that the reading glasses or drinking glasses broke. This skill has been shown to be a predictor of later reading ability. I am interested in showing that lexical ambiguity detection can be taught and skills can improve through training. In later studies I hope to show that teaching children to detect ambiguity can improve their reading skills. Please read this letter carefully to decide if you would like to allow your child to participate in this research study.

The study involves two individual sessions with your child and eight group sessions with other kindergarten children from the school. The first individual session will last about one hour, and the second will last about 20 minutes. The group sessions will last about 15-20 minutes. There will be a total of about 40 children participating in this study and they will be randomly divided into two groups. These two groups will be broken up into smaller groups of about 5 children each. During the groups sessions we will play games and read stories. One group will practice detecting sentences that mean more than one thing, and the other group will learn new vocabulary. These sessions will occur during the school day at a time chosen by the teachers to ensure that the children do not miss their regularly scheduled classroom activities. We will take breaks to ensure your child's comfort. Your child is always welcome to take a break at any time throughout the study, and you can choose to end your child's participation at any time.

With your permission, I would like to access your child's school test scores from his/her teacher to use as additional measures. I understand that every child has had a hearing screening in kindergarten. I will request to review the results with your permission.

Please note that your child will only receive one type of training. He/she will either learn about sentences that have more than one meaning or learn new vocabulary. This research will contribute to our understanding of how children use language and possibly allow the development of a training program that could lead to improvement in language processing skills.

Your child's research records will be assigned a participant code and will be kept under locked file in my home to protect you and your child's privacy. Only researchers directly involved with the study will have access to the information in your records. Results of this study may be published but will not include you or your child's name or any information that may identify you or your child. Please provide your name and address if you would like a copy of the completed study sent to you.

If you have any questions about this research, you may contact me or my advisor. To learn about your rights as a volunteer, please contact the IRB Administrator at The Graduate Center/City University of New York.

If you give consent for your child to participate in the research project, please sign below. I will make a copy of the signed letter for you to keep. Thank you for your consideration and please contact me if you have any questions.

Sincerely,

Margaret T. Kamowski- Shakibai, M.Phil.

I agree to let my child _____ participate in the research project described above.

I give permission for the researcher to have access to my child's test scores.

[circle one] Yes No

I give permission for the researcher to review my child's hearing screening.

[circle one] Yes No

_____ _____

Signature of Parent or Guardian Printed Name of Parent or Guardian Date

Assent Procedure

I have explained the study to your child and asked if he/she wants to participate. He/she knows what will happen during the study, how long it will take, and that he/she can stop at any time. He/she agrees to participate in the study.

_____ _____

Signature of principle investigator Date

_____Yes, I would like to be contacted to participate in future research studies.

_____Yes, I would like to have a copy of the completed study sent to me. I have provided my mailing address below.

PARENT QUESTIONNAIRE

Please read the following questions carefully and answer them as accurately as possible. This should take about 10 minutes. If you have any questions, please email or call me. Thank you for your time!

Child's Name: _____
Date of Birth: _____
Address: _____
Home Phone: _____

Mother's Name: _____

Father's Name: _____

1. What languages does the child speak? Please indicate the child's primary language.

2. Do you give permission for the researcher to access the results of your child's hearing screening given at school?

____ Yes ____ No

3. Has your child ever been evaluated by a speech-language specialist?

____ Yes ____ No

If yes, did your child receive services through early intervention and/or private therapy? Please describe.

4. Are there any speech, language, or hearing problems in your family?
If yes, please describe.

5. Has your child suffered from otitis media (i.e. middle ear infections) or is there anything of medical relevance you would like me to know (e.g. medications, hospitalizations, surgeries, etc.)?

6. Provide any additional information that you think is important.

Person completing form: _____

Relationship to child: _____

Signed: _____Date: _____

THANK YOU!!!!!

APPENDIX B

METHODS

Table B1 Methodology

PRE-TEST (H1)*	**INTERVENTION (H1)**	**POST-TEST (H2)***
• 1 individual session • 40 minutes	• 8 group sessions • 15-20 minutes each	• 1 individual session • 25 minutes
Peabody Picture Vocabulary Test III	**Experimental Group** • **BINGO** game boards depicted pictures of homophones from pre-tests, and meanings were discussed • **Sentence Presentation** one sentence from pre-test LADT was presented each session • See Table ___ for complete description of each session	**Peabody Picture Vocabulary Test III** was NOT administered
Picture Matching • 32 plates of 4 pictures • 8 noun-noun homophones • 8 noun-verb homophones • each meaning presented on a separate plate with 3 distracters	**Control Group** • **BINGO** game boards depicted pictures of unambiguous words • **Story Reading and Discussion** • See Table ___ for complete description of each session	**Picture Matching** • 32 plates of 4 pictures • 8 NEW noun-noun homophones • 8 NEW noun-verb homophones • each meaning presented on a separate plate with 3 distracters
Homophone Detection Task • 16 plates of 4 pictures • 8 noun-noun homophones • 8 noun-verb homophones • each homophone pair presented on one plate with 2 distracters		**Homophone Detection Task** • 16 plates of 4 pictures • 8 NEW noun-noun homophones • 8 NEW noun-verb homophones • each homophone pair presented on one plate with 2 distracters
Lexical Ambiguity Detection Task • 16 sentences • 8 noun-noun homophones • 8 unambiguous sentences		**Lexical Ambiguity Detection Task** • 16 NEW sentences • 8 NEW noun-noun homophones • 8 NEW unambiguous sentences

*H1 refers to the set of homophones presented during pre-testing and intervention; H2 refers to the second set of homophones presented during post-testing.

Table B2 Descriptions of each training session

SESSION	TRAINING GROUP	CONTROL GROUP
1	Noun/Noun homophone BINGO Experimenter called out words Sentence: "The children saw a bat lying by the fence."	BINGO Story: *Tiki Tiki Tembo* (Mosel, 1968)
2	Noun/Verb homophone BINGO Experimenter called out words Sentence: "The cellar/seller was cold"	BINGO Story: *Tiki Tiki Tembo* (Mosel, 1968), continued
3	Noun/Noun homophone BINGO Children were called upon to call out a word and then describe its two meanings. Sentence: "The kids showed the man the straw."	Children were called upon to call out a word during BINGO. Story: *Tucker Flips*, (McGuirk, 1999)
4	Noun/Verb homophone BINGO Children were called upon to call out a word and then describe its two meanings. Sentence: "The man and lady wanted a bright sun/son."	Children were called upon to call out a word during BINGO. Story: *Tucker Flips*, (McGuirk, 1999)
5	Noun/Noun homophone BINGO with single-meaning vocabulary Children were called upon to call out a word and then describe its one or two meanings. Sentence: "The man's nails were very sharp."	Children were called upon to call out a word during BINGO. Story: *The Little House,* (Burton, 1942)
6	Noun/Verb homophone BINGO with single-meaning vocabulary Children were called upon to call out a word and then describe its one or two meanings. Sentence: "The long tail/tale frightened the boy."	Children were called upon to call out a word during BINGO. Story: *The Little House,* (Burton, 1942)
7	Noun/Noun homophone BINGO with single-meaning vocabulary Children used BINGO boards with the Children were called upon to call out a word and then describe its one or two meanings. Sentence: "The cowboy was on the plane/plain."	Children were called upon to call out a word during BINGO. Story: *Oh, The Places You'll Go* (Dr. Suess, 1990)
8	Noun/Verb homophone BINGO with single-meaning vocabulary Children were called upon to call out a word and then describe its one or two meanings. Sentence: "The man saw the prints/prince in the desert."	Children were called upon to call out a word during BINGO. Story: *Oh, The Places You'll Go* (Dr. Suess, 1990)
EXTRA	Noun/Noun and Noun/Verb homophone BINGO with single-meaning vocabulary Children were called upon to call out a word and then describe its one or two meanings.	**xxx**

APPENDIX C

PRE-TEST SCORECARDS

Name:_____ Subject # _____ Date of testing: _____

DOB:_____ Age at time of testing:_____

PRETEST – Picture Matching
"We are going to look at some pictures, and I am going to say a word. Can you help me match the word with its picture?"

NOUN-NOUN

1. **Do you know the word cellar**? Can you point to the picture that shows **a cellar**?
_____
Yes, that's a picture that shows cellar.

2. Point to the picture that shows **a bat**. _____
Yes, that's a picture that shows bat.

3. Point to the picture that shows **a straw**. _____
Yes, that's a picture that shows straw.

4. Point to the picture that shows **nails**. _____
Yes, that's a picture that shows nails.

5. Point to the picture that shows **a tale**. _____
Yes, that's a picture that shows tale.

6. Point to the picture that shows **a prince**. _____
Yes, that's a picture that shows prince.

7. Point to the picture that shows **a son**. _____
Yes, that's a picture that shows son.

8. Point to the picture that shows **the plain**. _____
Yes, that's a picture that shows bow.

9. Point to the picture that shows **a seller.** _____
Yes, that's a picture that shows seller.

10.Point to the picture that shows **a bat**. _____
Yes, that's a picture that shows bat.

11. Point to the picture that shows **straw**. _____
Yes, that's a picture that shows straw.

12. Point to the picture that shows **the nails**. _____
Yes, that's a picture that shows nails.

13. Point to the picture that shows **a tail.** _____
Yes, that's a picture that shows tail.

14. Point to the picture that shows **some prints**. _____
Yes, that's a picture that shows prints.

15. Point to the picture that shows **the sun.** _____
Yes, that's a picture that shows sun.

16. Point to the picture that shows **the plane**. _____
Yes, that's a picture that shows bow.

Good Job!! Let's take a break.
Are you ready to look at some more pictures?

NOUN-VERB

1. Can you point to the picture that shows **something that can roll**? _____
Yes, that's a picture that shows roll.

2. Point to the picture that shows **the color red**. _____
Yes, that's a picture that shows red.

3. Point to the picture that shows **rains**. _____
Yes, that's a picture that shows rains.

4. Point to the picture that shows **how something can soar**. _____
Yes, that's a picture that shows soar.

5. Point to the picture that shows **wave**. _____
Yes, that's a picture that shows wave.

6.Point to the picture that shows **a toe**. _____
Yes, that's a picture that shows toe.

7. Point to the picture that shows **a rock**. _____
Yes, that's a picture that shows rock.

8. Point to the picture that shows **rode**. _____
Yes, that's a picture that shows rode.

9. Point to the picture that shows **a roll**. _____
Yes, that's a picture that shows roll.

10. Point to the picture that shows **read**. _____
Yes, that's a picture that shows read.

11. Point to the picture that shows **the reins**. _____
Yes, that's a picture that shows reins.

12. Point to the picture that shows **something sore**. _____
Yes, that's a picture that shows sore.

13. Point to the picture that shows **a wave**. _____
Yes, that's a picture that shows wave.

14. Point to the picture that shows **tow**. _____
Yes, that's a picture that shows tow.

15. Point to the picture that shows **rock**. _____
Yes, that's a picture that shows rock.

16. Point to the picture that shows **the road**. _____
Yes, that's a picture that shows road.

PRE-TEST HOMPHONE DETECTION SCORECARD

Now we're going to play a game with words that sound the same, but mean different things.
I want you point to two pictures that sound just the same but can mean different things. Let's do one together: here is a picture of an isle and this is also aisle. Aisle and isle (point to pictures). An aisle in the grocery store and an isle with a palm tree; they sound the same, but they mean different things.

1) Present grid of four pictures. "**Can you find two things that sound just the same but mean different things**". (Mark "1" under any pictures he/she points to.) **Can you name those pictures? (**Write in response)
2) If child points to anything besides homophones, "**Do those sound <u>exactly</u> the same**?" If child points to semantic distracter, "**Yes, that's the same kind of thing, but can you find any words that <u>sound</u> the same, but mean <u>different</u> things?" (**Mark "2" in the boxes under the words)
3) If child gives up, point to one of the homophones. "**Can you find another picture that sounds the same as this?"** (Mark "3")
4) If he/she can't, "**Can you point to X?" And can you point to another kind of X?"** (Mark "4")

PRE-TEST HOMPHONE DETECTION

preHD1NN	**cellar**	lightbulb	**seller**	money
preHD2NN	**bat**	glove	**bat**	spider's web
preHD3NN	**straw**	tractor	**straw**	lemon
preHD4NN	**nails**	hands	**nails**	hammer
preHD5NN	**tail**	horse	**tale**	frog
preHD6NN	**prince**	crown	**prints**	policeman
preHD7NN	**son**	daughter	**sun**	clouds
preHD8NN	**plain**	cactus	**plane**	suitcase
preHD1NV	**roll**	kick	**roll**	knife
preHD2NV	**read**	book	**red**	crayons
preHD3NV	**rains**	clouds	**reins**	horse
preHD4NV	**soar**	clouds	**sore**	band aid
preHD5NV	**wave**	hands	**wave**	bathing suit
preHD6NV	**tow**	truck	**toe**	flip flops
preHD7NV	**rock**	chair	**rock**	volcano
preHD8NV	**rode**	cowboy	**road**	car

Name:_____ Subject # _____ Date of testing: _____

DOB:_____ Age at time of testing:_____

PRETEST PRACTICE AND EXPERIMENTAL SENTENCES

We are going to talk about some sentences. Did you ever think about the fact that some sentences can mean more than one thing? Let's do some together so that you can see what I mean. (After presenting sentence and pictures, point to the picture that corresponds to the child's initial characterization. If they can't articulate one, explain the two meanings.)

If they mischaracterize the meaning:

a) recast what they've said

b) "Well, actually I was thinking of…"

P1. Now think about the sentence, **The cup is on the table**. Do you think that sentence can mean two things or just one thing?

Child _____

Well, let's look at these pictures. Does this show "The cup is on the table?"_____ I can't think of anything else that this sentence could mean. Does this other picture show "The cup is on the table?" No because there's no cup, right?

Comment _____

P2. **The woman sat on the trunk.** What is that sentence telling us? Can it mean two things or just one?

Child_____

Can you think of anything else that the sentence might mean? Here's a picture of the _____ and here's another picture showing_____. Do both pictures match the sentence? Yes, _____ can mean _____ and _____.

Comment_____

P3. Now think about the sentence, **The lady's shoes were on the couch**. Do you think that sentence can mean two things or just one thing?

Child _____

Well, let's look at these pictures. Does this show "The ladies shoes were on the couch?"_____
I can't think of anything else that this sentence could mean. Does this other picture show "The ladies shoes were on the couch?" No.

Comment _____

P4. **He felt terrible after the punch.** What is that sentence telling us? Can it mean two things or just one?

Child_____

Can you think of anything else that the sentence might mean? Here's a picture of the _____ and here's another picture showing_____. Do both pictures match the sentence? Yes, _____ can mean _____ and _____.

Comment_____

So we've seen that some sentences can mean just one thing, but others can mean more than one thing. I have some more sentences, and I want you to tell me whether you think they can mean only one thing or two things.

Pre-test
First, present sentence, then ask for the meaning, then ask if the sentence could mean anything else (no prompt). If no, then ask question (verbal prompt). If the child still does not answer correctly, describe the two meanings of the homophones, re-read the sentence, and ask what the sentence means again (second verbal prompt). Put a check if ambiguity is detected.

1. **The cellar/seller was cold.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the cellar/seller look like?

No prompt_____ Verbal prompt_____

Comments _____

2. **The lady asked the children to stop playing baseball.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean?

No prompt_____ Verbal prompt_____

Comments _____

3. **The children saw a bat lying by the fence.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the bat look like?

No prompt_____ Verbal prompt_____

Comments _____

4. **The kids showed the man the straw.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the straw look like?

No prompt_____ Verbal prompt_____

Comments _____

5. **The teachers told the children not to eat in the classroom.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean?

No prompt_____ Verbal prompt_____

Comments _____

6. **The man saw the puppy with the four white paws.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean?

No prompt_____ Verbal prompt_____

Comments _____

7. **The man's nails were very sharp.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the nails look like?

No prompt_____ Verbal prompt_____

Comments _____

8. **The long tale/tail frightened the boy.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the tail/tale look like?

No prompt_____ Verbal prompt_____

Comments _____

9. **The man almost ran over the doll with the car.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean?

No prompt_____ Verbal prompt_____

Comments _____

10. **The tired little girl was ready to sleep.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean?

No prompt_____ Verbal prompt_____

Comments _____

11. **The man saw the prints/prince in the desert.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the prints/prince look like?

No prompt_____ Verbal prompt_____

Comments _____

12. **The baby's room had a crib in it.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

Comments _____

13. **The man and lady wanted a bright son/sun.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the son look like?

No prompt_____ Verbal prompt_____

Comments _____

14. **The woman drove the new car.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

Comments _____

15. **The cowboy was on the plane/plain.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the plane/plain look like?

No prompt_____ Verbal prompt_____

Comments _____

16. **The children ate ice cream in the park.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

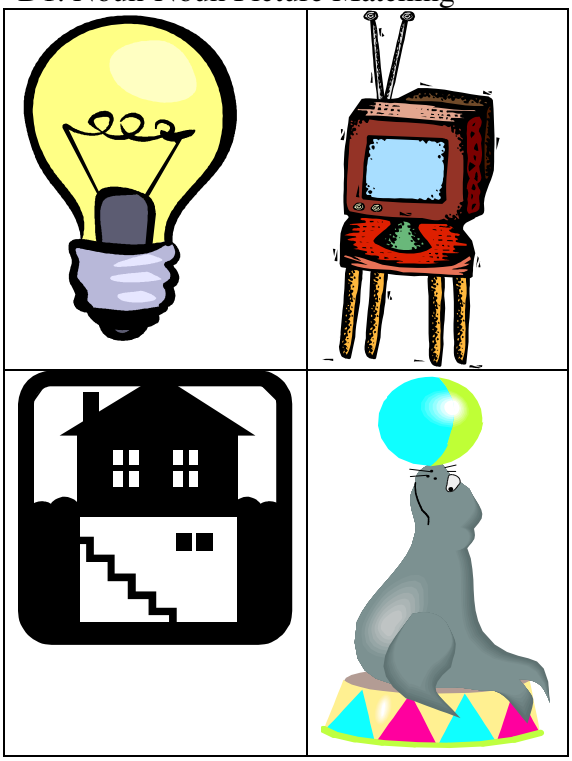
Comments _____

APPENDIX D

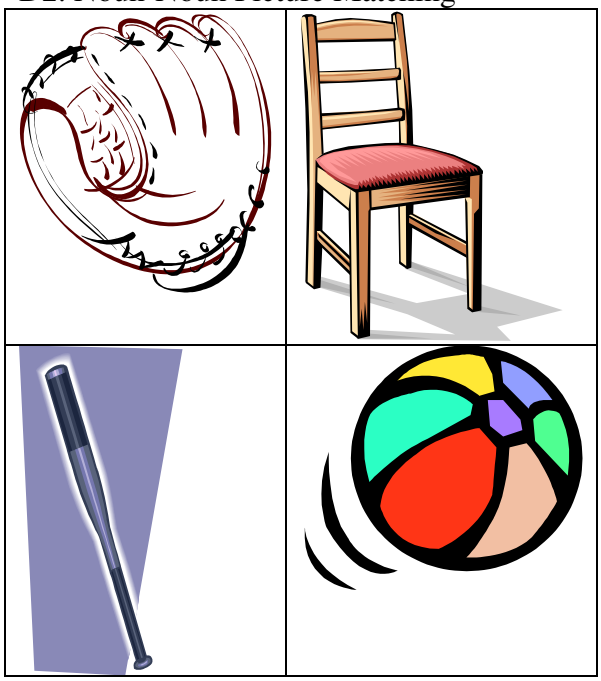
PRE-TEST NOUN-NOUN HOMOPHONE PICTURE MATCHING TASK

		semantic	**phonemic**	**irrelevant**
prePMT1NN	**cellar**	lightbulb	seal	TV
prePMT2NN	**bat**	catcher's mitt	beach ball	chair
prePMT3NN	**straw**	lemon	stroller	bicycle
prePMT4NN	**nails**	hammer	necklace	bus
prePMT5NN	**tale**	frog	towel	elephant
prePMT6NN	**prince**	crown	pretzel	taxi
prePMT7NN	**son**	daughter	soccer ball	telephone
prePMT8NN	**plain**	cactus	pilot	oven
prePMT9NN	**seller**	money	seal	TV
prePMT10NN	**bat**	spiders web	beach ball	chair
prePMT11NN	**straw**	tractor	stroller	bicycle
prePMT12NN	**nails**	hand	necklace	bus
prePMT13NN	**tail**	horse	towel	penguin
prePMT14NN	**prints**	policeman	pretzel	taxi
prePMT15NN	**sun**	cloud	soccer ball	telephone
prePMT16NN	**plane**	suitcase	pilot	oven

D1. Noun-Noun Picture Matching

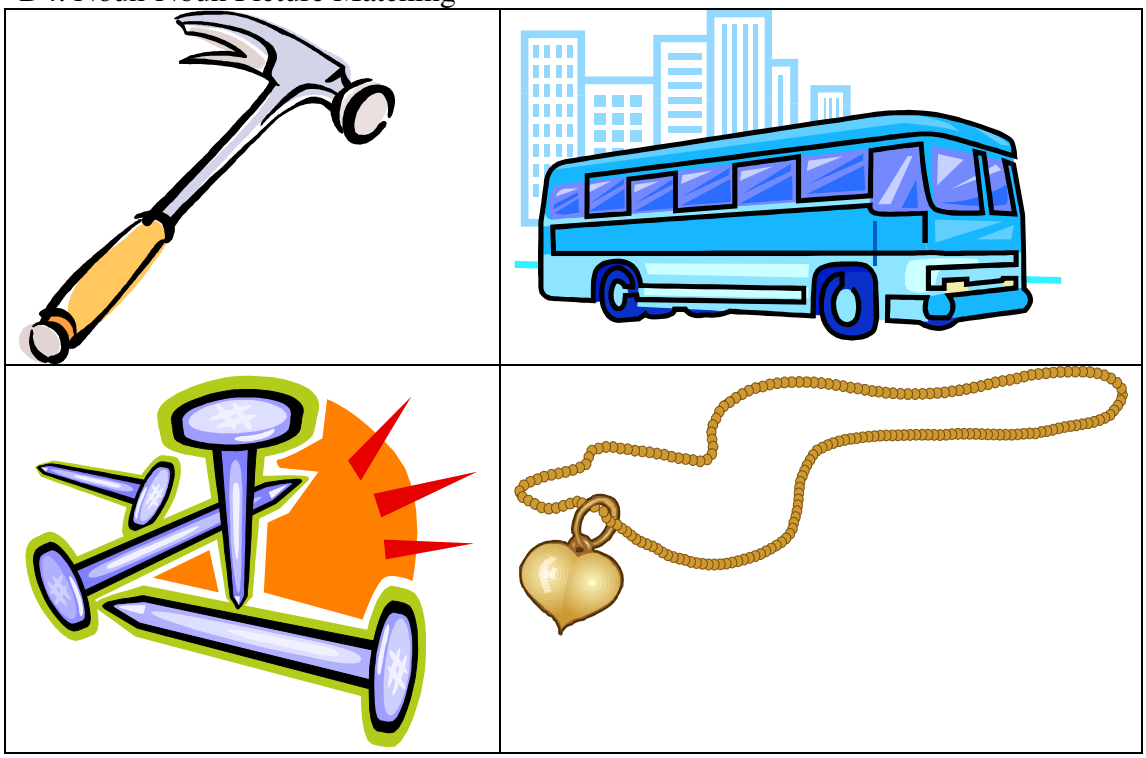


D2. Noun-Noun Picture Matching



D3. Noun-Noun Picture Matching

D4. Noun-Noun Picture Matching



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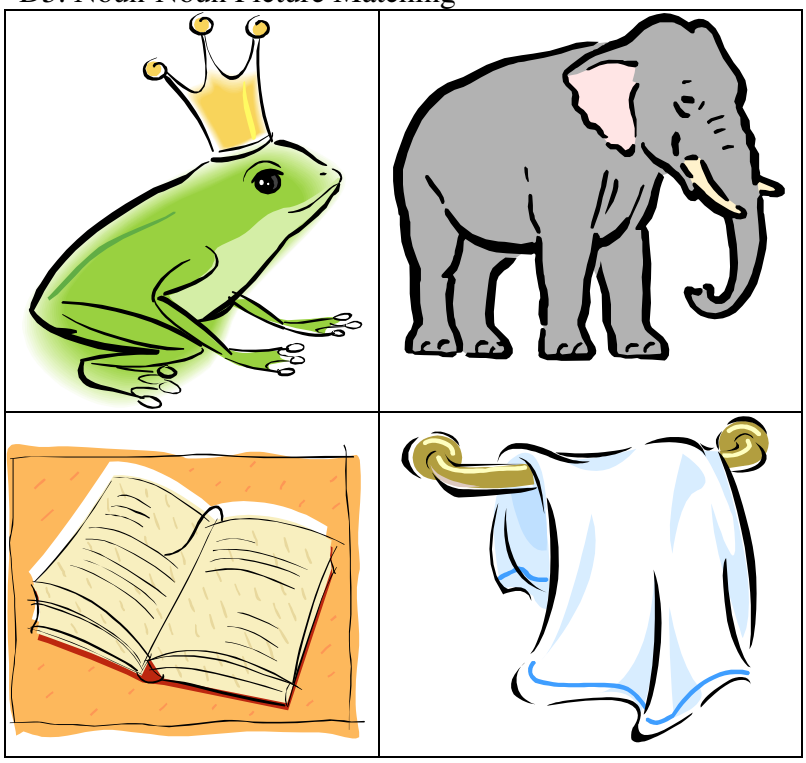

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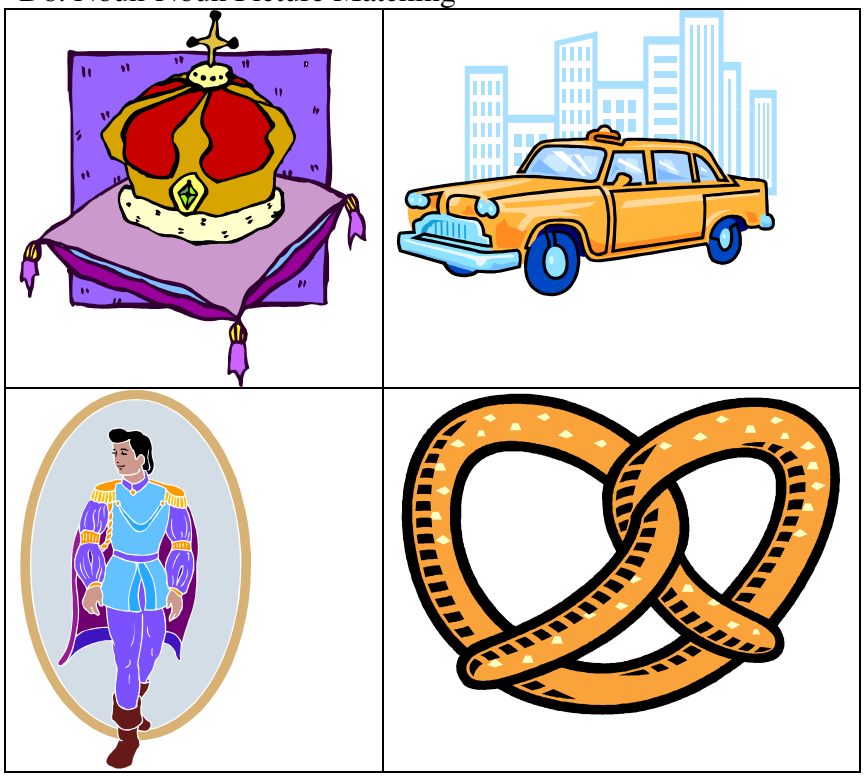
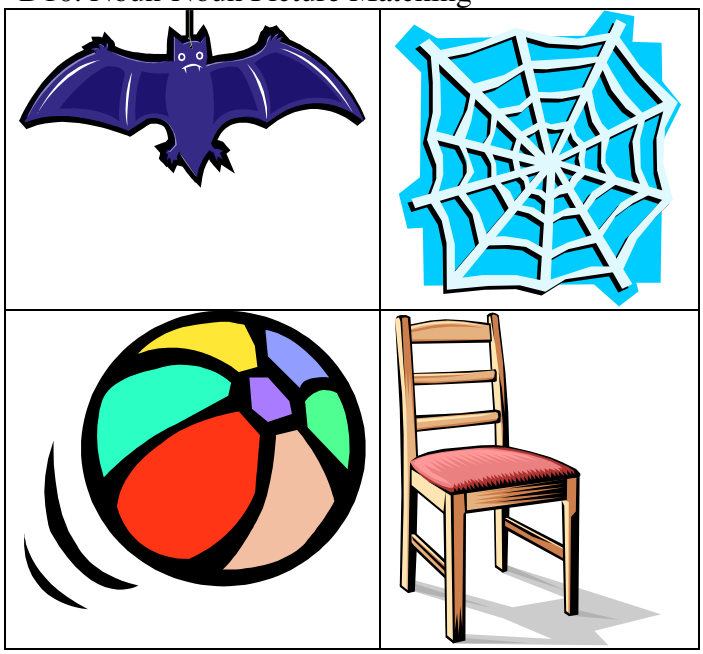


D7. Noun-Noun Picture Matching

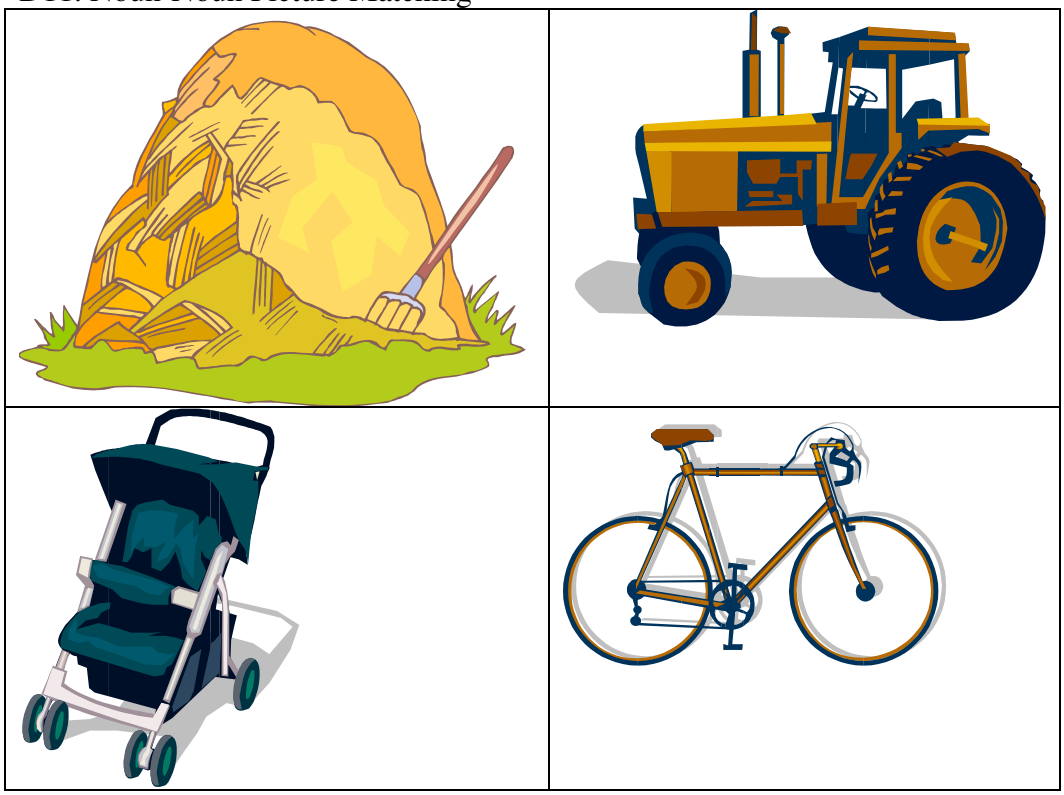
D8. Noun-Noun Picture Matching

D9. Noun-Noun Picture Matching

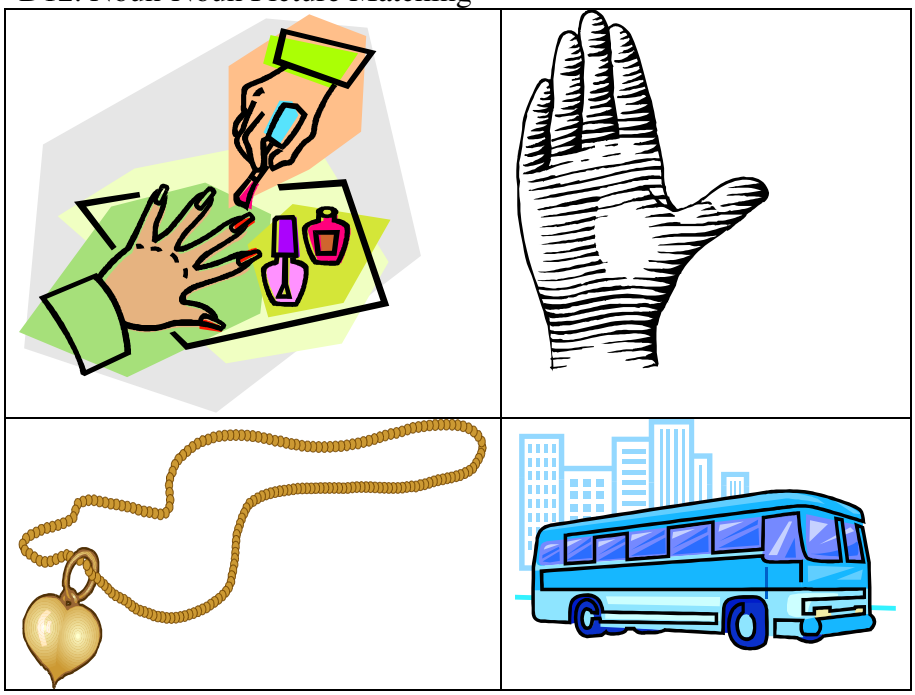
D10. Noun-Noun Picture Matching



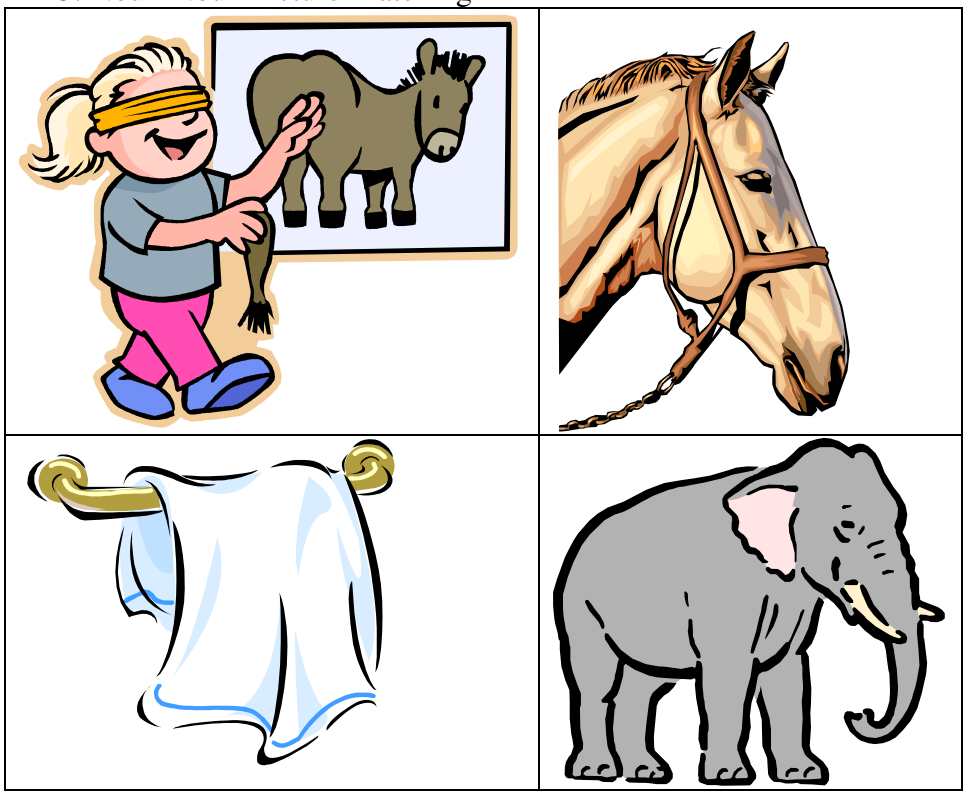
D11. Noun-Noun Picture Matching



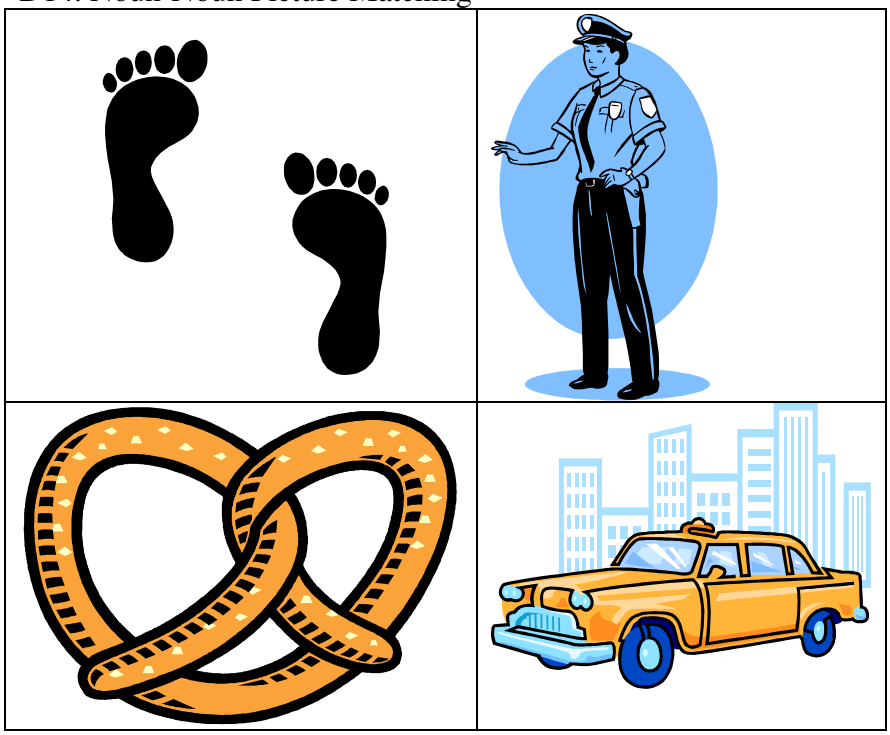
D12. Noun-Noun Picture Matching



D13. Noun-Noun Picture Matching



D14. Noun-Noun Picture Matching



D15. Noun-Noun Picture Matching

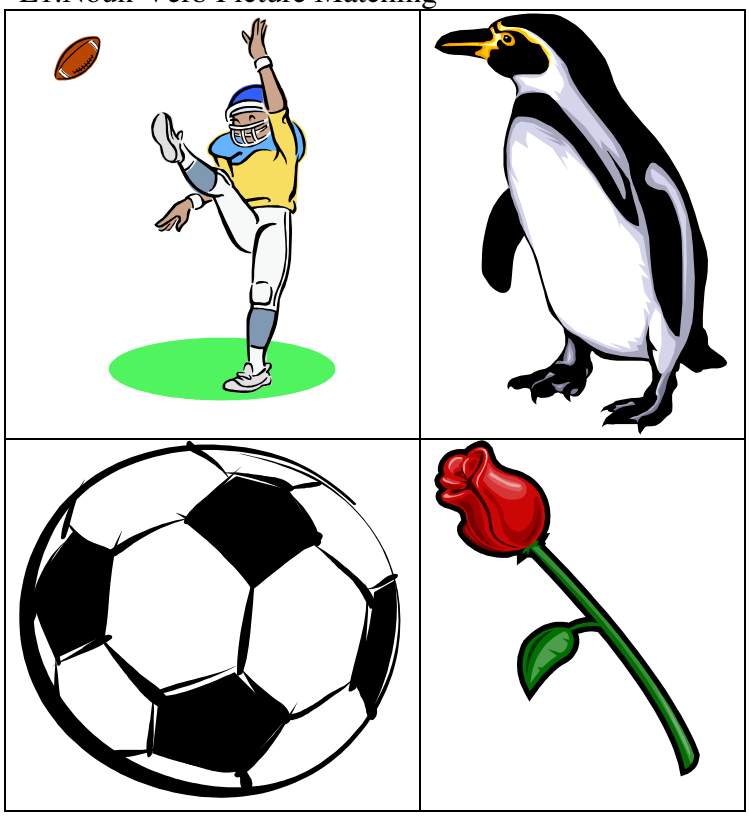
D16. Noun-Noun Picture Matching

APPENDIX E

PRE-TEST NOUN-VERB HOMOPHONE PICTURE MATCHING TASK

		semantic	**phonemic**	**irrelevant**
prePMT1NV	**roll**	kick	rose	penguin
prePMT2NV	**red**	crayon	beet	star
prePMT3NV	**rains**	cloud	rake	box
prePMT4NV	**soar**	fish	soccer ball	necklace
prePMT5NV	**wave**	hand	washing machine	spider web
prePMT6NV	**toe**	sandals	towel	pear
prePMT7NV	**rock**	volcano	sock	cow
prePMT8NV	**rode**	cowboy	toad	oven
prePMT9NV	**roll**	knife	rose	penguin
prePMT10NV	**read**	book	beet	star
prePMT11NV	**reins**	horse	rake	box
prePMT12NV	**sore**	band aid	soccer ball	necklace
prePMT13NV	**wave**	bathing suit	washing machine	spider web
prePMT14NV	**tow**	truck	towel	pear
prePMT15NV	**rock**	chair	sock	cow
prePMT16NV	**road**	car	toad	oven

E1.Noun-Verb Picture Matching



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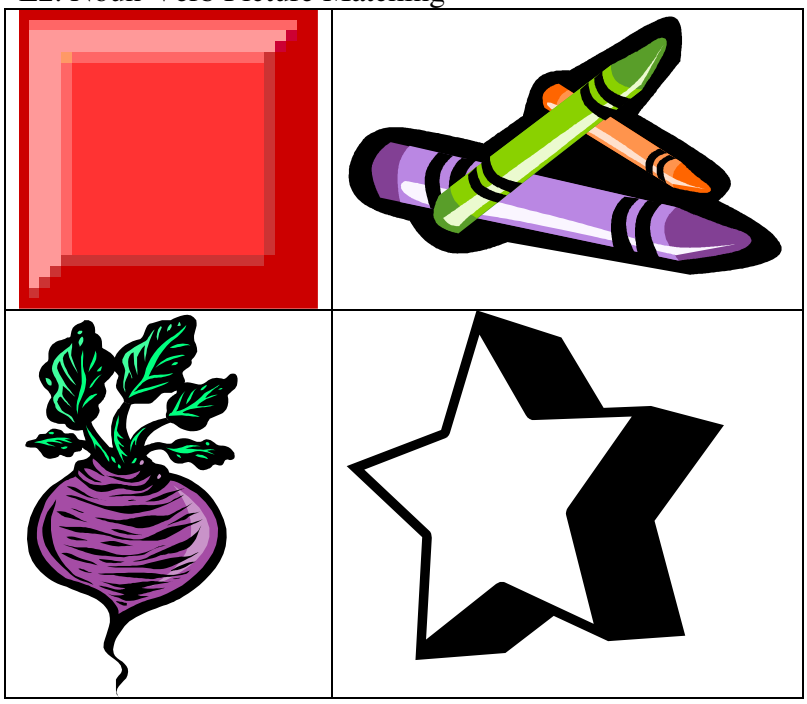

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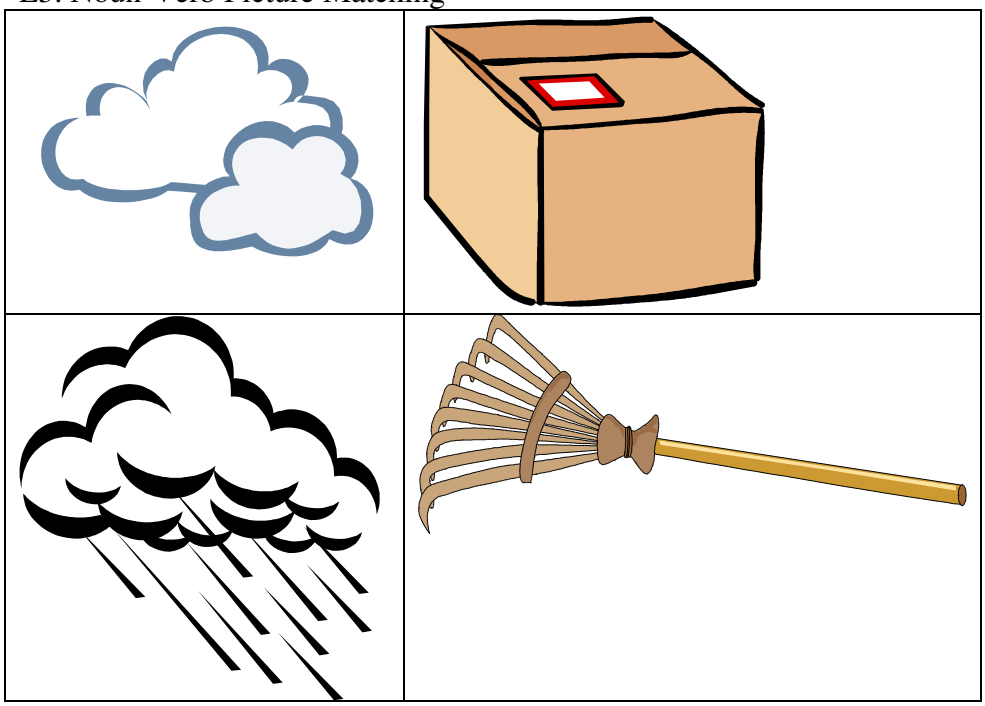

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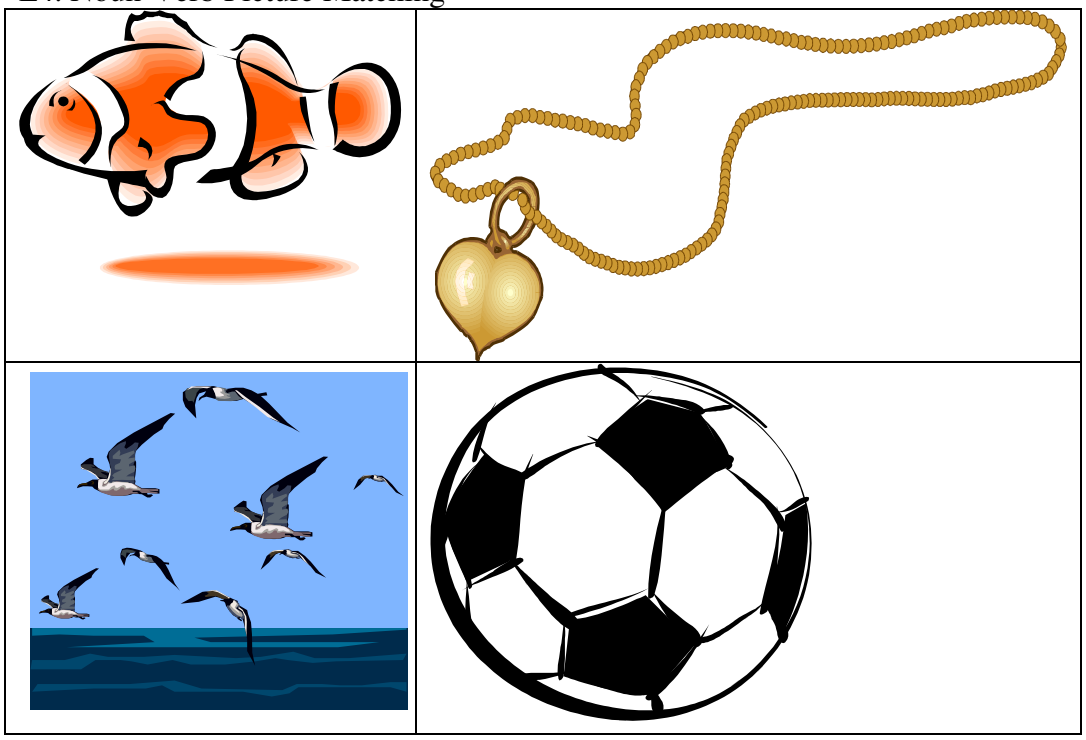
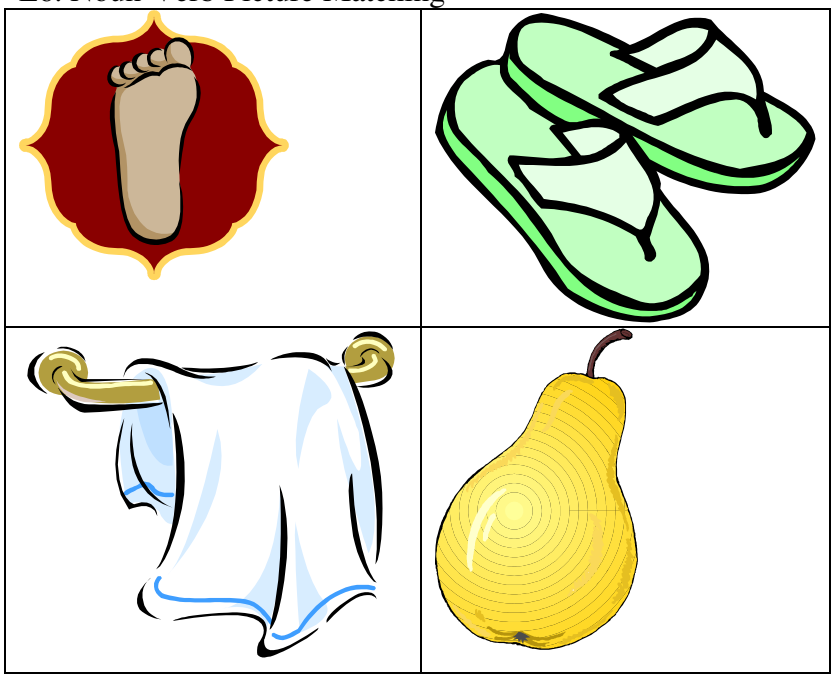
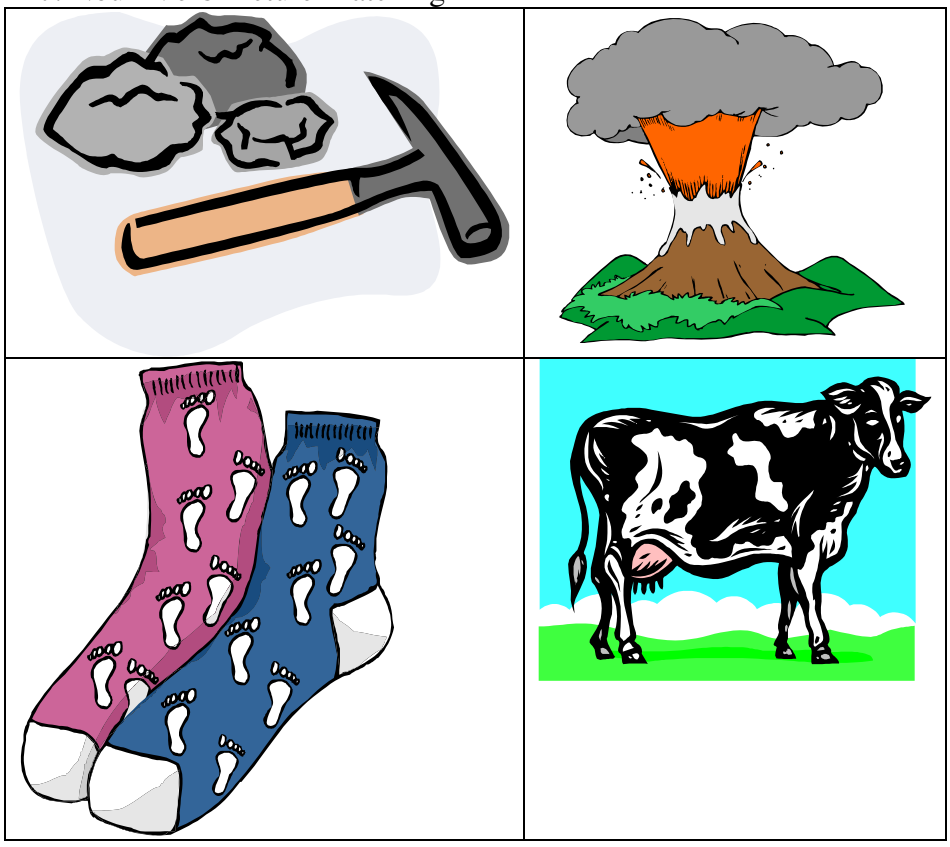


E5. Noun-Verb Picture Matching

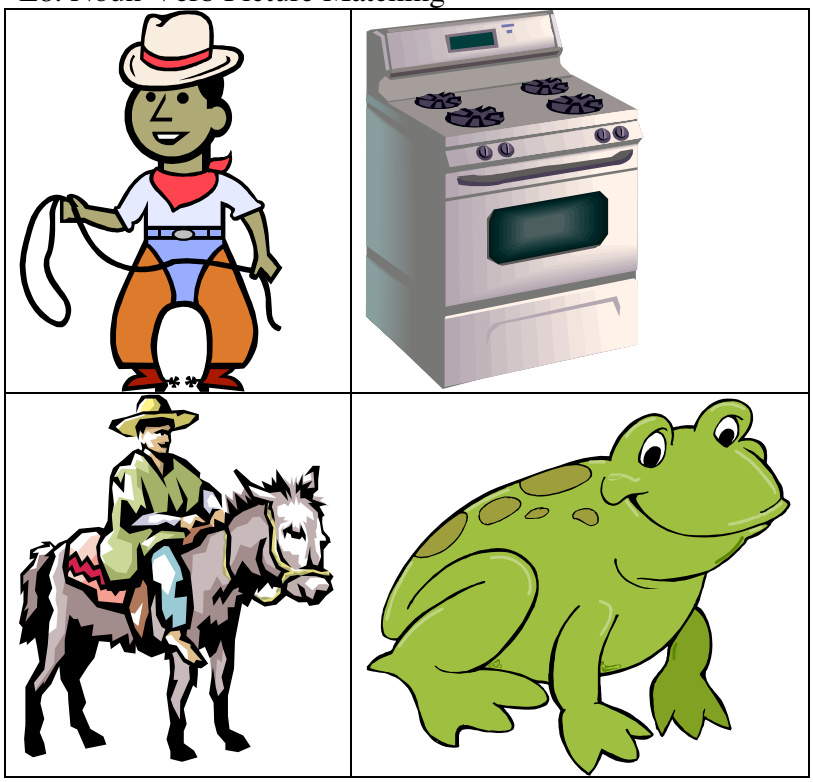
E6. Noun-Verb Picture Matching



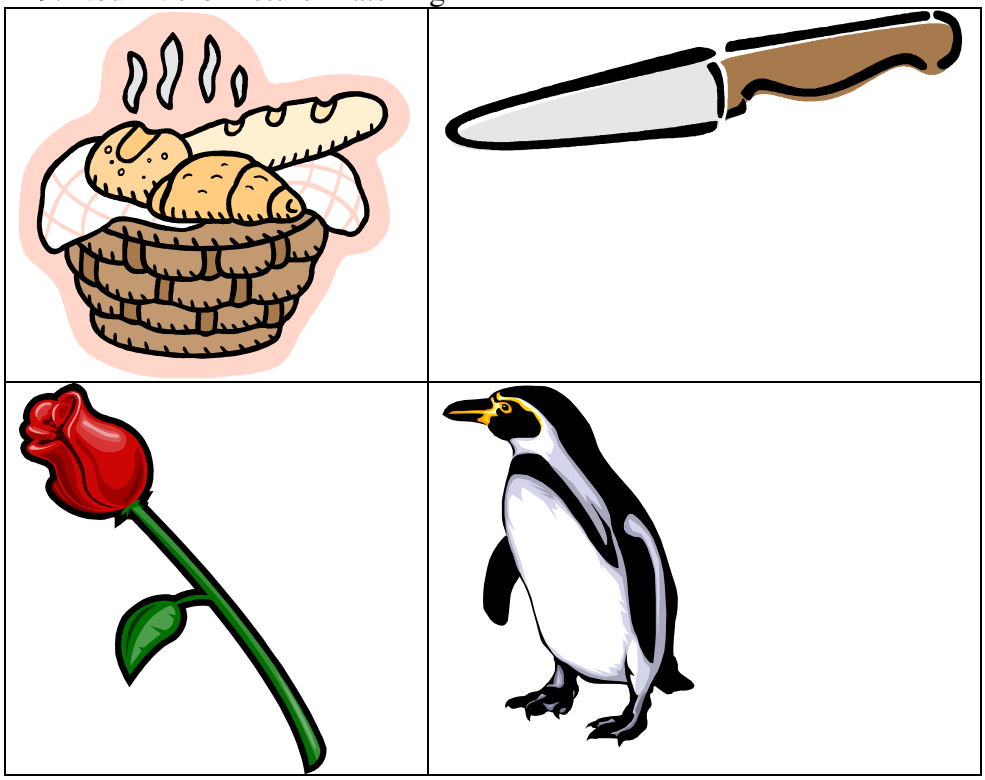
E7. Noun-Verb Picture Matching



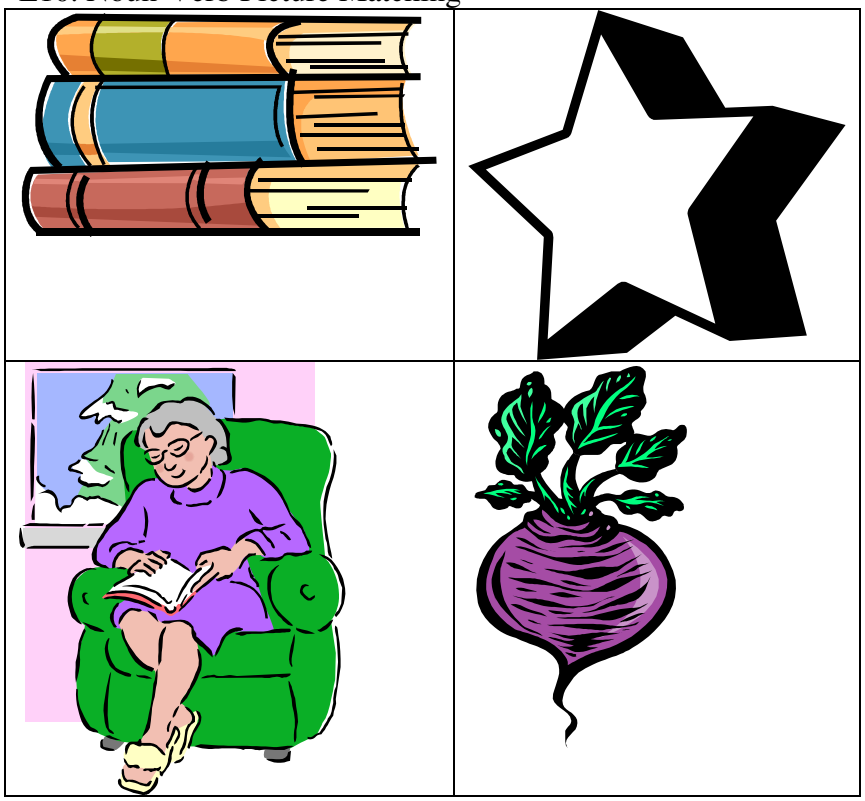
E8. Noun-Verb Picture Matching



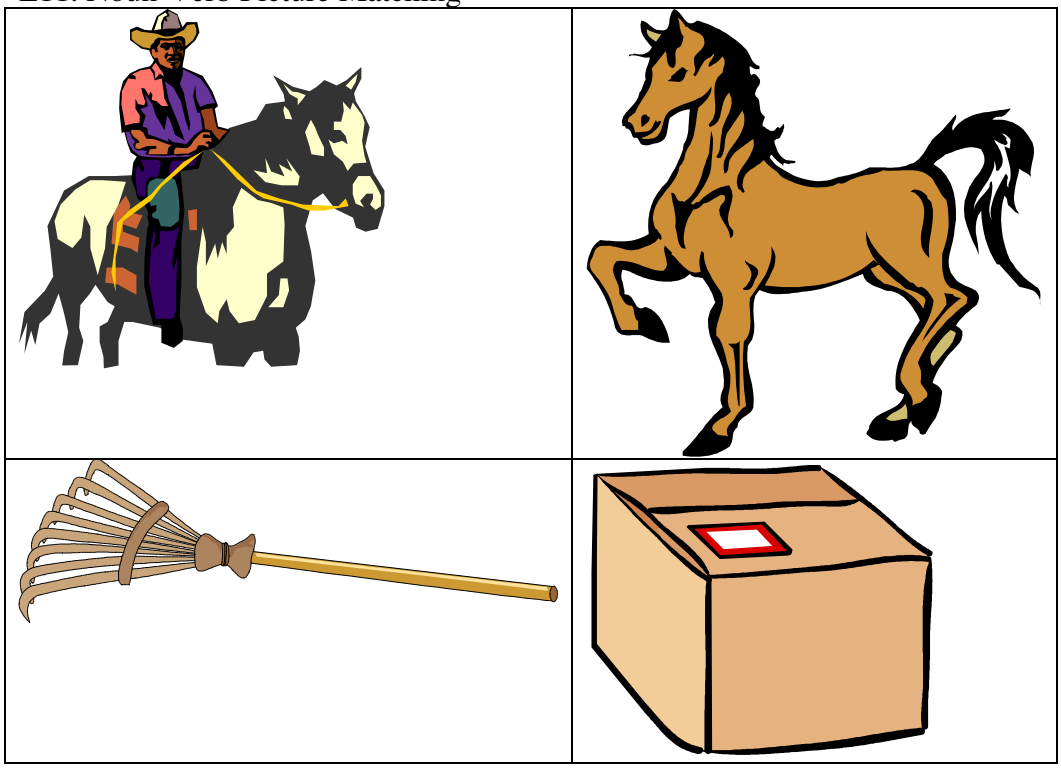
E9. Noun-Verb Picture Matching



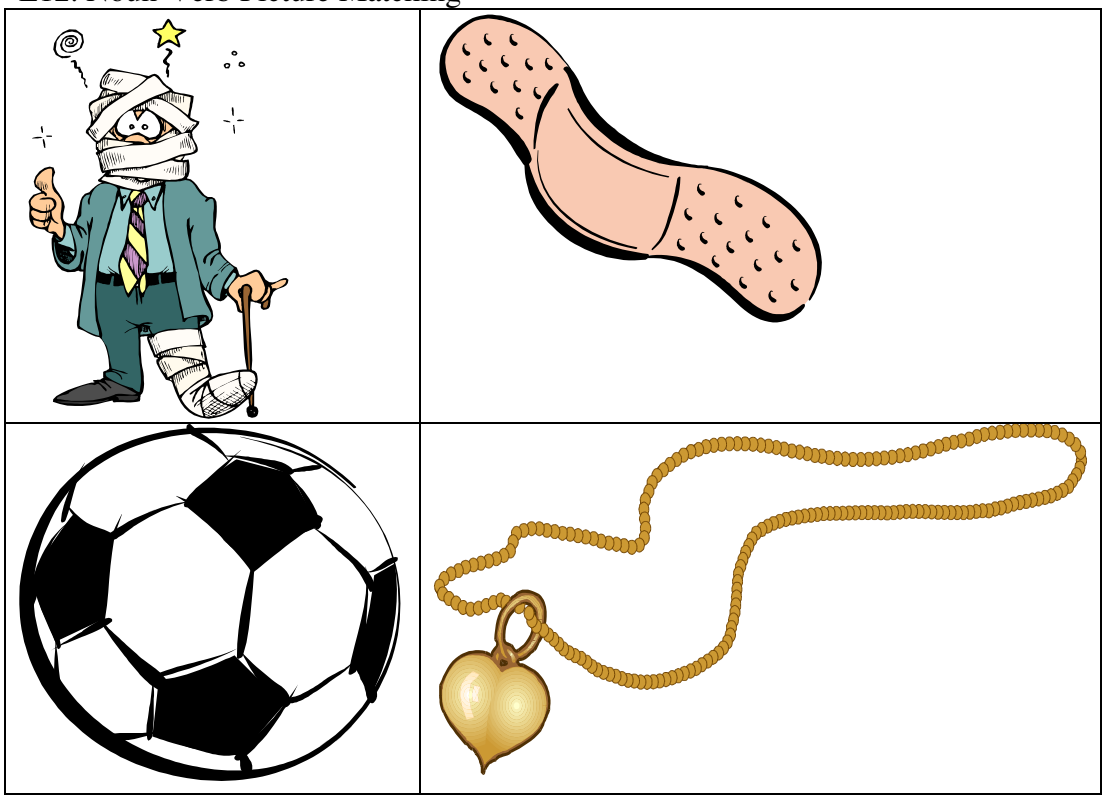
E10. Noun-Verb Picture Matching



E11. Noun-Verb Picture Matching

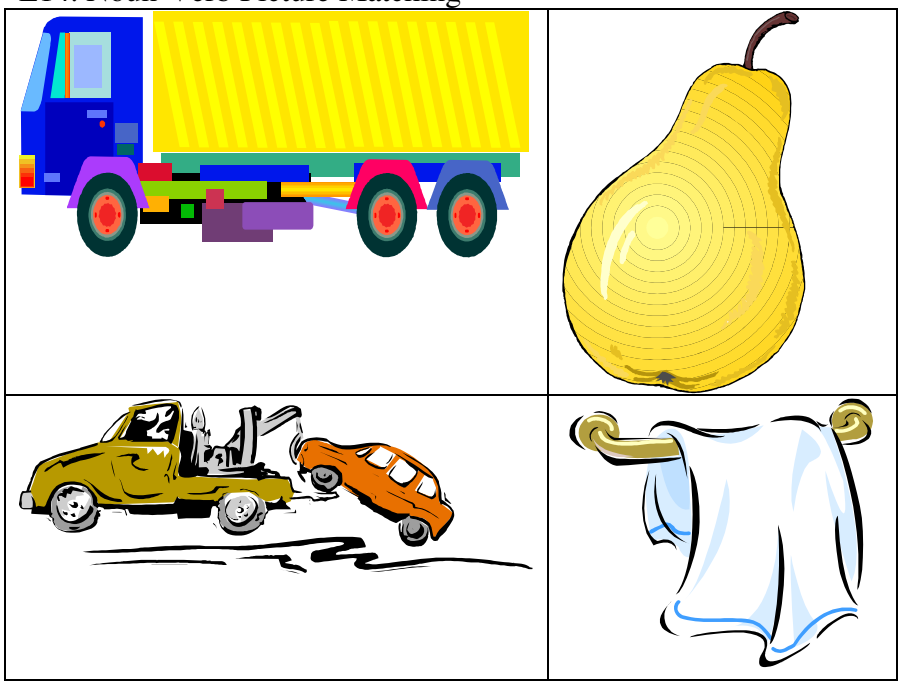


E12. Noun-Verb Picture Matching

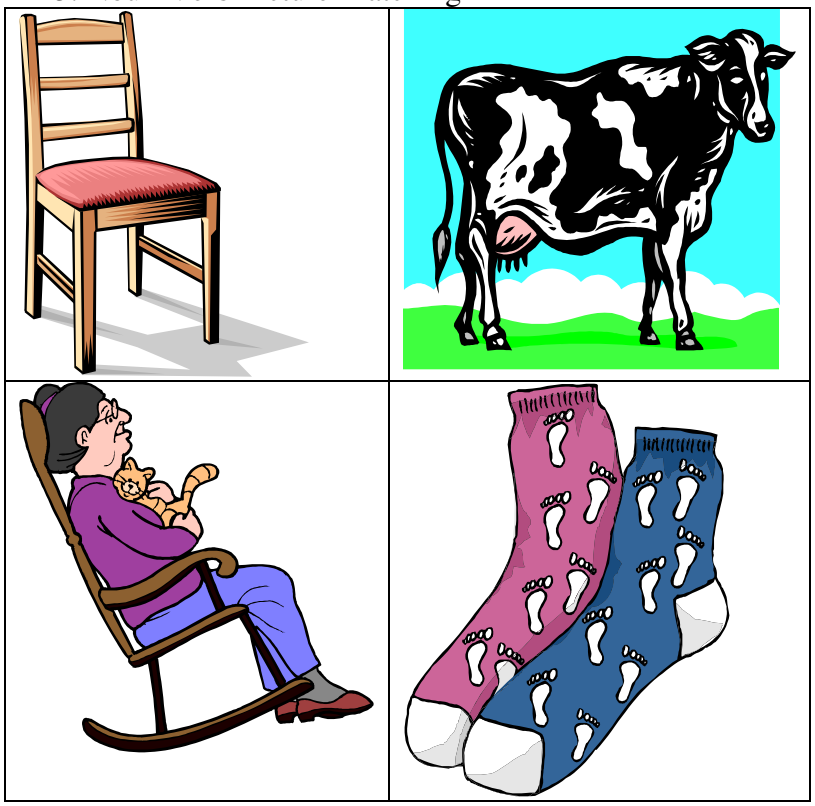


E13. Noun-Verb Picture Matching

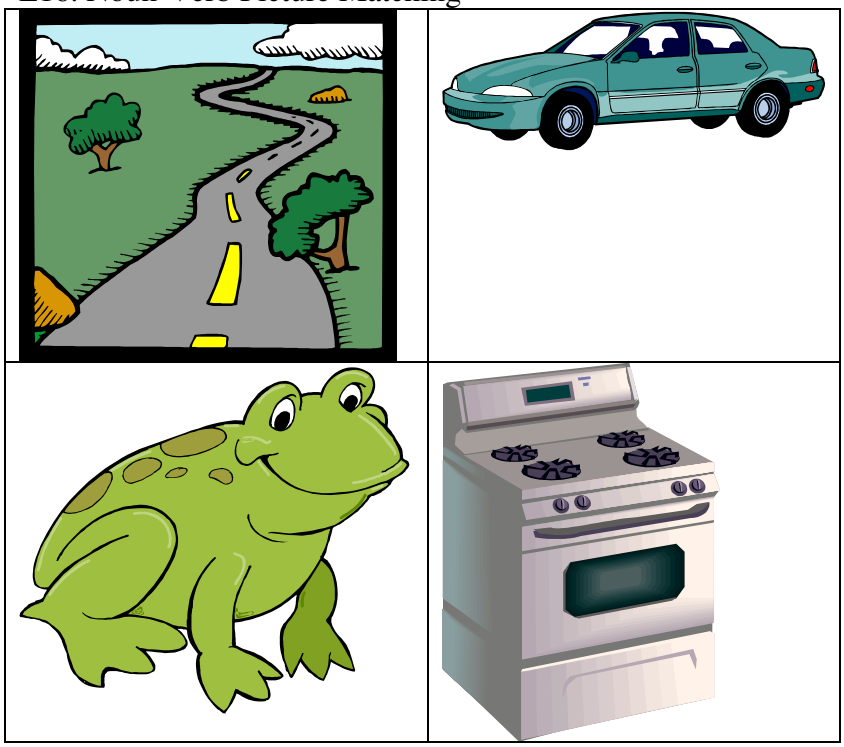
E14. Noun-Verb Picture Matching



E15. Noun-Verb Picture Matching



E16. Noun-Verb Picture Matching



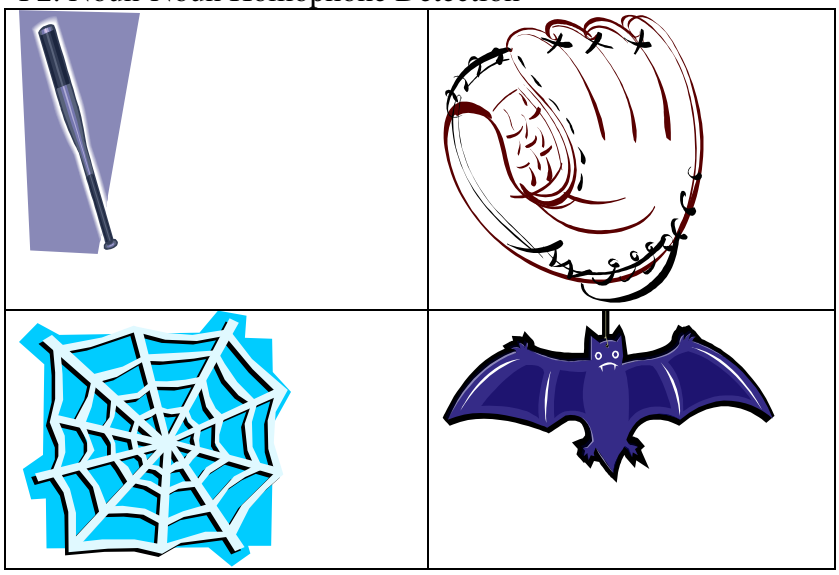
APPENDIX F

PRE-TEST NOUN-NOUN HOMOPHONE DETECTION TASK

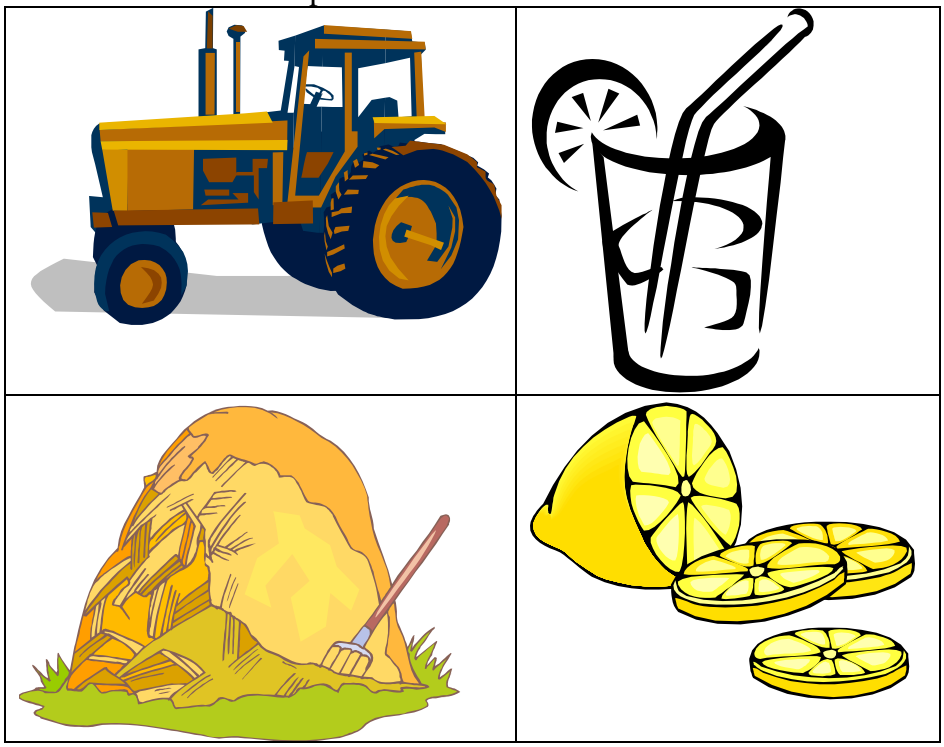
preHD1NN	**cellar**	lightbulb	seller	money
preHD2NN	**bat**	glove	bat	spider's web
preHD3NN	**straw**	farmer	straw	lemon
preHD4NN	**nails**	hands	nails	hammer
preHD5NN	**tail**	horse	tale	frog
preHD6NN	**prince**	policeman	prints	crown
preHD7NN	**son**	daughter	son	clouds
preHD8NN	**plane**	cactus	plane	suitcase

F1. Noun-Noun Homophone Detection

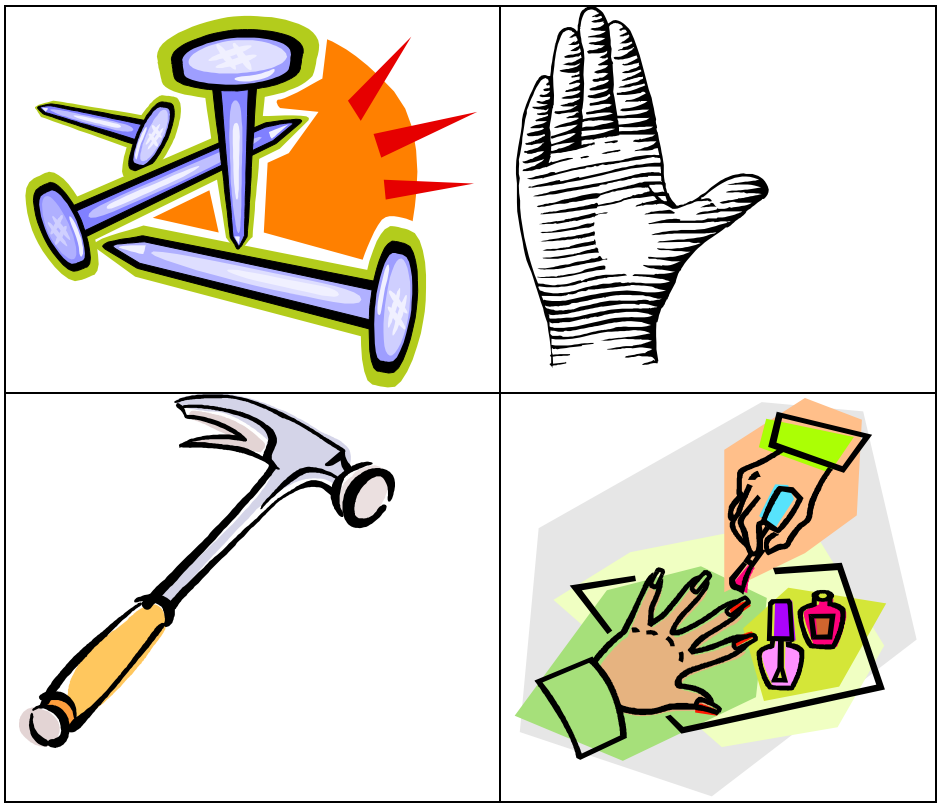
F2. Noun-Noun Homophone Detection



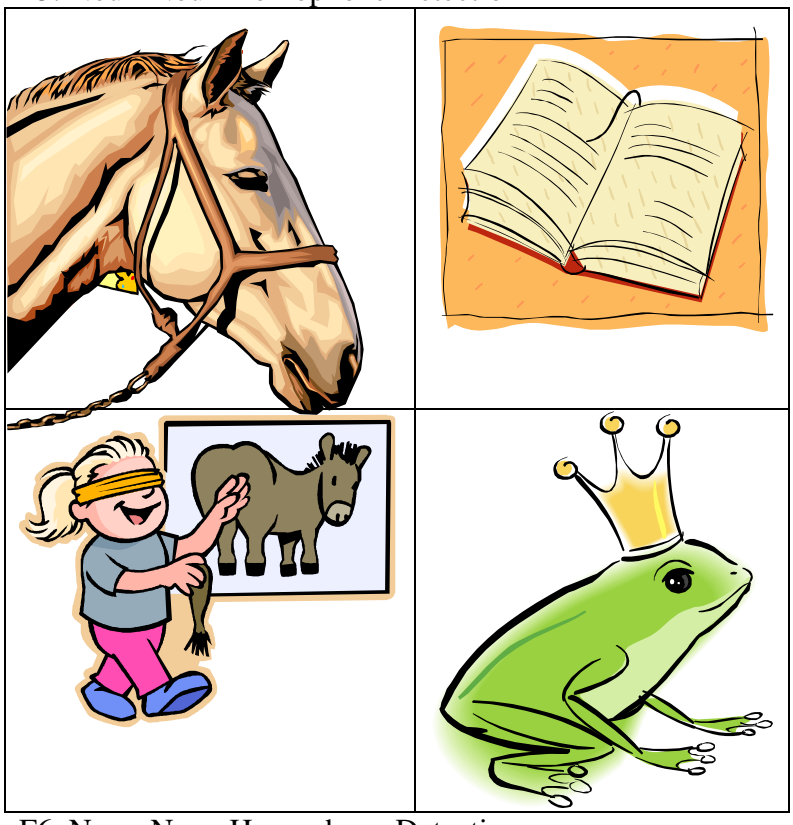
F3. Noun-Noun Homophone Detection



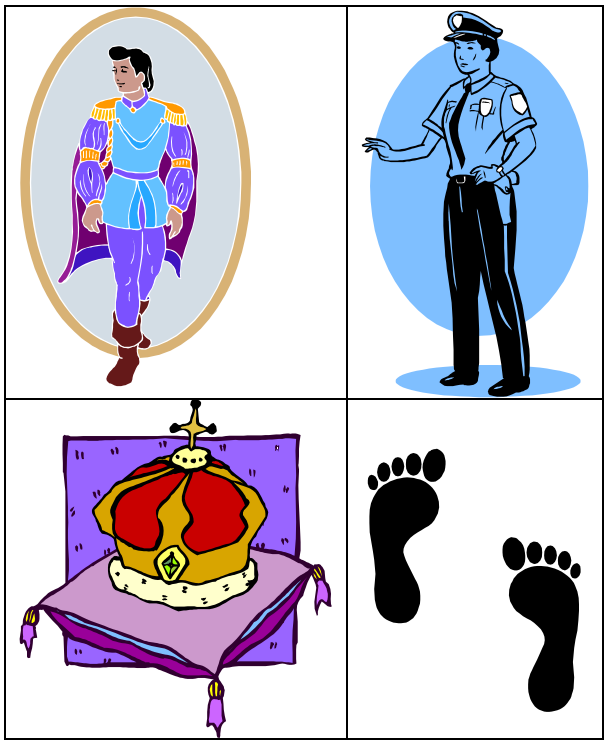
F4. Noun-Noun Homophone Detection



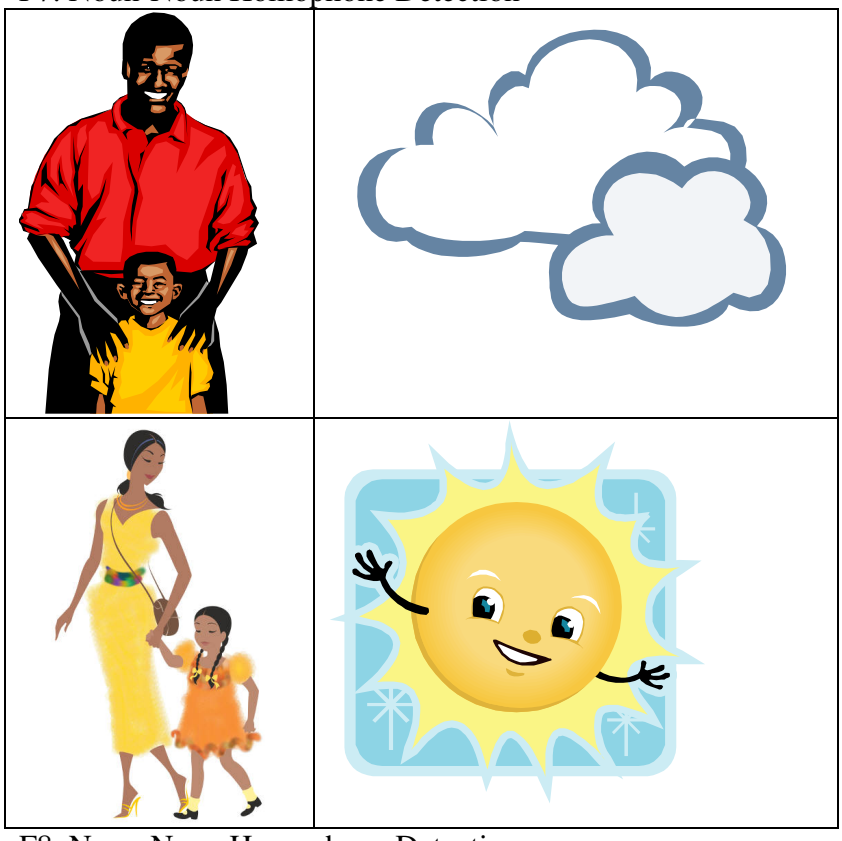
F5. Noun-Noun Homophone Detection



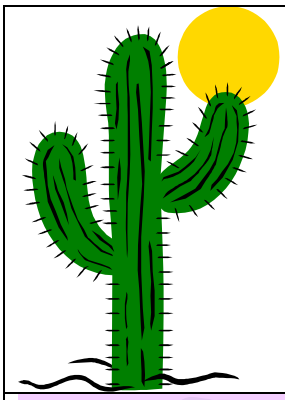
F6. Noun-Noun Homophone Detection

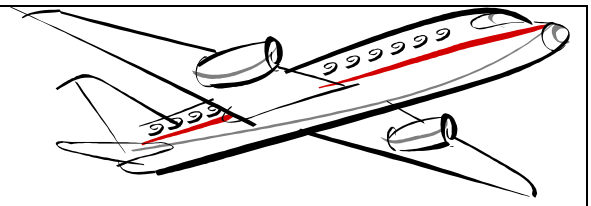


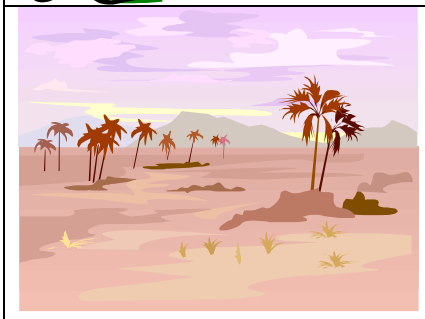
F7. Noun-Noun Homophone Detection

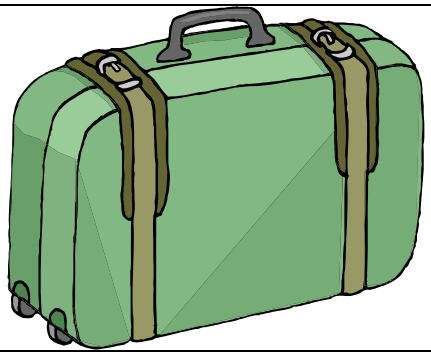


F8. Noun-Noun Homophone Detection







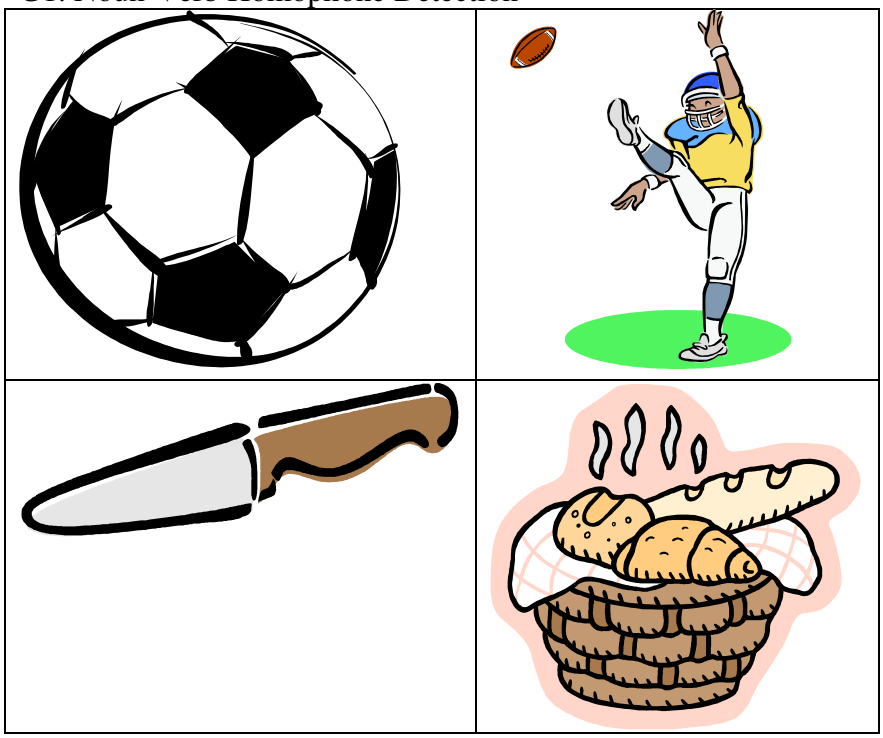


APPENDIX G

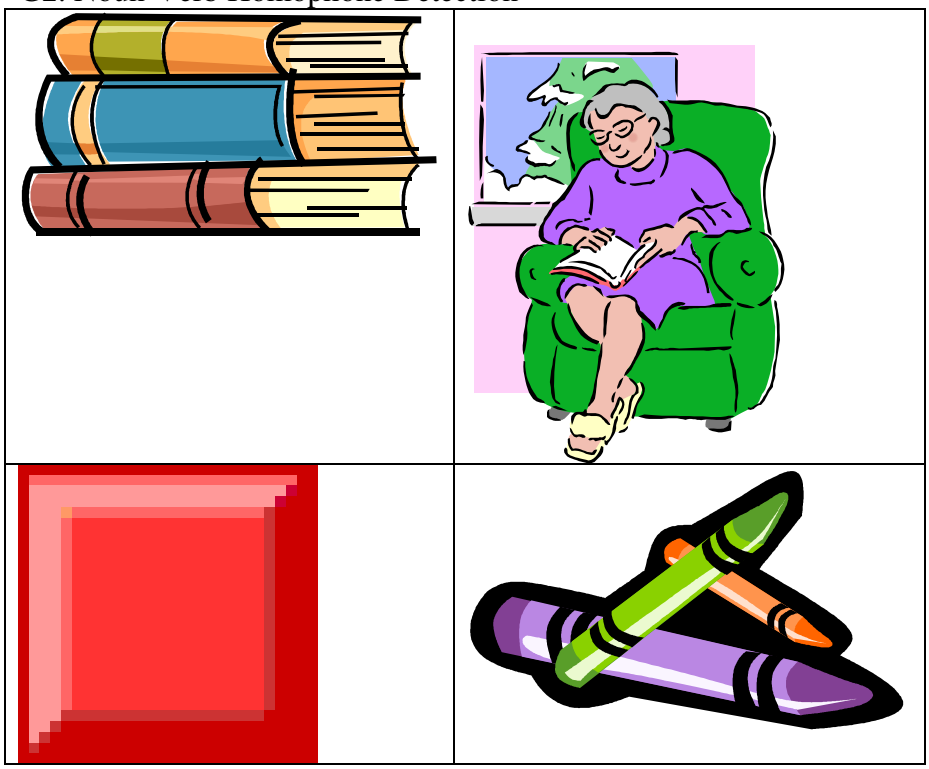
PRE-TEST NOUN-VERB HOMOPHONE DETECTION TASK

preHD1NV	**roll**	kick	roll	knife
preHD2NV	**read**	book	red	crayons
preHD3NV	**rains**	clouds	reins	horse
preHD4NV	**soar**	clouds	sore	band aid
preHD5NV	**wave**	hands	wave	bathing suit
preHD6NV	**tow**	truck	toe	flip flops
preHD7NV	**rock**	chair	rock	volcano
preHD8NV	**rode**	cowboy	road	car

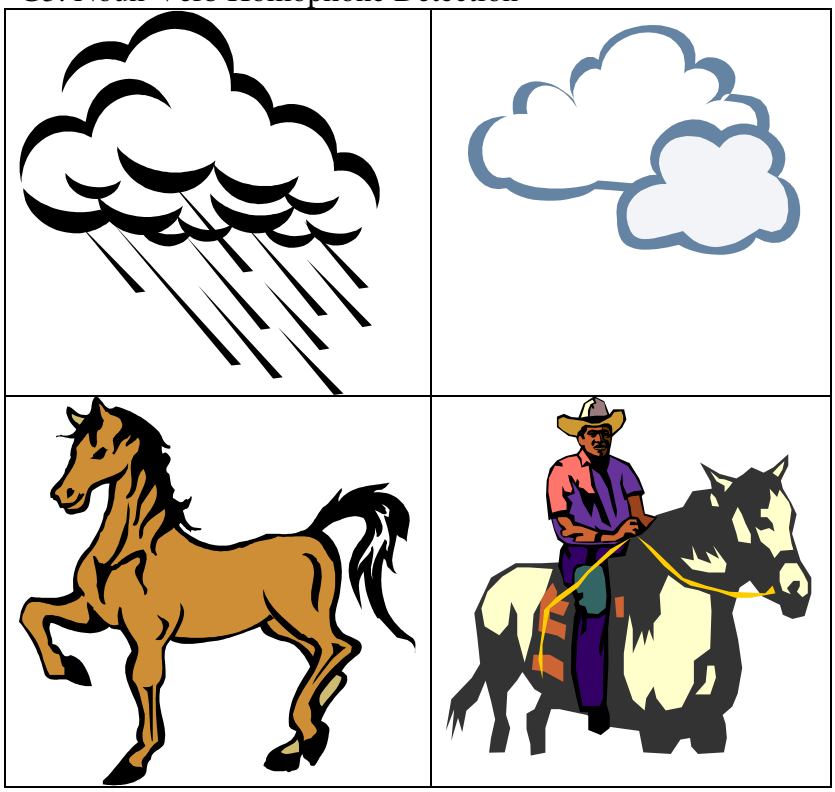
G1. Noun-Verb Homophone Detection



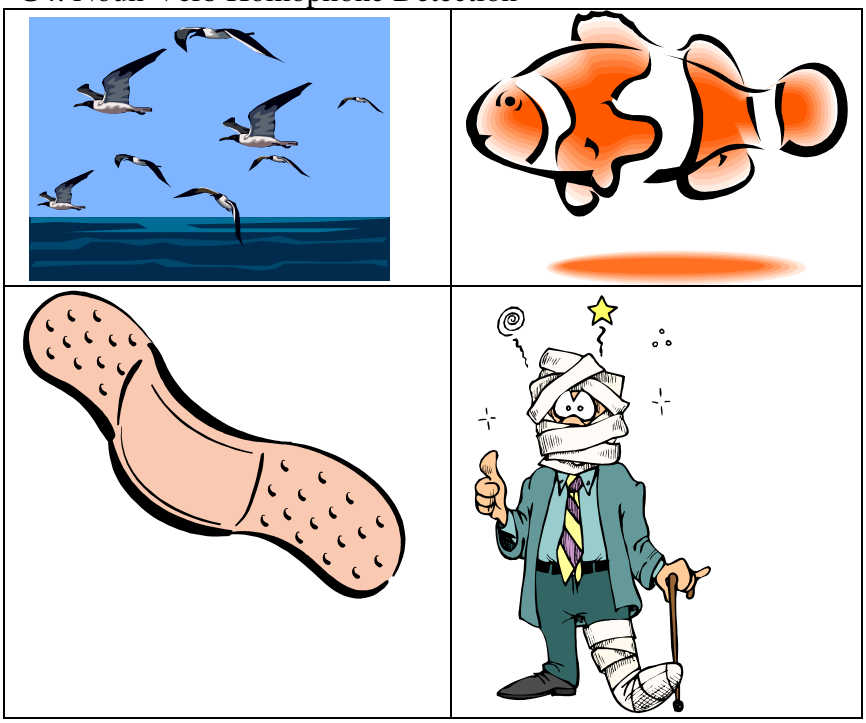
G2. Noun-Verb Homophone Detection



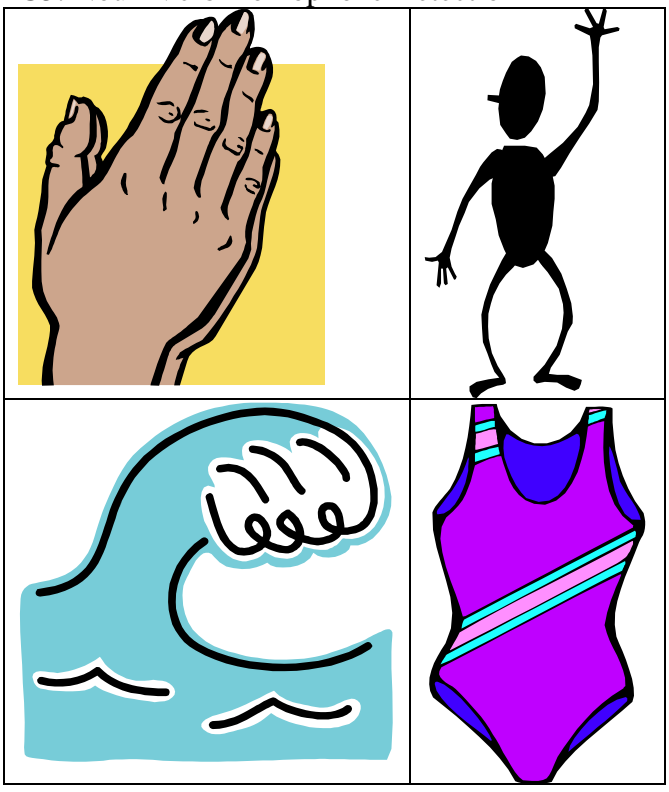
G3. Noun-Verb Homophone Detection



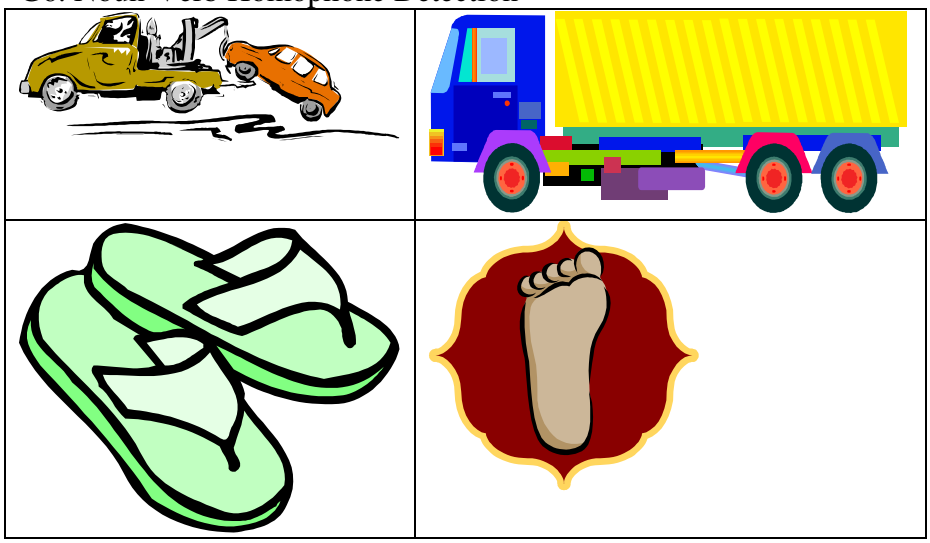
G4. Noun-Verb Homophone Detection



G5. Noun-Verb Homophone Detection

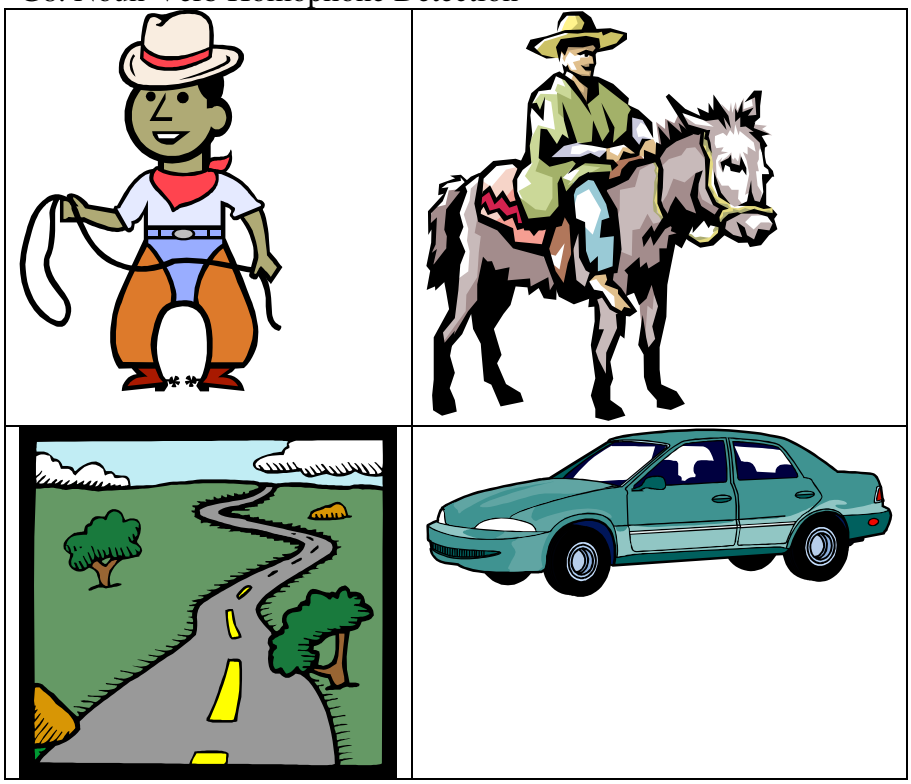


G6. Noun-Verb Homophone Detection



G7. Noun-Verb Homophone Detection

G8. Noun-Verb Homophone Detection



APPENDIX H

POST-TEST SCORECARDS

Name:_____ Subject # _____ Date of testing: _____

DOB:_____ Age at time of testing:_____

POSTTEST – Picture Matching
"We are going to look at some pictures, and I am going to say a word. Can you help me match the word with its picture?"

NOUN-NOUN

1. **Do you know the word steak?** Can you point to the picture that shows **a steak**?
_____
Yes, that's a picture that shows steak.

2. Can you point to the picture that shows **cold**. _____
Yes, that's a picture that shows cold.

3. Point to the picture that shows **a pipe**. _____
Yes, that's a picture that shows pipe.

4. Point to the picture that shows **a horn**. _____
Yes, that's a picture that shows horn.

5. Point to the picture that shows **the night**. _____
Yes, that's a picture that shows night.

6. Point to the picture that shows **the glasses**. _____
Yes, that's a picture that shows glasses.

7. Point to the picture that shows **a bow**. _____
Yes, that's a picture that shows plain.

8. Point to the picture that shows **the flour**. _____
Yes, that's a picture that shows flour.

9. Point to the picture that shows **a stake**. _____
Yes, that's a picture that shows stake.

10.Point to the picture that shows **a cold**. _____
Yes, that's a picture that shows cold.

11. Point to the picture that shows **a pipe**. _____
Yes, that's a picture that shows pipe.

12. Point to the picture that shows **a horn**. _____
Yes, that's a picture that shows horn.

13. Point to the picture that shows **a knight**. _____
Yes, that's a picture that shows knight.

14. Point to the picture that shows **the glasses**. _____
Yes, that's a picture that shows glasses.

15. Point to the picture that shows **the bow**. _____
Yes, that's a picture that shows plane.

16. Point to the picture that shows **a flower**. _____
Yes, that's a picture that shows flower.

Good Job! Let's take a break.

NOUN-VERB

1. Can you point to the picture that shows **ring**? _____
Yes, that's a picture that shows ring.

2. Point to the picture that shows **clothes**. _____
Yes, that's a picture that shows clothes.

3. Point to the picture that shows **how someone can wait**. _____
Yes, that's a picture that shows wait.

4. Point to the picture that shows **the meat**. _____
Yes, that's a picture that shows meat.

5. Point to the picture that shows **punch**. _____
Yes, that's a picture that shows punch.

6. Point to the picture that shows **the color blue**. _____
Yes, that's a picture that shows blue.

7. Point to the picture that shows **tie**. _____
Yes, that's a picture that shows tie.

8. Point to the picture that shows **a sink**. _____
Yes, that's a picture that shows sink.

9. Point to the picture that shows **a ring**. _____
Yes, that's a picture that shows ring.

10.Point to the picture that shows **close**. _____
Yes, that's a picture that shows close.

11. Point to the picture that shows **the weight**. _____
Yes, that's a picture that shows weight.

12. Point to the picture that shows **meet**. _____
Yes, that's a picture that shows meet.

13. Point to the picture that shows **a punch**. _____
Yes, that's a picture that shows punch.

14. Point to the picture that shows **blew**. _____
Yes, that's a picture that shows blew.

15. Point to the picture that shows **a tie**. _____
Yes, that's a picture that shows tie.

16. Point to the picture that shows **sink**. _____
Yes, that's a picture that shows sink.

POST-TEST - HOMOPHONE DETECTION SCORECARD

Now we're going to play a game with words that sound the same, but mean different things.
I want you point to two pictures that sound just the same but can mean different things. Let's do one together: here is a picture of trunk and this is also trunk. Trunk and trunk (point to pictures). The trunk of an elephant and a trunk that can hold toys; they sound the same, but they mean different things.

5) Present grid of four pictures. "**Can you find two things that sound the same but mean different things**". (Mark "1" under any pictures he/she points to.) **Can you name those pictures? (**Write in response)
6) If child points to anything besides homophones, "**Do those sound <u>exactly</u> the same**?" If child points to semantic distracter, "**Yes, that's the same kind of thing, but can you find any words that <u>sound</u> the same, but mean <u>different</u> things?" (**Mark "2" in the boxes under the words)
7) If child gives up, point to one of the homophones. "**Can you find another picture that sounds the same as this?"** (Mark "3")
8) If he/she can't, "**Can you point to X?" And can you point to another kind of X?"** (Mark "4")

POST-TEST HOMOPHONE DETECTION

postHD1NN	**steak**	tomatoes	stake	cow
postHD2NN	**cold**	mittens	cold	tissues
postHD3NN	**pipe**	cigar	pipe	wrench
postHD4NN	**horn**	saxophone	horn	bull
postHD5NN	**night**	horse	knight	star
postHD6NN	**glasses**	eyes	glasses	pitcher
postHD7NN	**bow**	arrow	bow	scissors
postHD8NN	**flour**	leaf	flower	bread
postHD1NV	**ring**	sing	ring	hands
postHD2NV	**close**	key	clothes	shoe
postHD3NV	**wait**	bus	weight	towel
postHD4NV	**meet**	coffee	meat	sandwich
postHD5NV	**punch**	arm	punch	glasses
postHD6NV	**blew**	hat	blue	crayons
postHD7NV	**tie**	shoe	tie	shirt
postHD8NV	**sink**	ship	sink	faucet

Name:_____ Subject # _____ Date of testing: _____

DOB:_____ Age at time of testing:_____

POST-TEST PRACTICE AND EXPERIMENTAL SENTENCES
We are going to talk about some sentences. Did you ever think about the fact that some sentences can mean more than one thing? Let's do some together so that you can see what I mean. (After presenting sentence and pictures, point to the picture that corresponds to the child's initial characterization. If they can't articulate one, explain the two meanings.)
If they mischaracterize the meaning:
a) recast what they've said
b) "Well, actually I was thinking of…"

P1. **The woman sat on the trunk.** What is that sentence telling us? Can it mean two things or just one?

Child_____

Can you think of anything else that the sentence might mean? Here's a picture of the _____ and here's another picture showing_____. Do both pictures match the sentence? Yes, _____ can mean _____ and _____.

Comment_____

P2. How about this one: "**The train stopped near a tree**." What is that sentence telling us? Can it mean two things or just one?

Child_____

Can you think of anything else that the sentence might mean? Here's a picture of the train and the tree. I can't think of anything else it might mean. Look at this picture. Does it match the sentence? No, it looks like the train stopped by a gas station instead of a tree.

Comment_____

P3. What is that sentence telling us? Can it mean two things or just one?

Child_____

Can you think of anything else that the sentence might mean? Here's a picture of the _____ and here's another picture showing_____. Do both pictures match the sentence? Yes, _____ can mean _____ and _____.

Comment_____

P4. **The turtles had spots on their shells.** What is that sentence telling us? Can it mean two things or just one?

Child_____

Can you think of anything else that the sentence might mean? Here's a picture of the _____. I can't think of anything else it might mean. Now, look at this picture. Does it match the sentence? No, it looks like _____. So _____ can only mean one thing.

Comment_____

So we've seen that some sentences can mean just one thing, but others can mean more than one thing. I have some more sentences, and I want you to tell me whether you think they can mean only one thing or two things.

Post-test

First, present sentence, then ask for the meaning, then ask if the sentence could mean anything else (no prompt). If no, then ask question (verbal prompt). If the child still does not answer correctly, describe the two meanings of the homophones, re-read the sentence, and ask what the sentence means again (second verbal prompt). Put a check if ambiguity is detected.

1. **The man wore boots in the snow**. Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

Comments _____

2. **The man went to the store to buy a steak/stake**. Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the steak/stake look like?

No prompt_____ Verbal prompt_____

Comments _____

3. **The boy climbed the stairs.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

Comments _____

4. **The cold made Betty feel terrible.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: Why did Betty feel terrible?

No prompt_____ Verbal prompt_____

Comments _____

5. **The man held the pipe.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the pipe look like?

No prompt_____ Verbal prompt_____

Comments _____

6. **The woman cooked chicken for dinner.**
Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

Comments _____

7. **The gardener planted a tree in front of the house.**
Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

Comments _____

8. How about the sentence "**The children touched the horn.**" Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the horn look like?

No prompt_____ Verbal prompt_____

Comments _____

9. **The man wrote a letter to his wife.**
Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

Comments _____

10. **The night/knight came quickly**. Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the night/knight look like?

No prompt_____ Verbal prompt_____

Comments _____

11. **The girl bought earrings at the shop.**
Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

Comments _____

12. **The glasses fell on the floor and broke.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the glasses look like?

No prompt_____ Verbal prompt_____

Comments _____

13. **The boy picked up the bow.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the bow look like?

No prompt_____ Verbal prompt_____

Comments _____

14. **The little boy ate cake at the birthday party.**
Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt:

No prompt_____ Verbal prompt_____

Comments _____

15. **The lady put the flour/flower on the table.** Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What did the flower/flour look like?

No prompt_____ Verbal prompt_____

Comments _____

16. **The man used the computer at work.**
Do you think that sentence can mean two things or just one thing?

Meaning_____

Verbal prompt: What does that sentence mean? Can it mean anything else?

No prompt_____ Verbal prompt_____

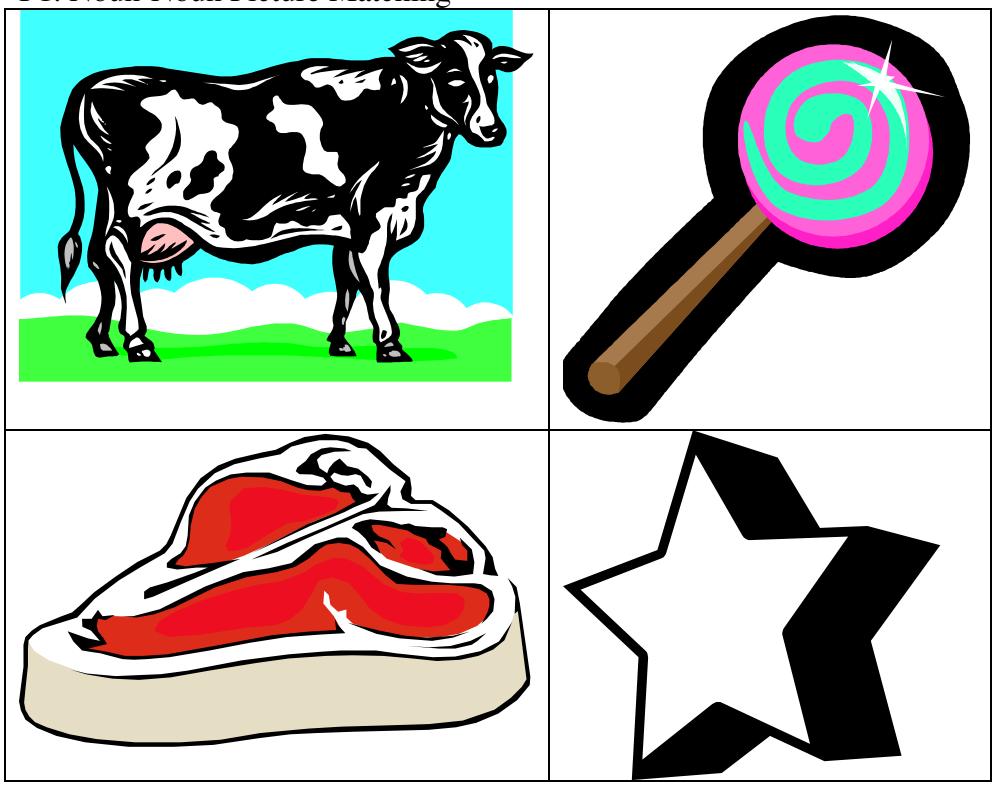
Comments _____

APPENDIX I

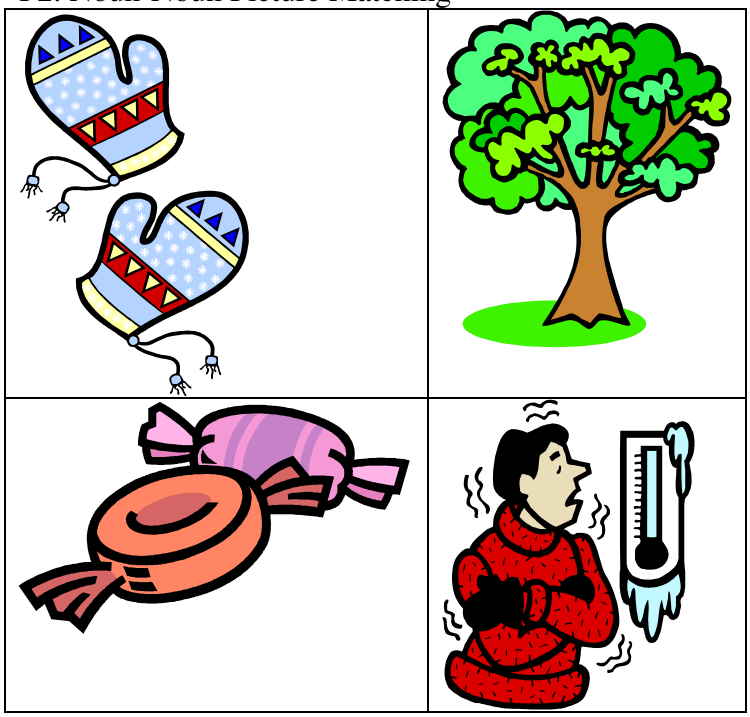
POST-TEST NOUN-NOUN HOMOPHONE PICTURE MATCHING TASK

	NOUN	**semantic**	**phonemic**	**irrelevant**
postPMT1NN	**steak**	cow	star	lollipop
postPMT2NN	**cold**	mittens	candy	tree
postPMT3NN	**pipe**	wrench	pie	fish
postPMT4NN	**horn**	rabbit	hat	book
postPMT5NN	**night**	star	kite	apple
postPMT6NN	**glasses**	pitcher	globe	bed
postPMT7NN	**bow**	scissors	bed	shoe
postPMT8NN	**flour**	bread	fly	car
postPMT9NN	**stake**	tomatoes	star	lollipop
postPMT10NN	**cold**	tissue	candy	tree
postPMT11NN	**pipe**	cigar	pie	fish
postPMT12NN	**horn**	saxophone	hat	book
postPMT13NN	**knight**	horse	kite	apple
postPMT14NN	**glasses**	eyes	globe	bed
postPMT15NN	**bow**	arrow	bed	shoe
postPMT16NN	**flower**	leaf	fly	car

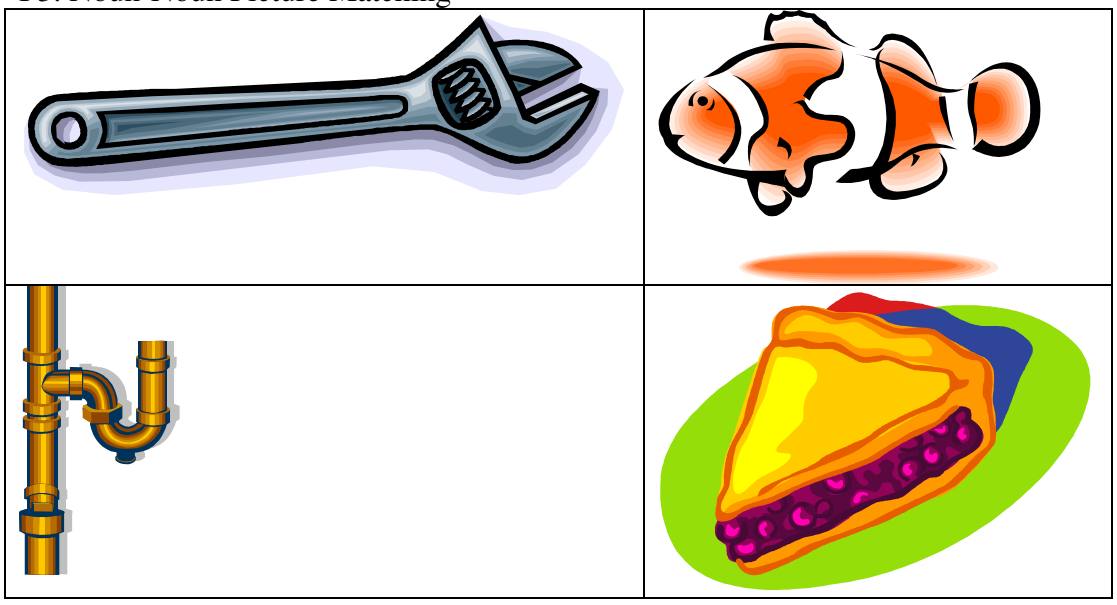
I 1. Noun-Noun Picture Matching



I 2. Noun-Noun Picture Matching



I 3. Noun-Noun Picture Matching



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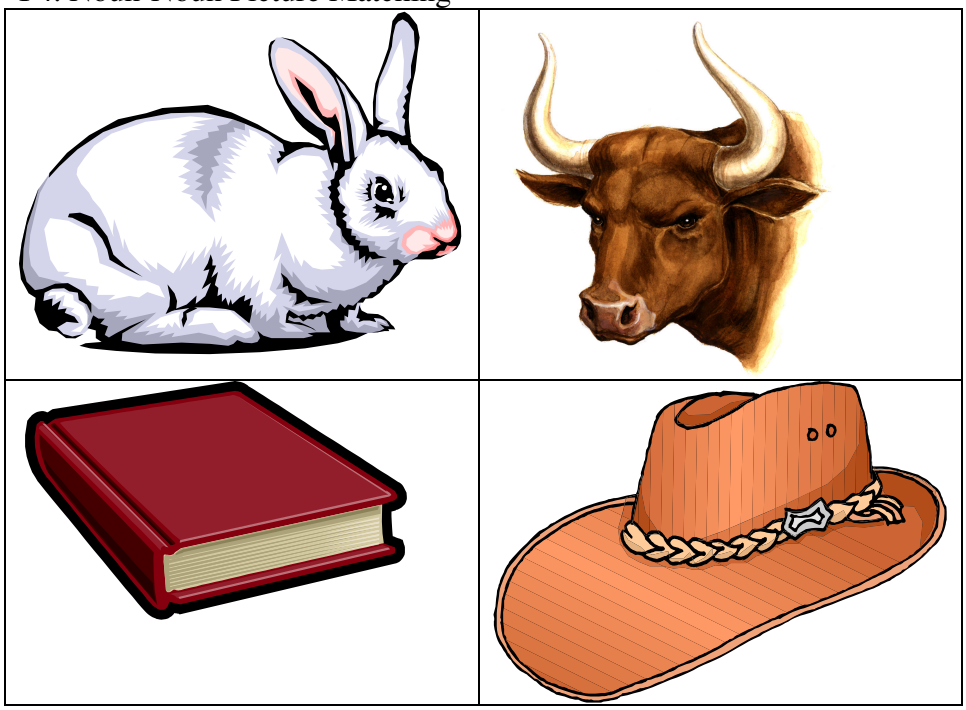
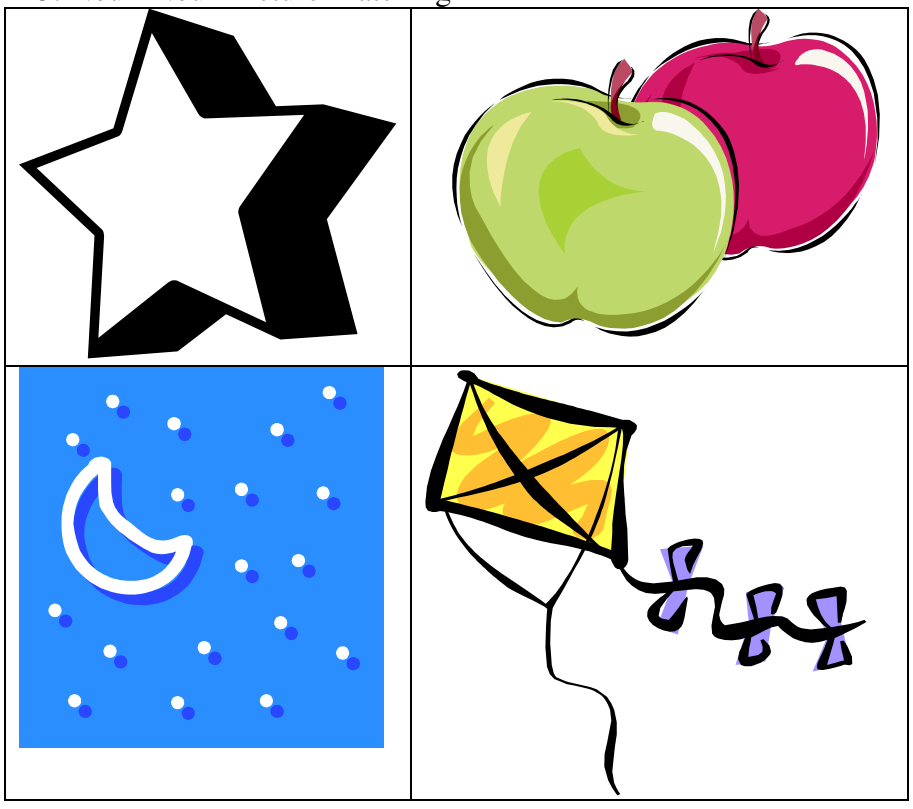
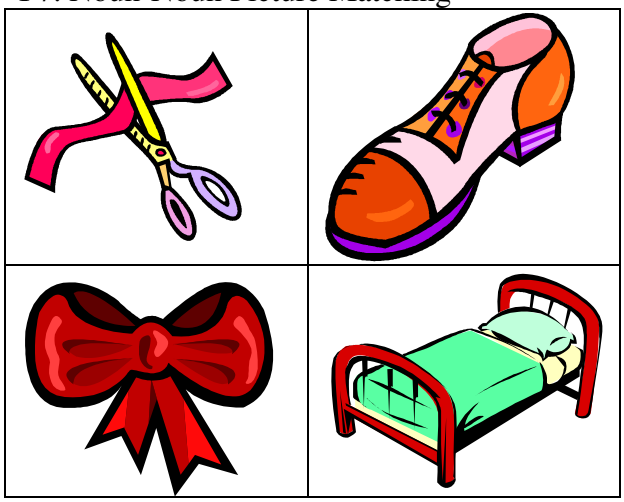


I 5. Noun-Noun Picture Matching



I 6. Noun-Noun Picture Matching

I 7. Noun-Noun Picture Matching



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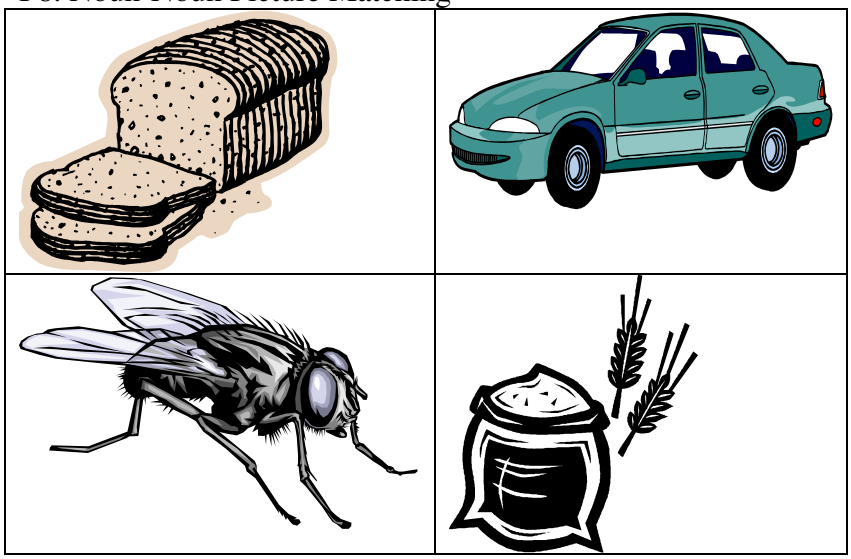
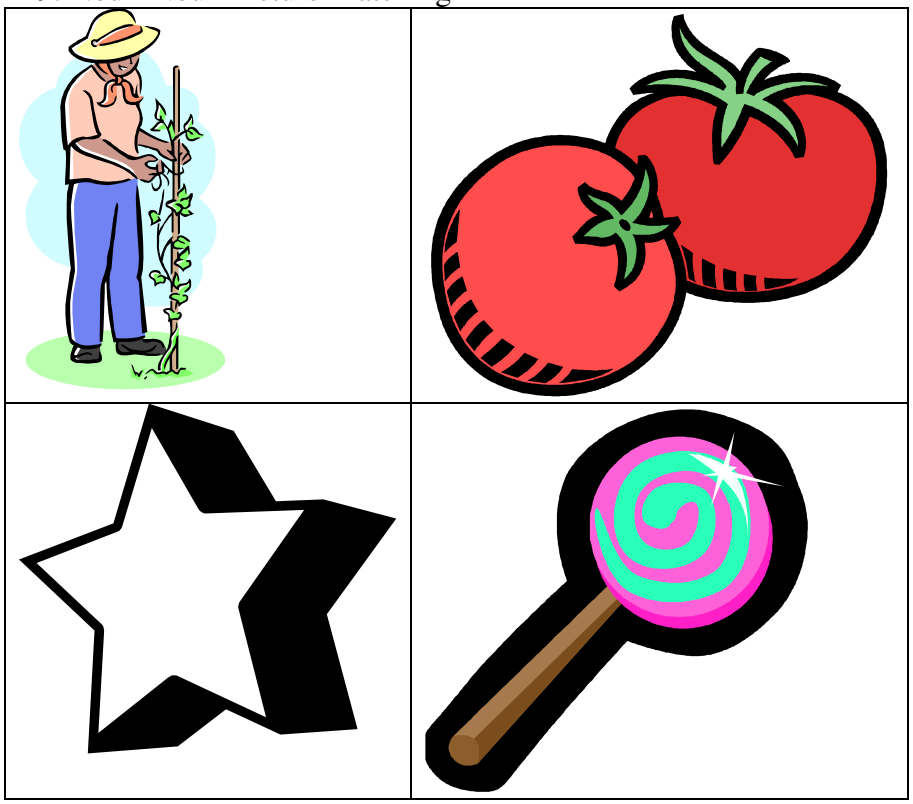
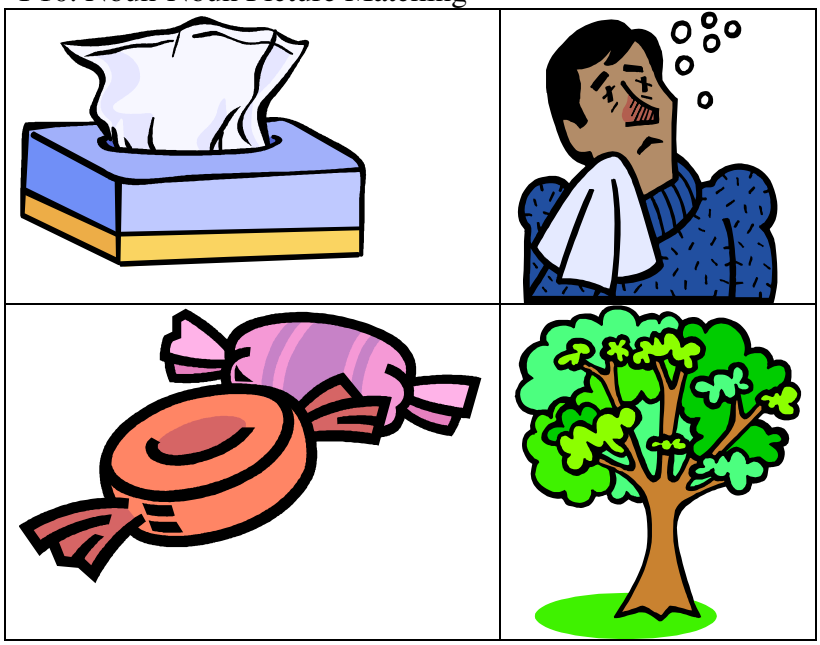


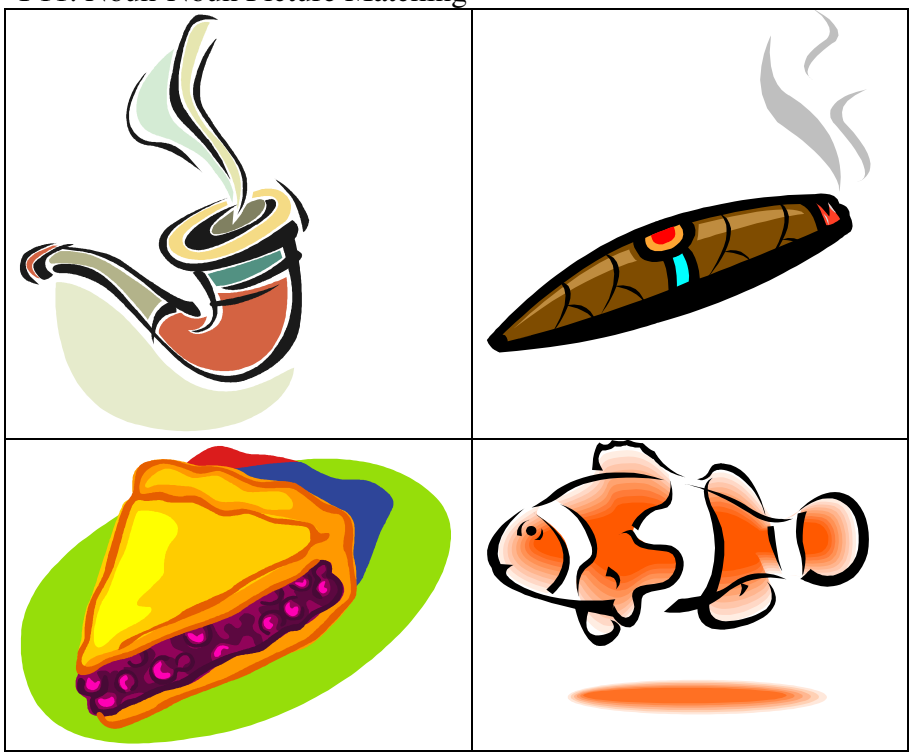
I 9. Noun-Noun Picture Matching



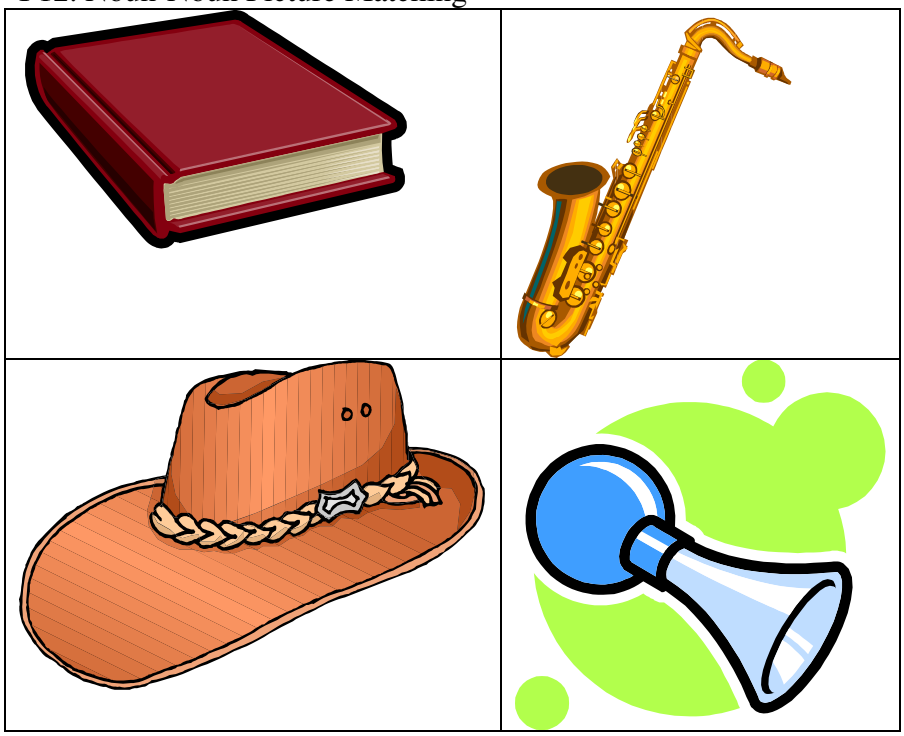
I 10. Noun-Noun Picture Matching



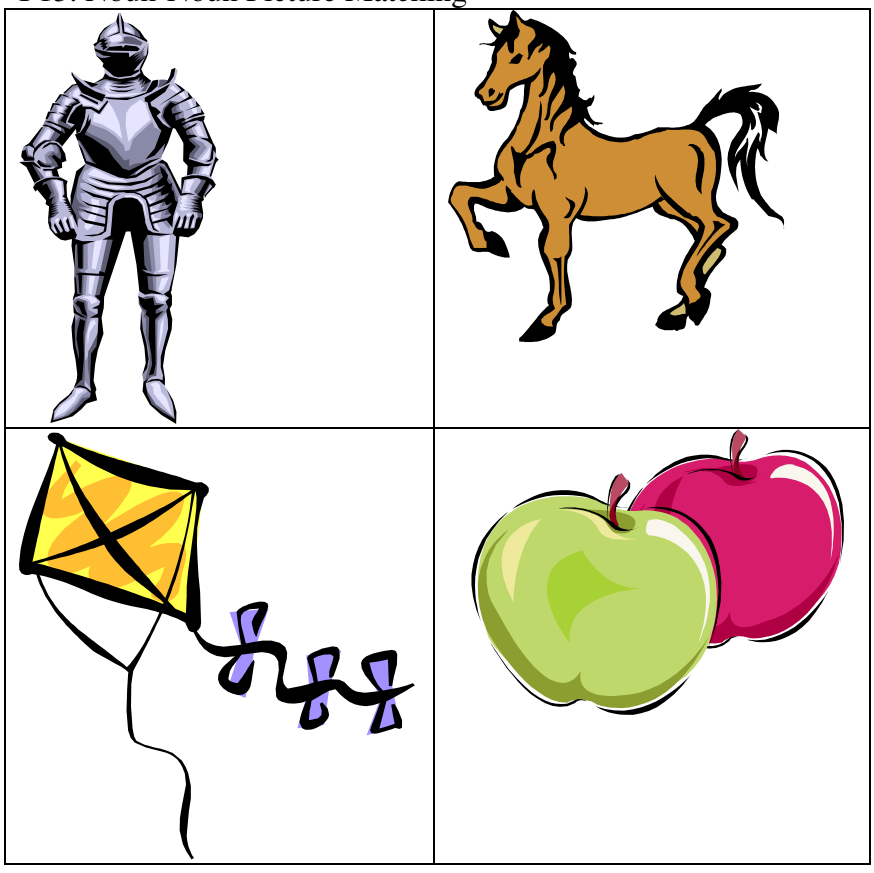
I 11. Noun-Noun Picture Matching



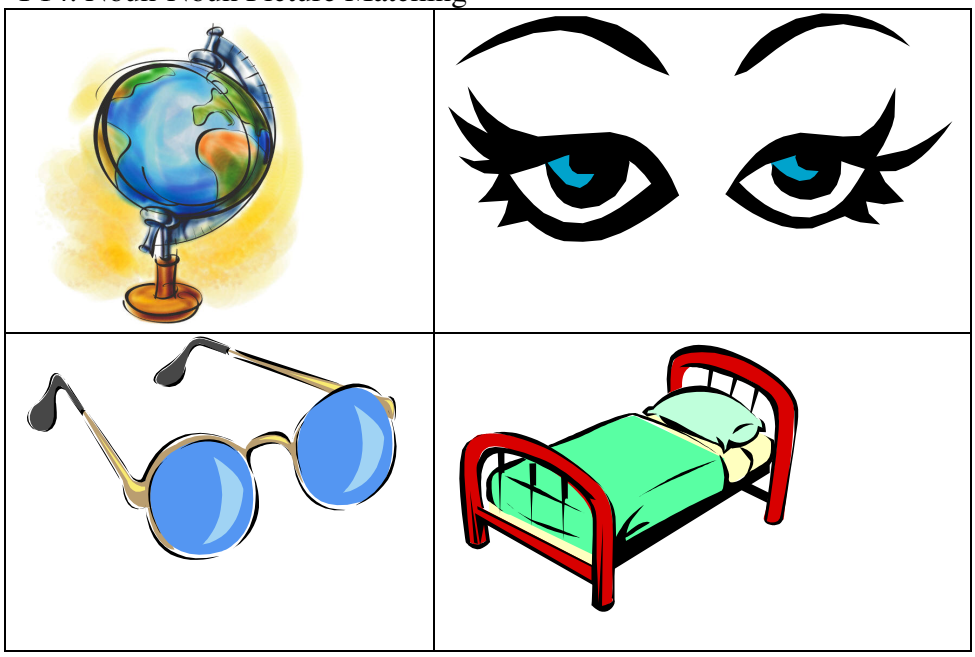
I 12. Noun-Noun Picture Matching



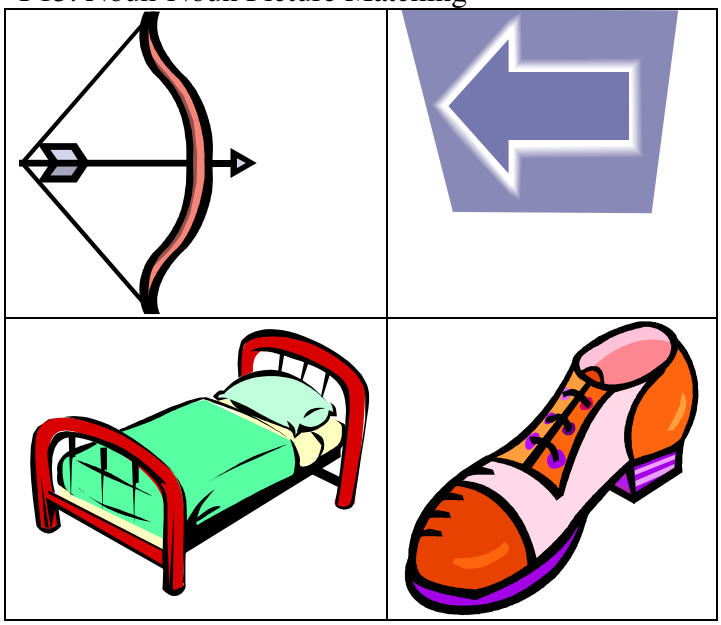
I 13. Noun-Noun Picture Matching



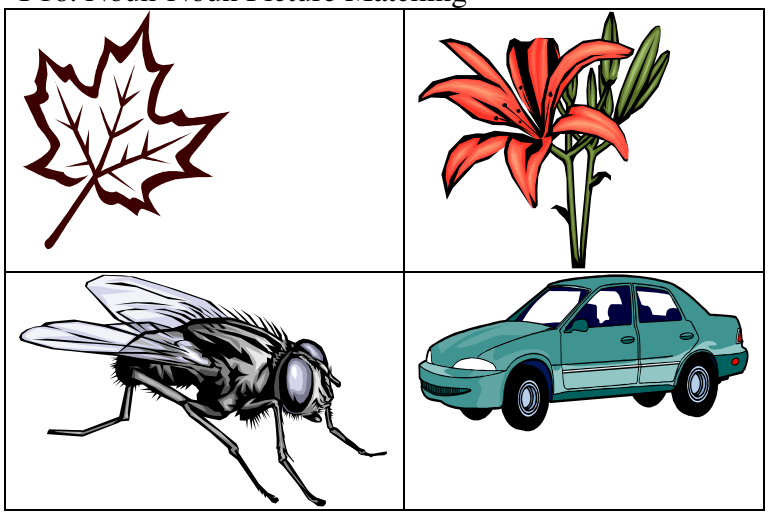
I 14. Noun-Noun Picture Matching



I 15. Noun-Noun Picture Matching



I 16. Noun-Noun Picture Matching

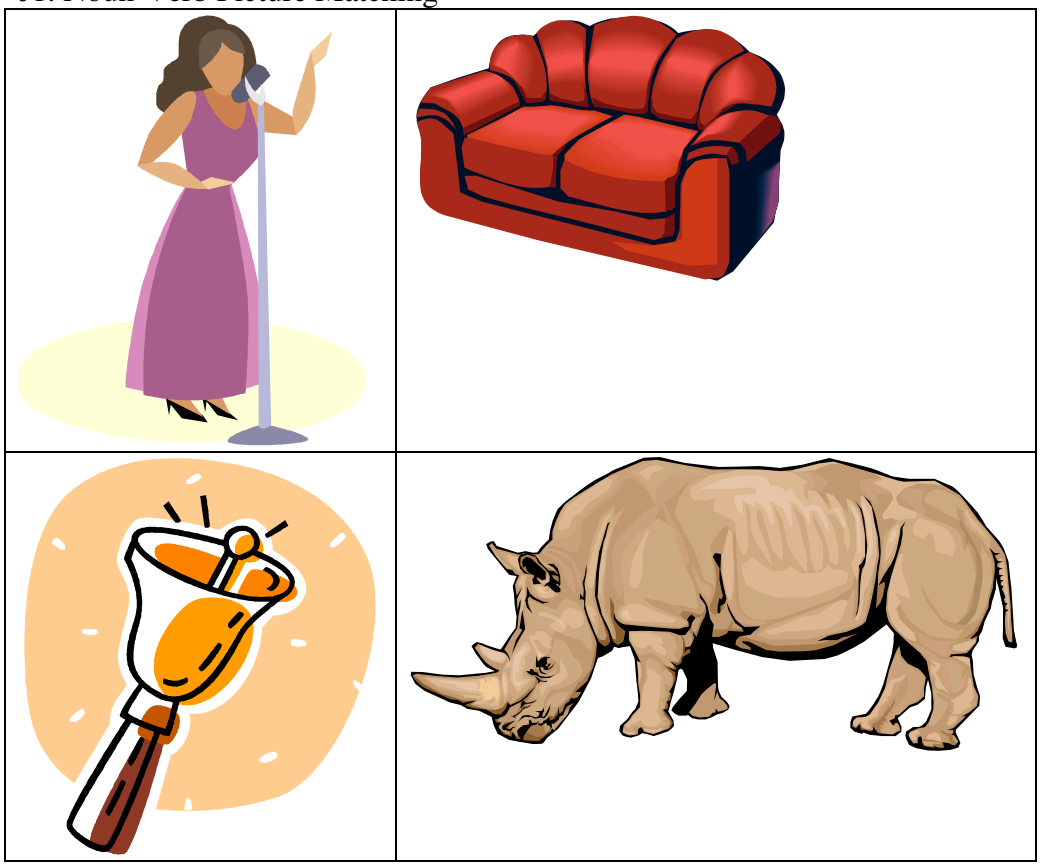


APPENDIX J

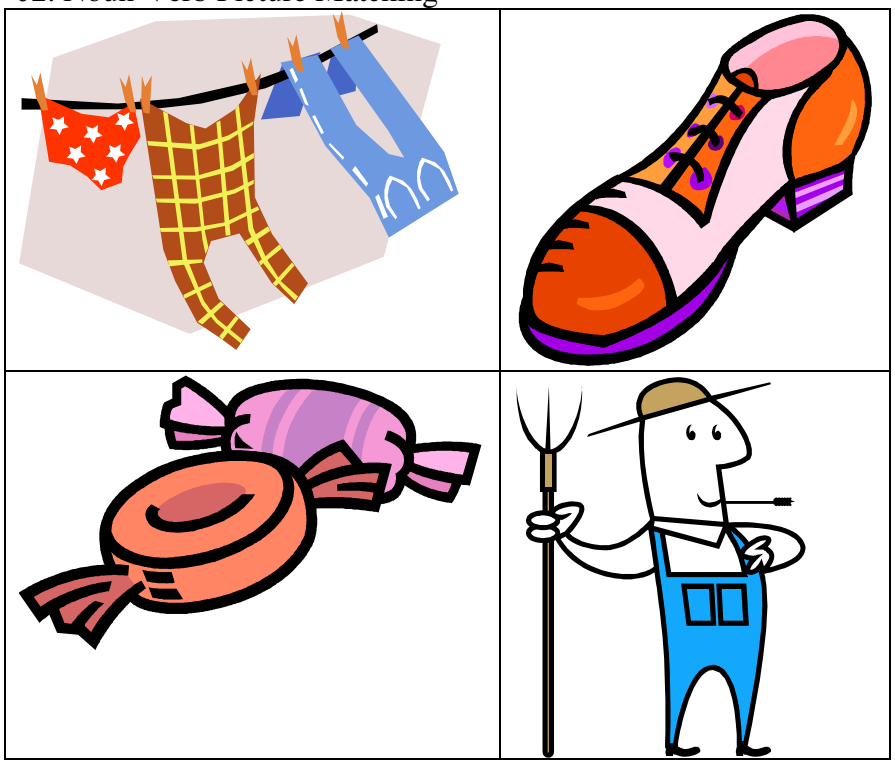
POST-TEST NOUN-VERB HOMOPHONE PICTURE MATCHING TASK

	NV	**semantic**	**phonemic**	**irrelevant**
postPMT1NV	**ring**	sing	rhinoceros	couch
postPMT2NV	**clothes**	shoe	candy	farmer
postPMT3NV	**wait**	bus	whale	tomatoes
postPMT4NV	**meat**	sandwich	money	stroller
postPMT5NV	**punch**	fist	pizza	iron
postPMT6NV	**blue**	crayon	baby	ice cream
postPMT7NV	**tie**	shoe	pie	kite
postPMT8NV	**sink**	faucet	snowflake	table
postPMT9NV	**ring**	hand	rhinoceros	couch
postPMT10NV	**close**	key	candy	farmer
postPMT11NV	**weight**	towel	whale	tomatoes
postPMT12NV	**meet**	coffee	money	stroller
postPMT13NV	**punch**	glasses	pizza	iron
postPMT14NV	**blew**	hat	baby	ice cream
postPMT15NV	**tie**	shirt	pie	kite
postPMT16NV	**sink**	shell	snowflake	table

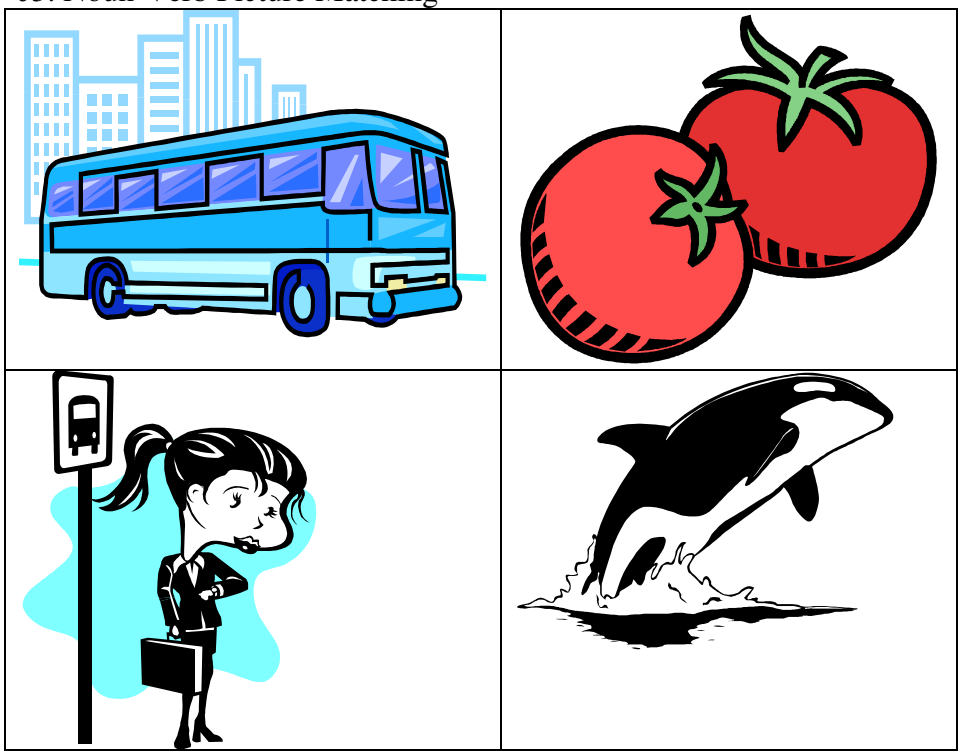
J1. Noun-Verb Picture Matching



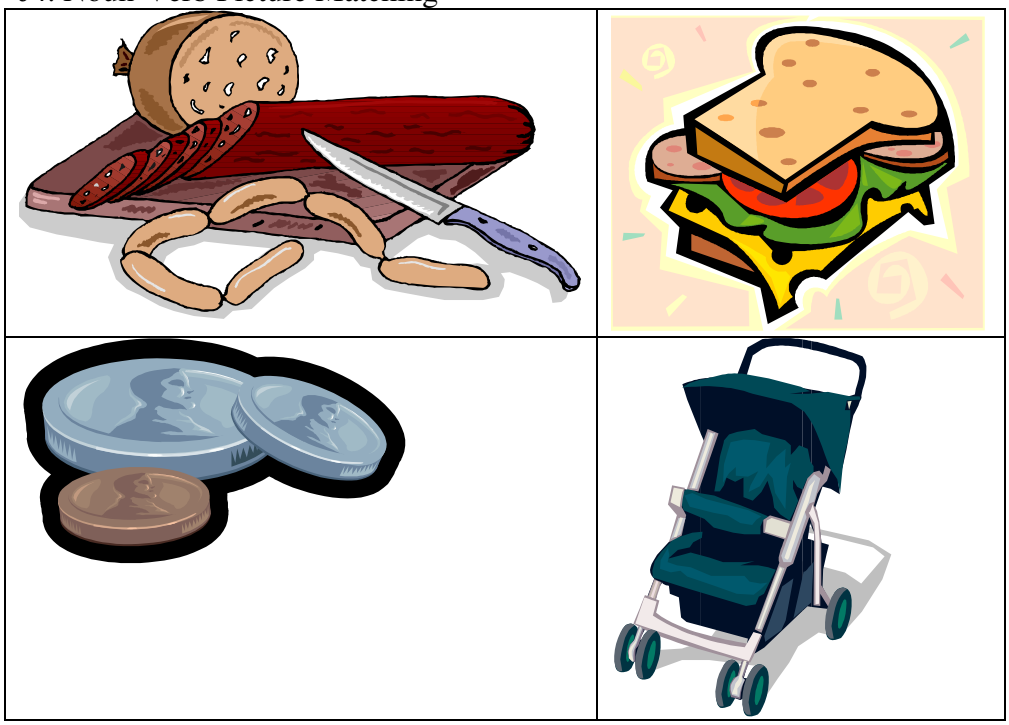
J2. Noun-Verb Picture Matching



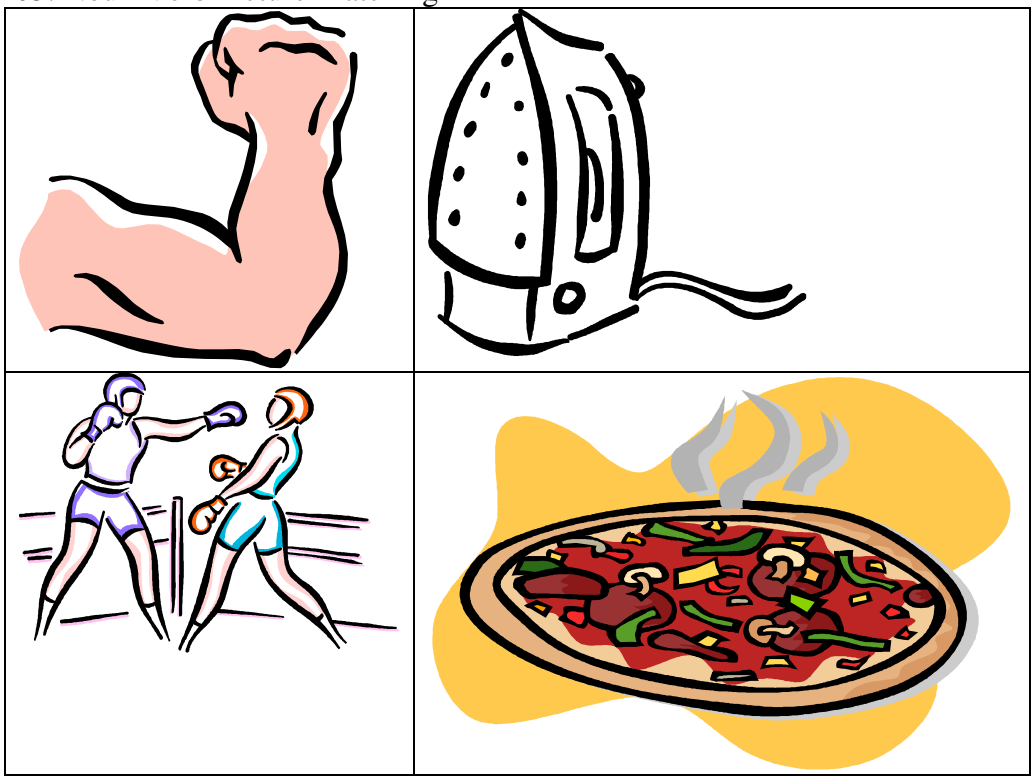
J3. Noun-Verb Picture Matching



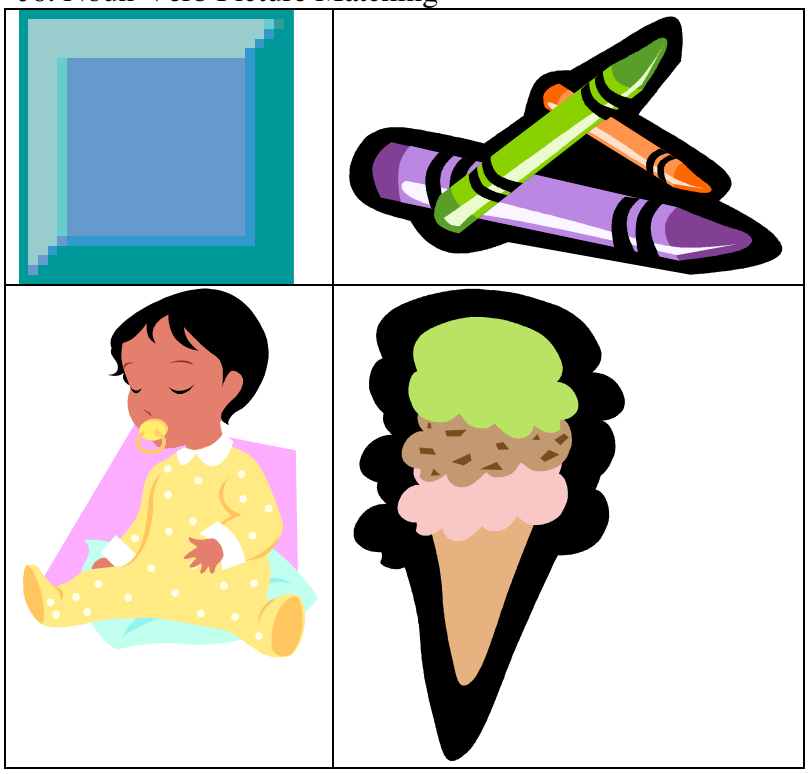
J4. Noun-Verb Picture Matching



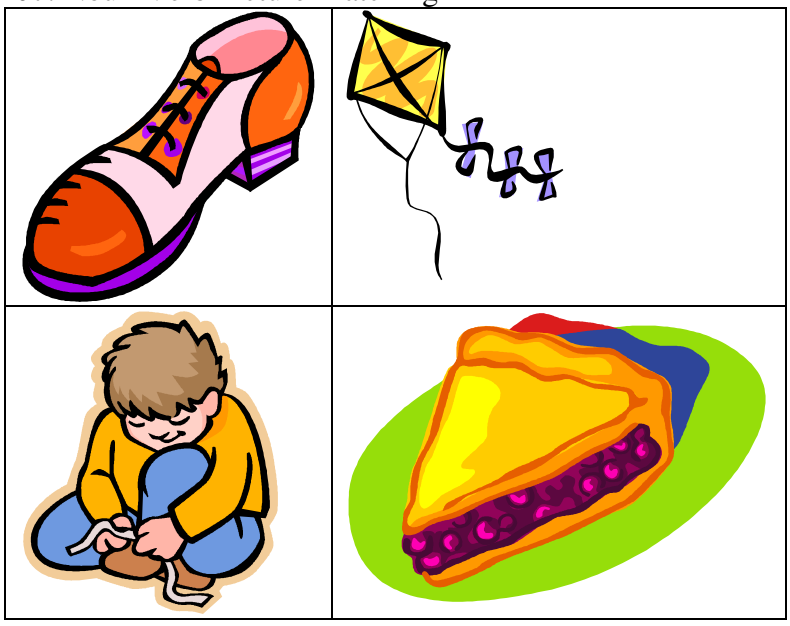
J5. Noun-Verb Picture Matching



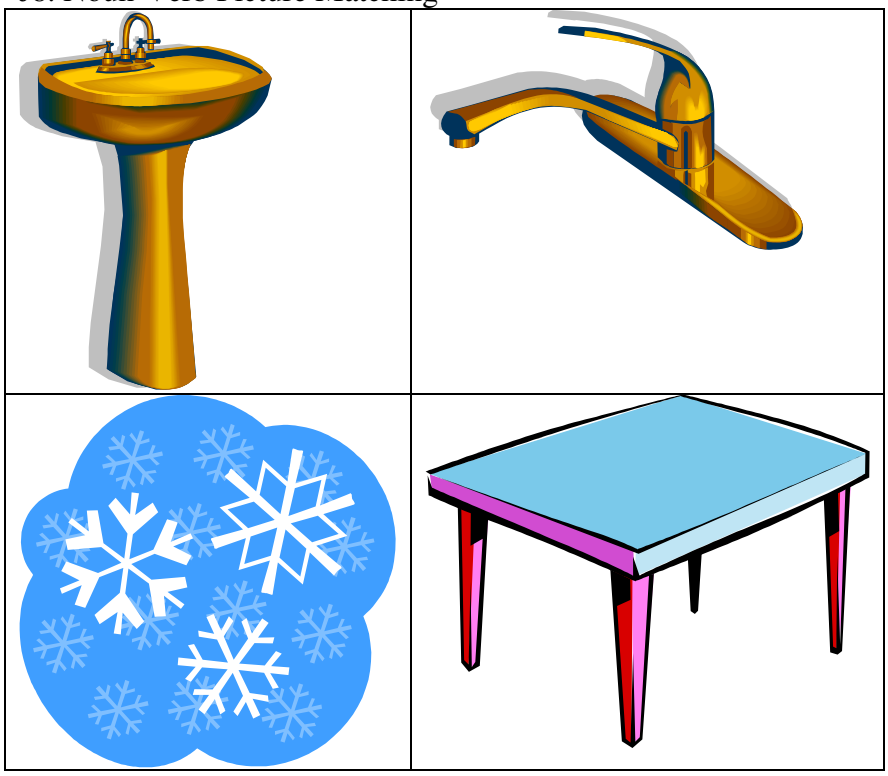
J6. Noun-Verb Picture Matching



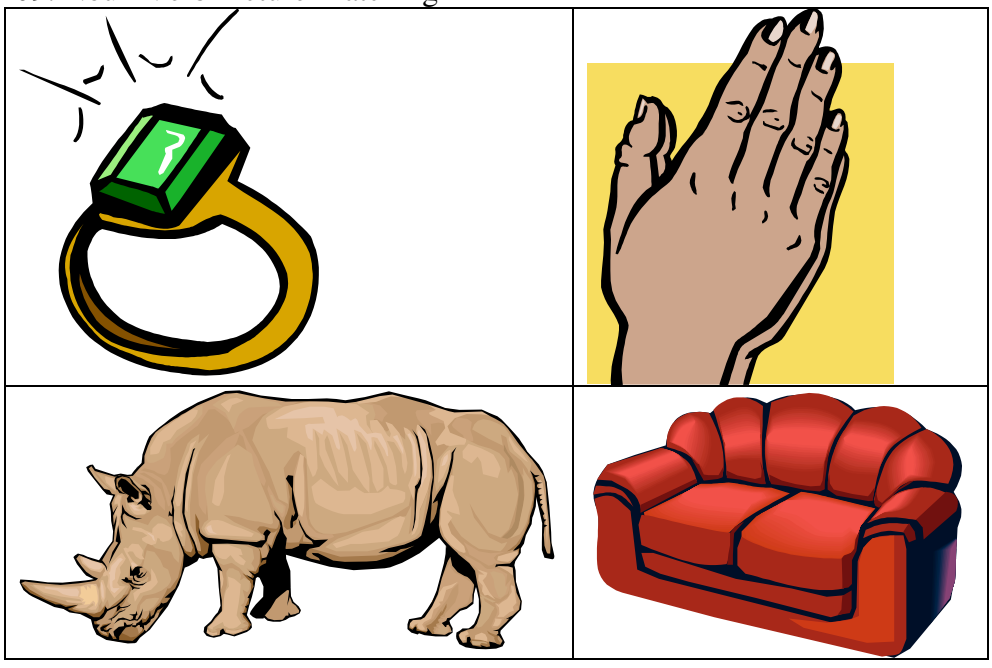
J7. Noun-Verb Picture Matching



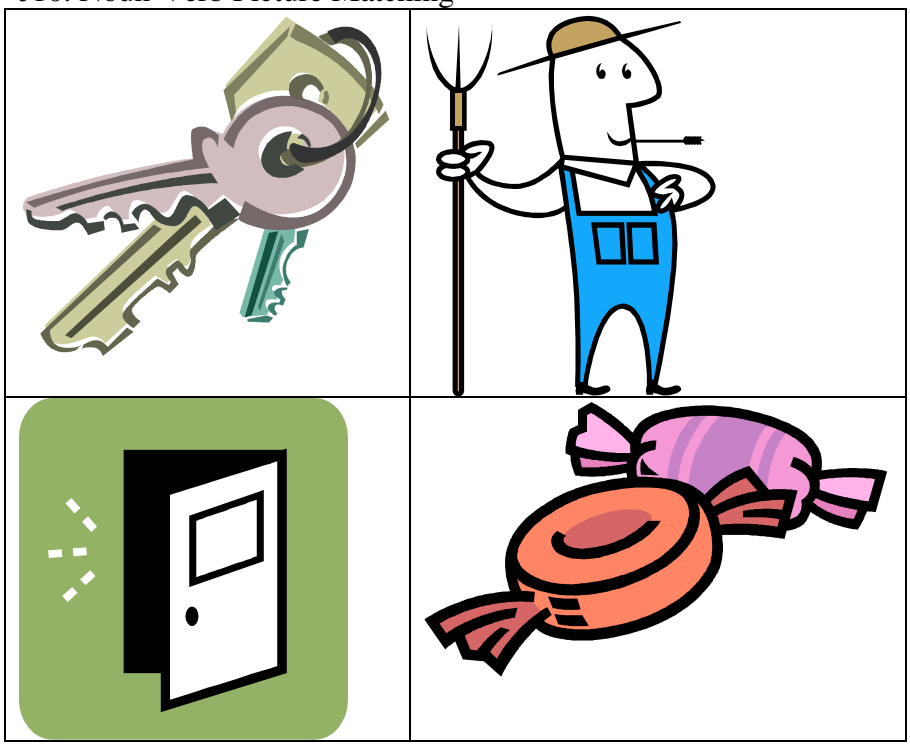
J8. Noun-Verb Picture Matching



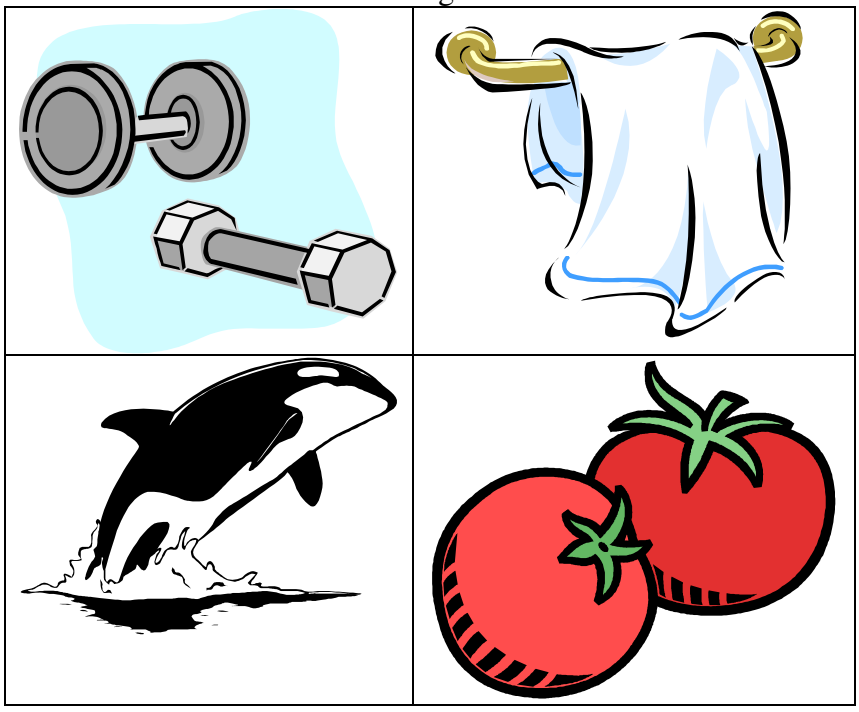
J9. Noun-Verb Picture Matching



J10. Noun-Verb Picture Matching

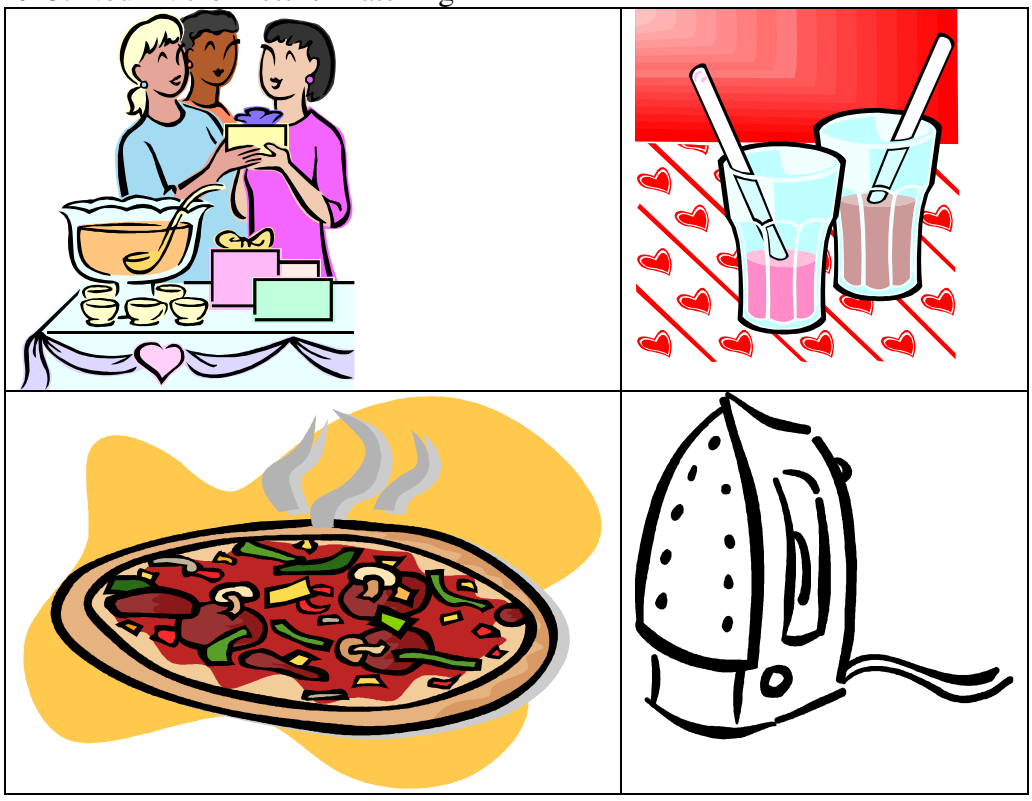


J11. Noun-Verb Picture Matching

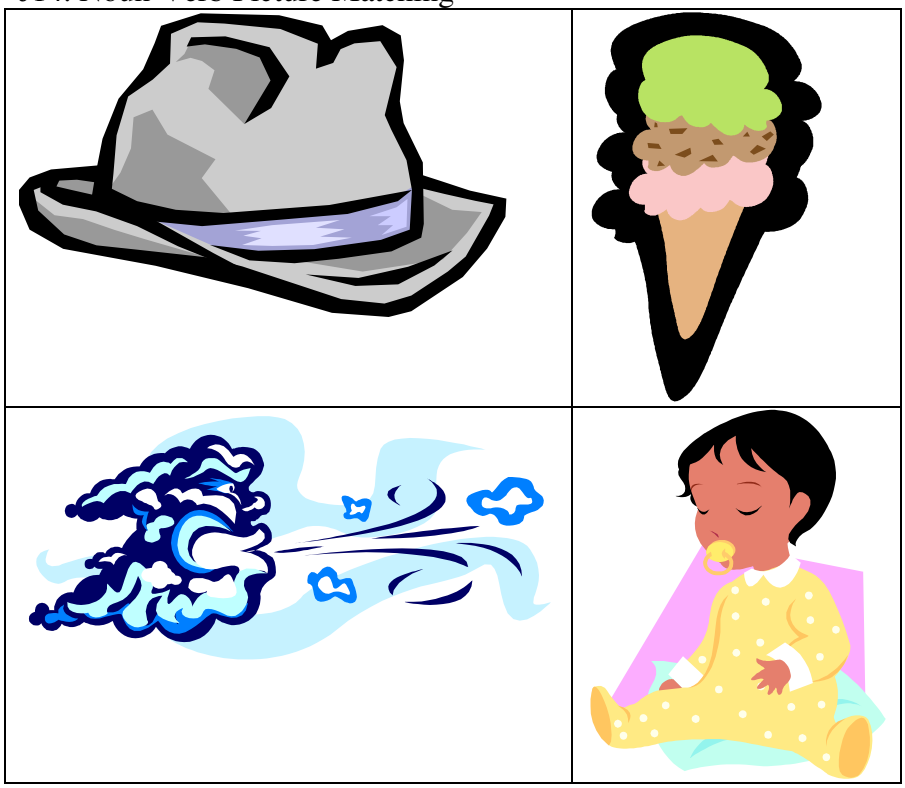


J12. Noun-Verb Picture Matching

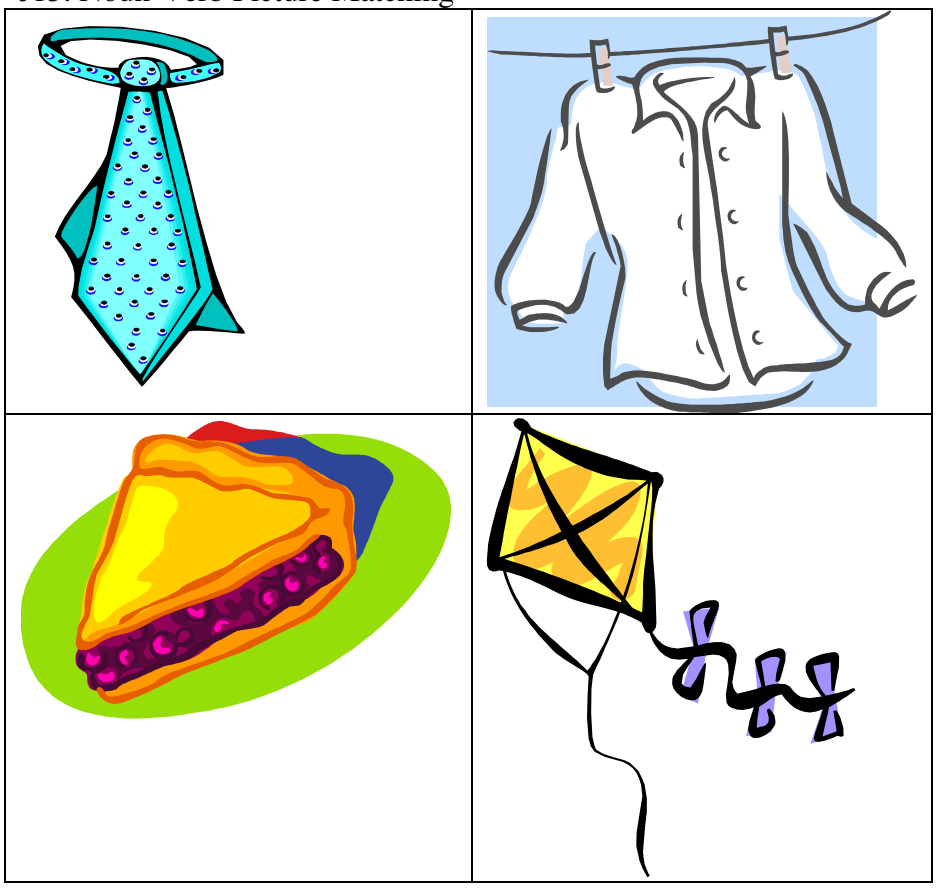
J13. Noun-Verb Picture Matching



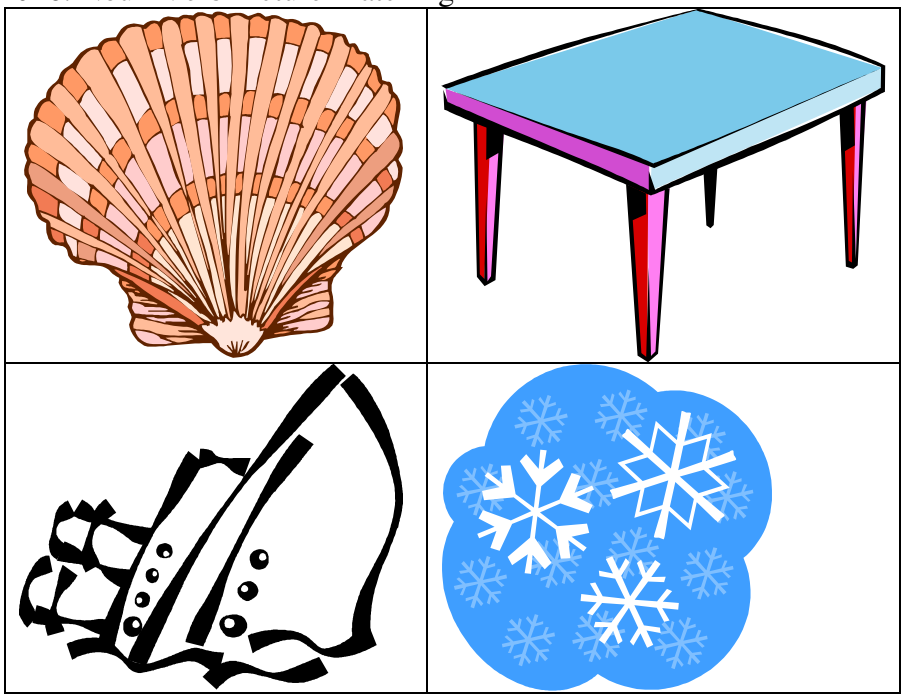
J14. Noun-Verb Picture Matching



J15. Noun-Verb Picture Matching



J16. Noun-Verb Picture Matching

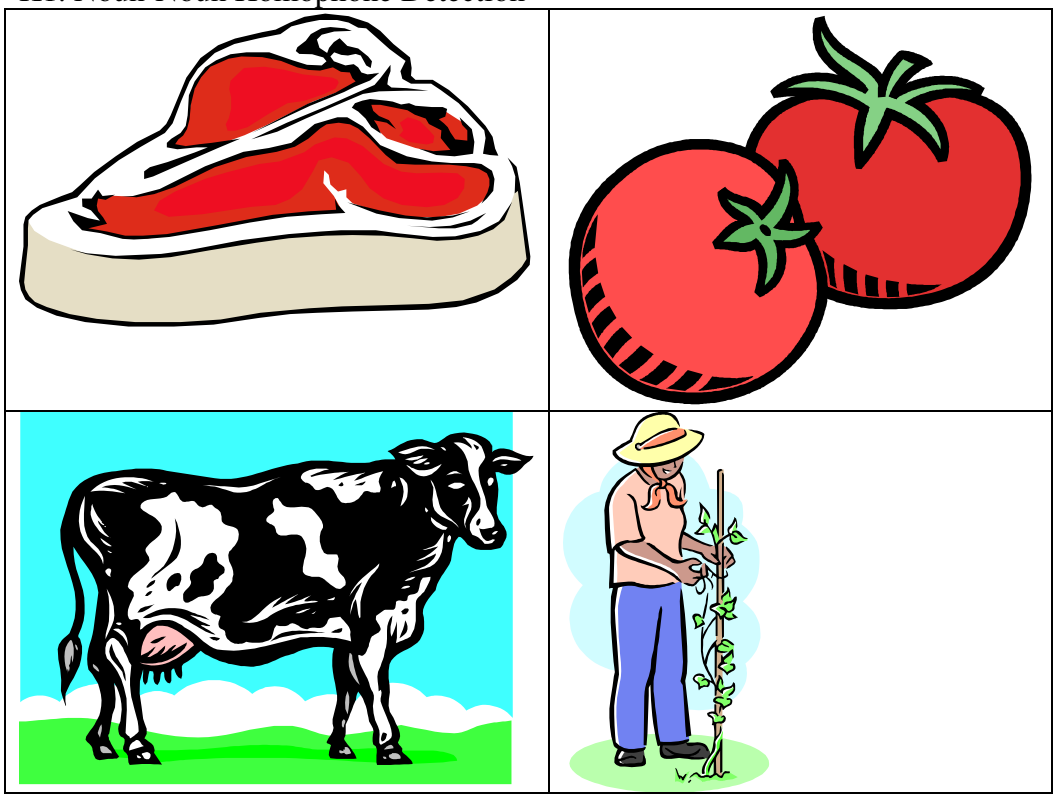


APPENDIX K

POST-TEST NOUN-NOUN HOMOPHONE DETECTION TASK

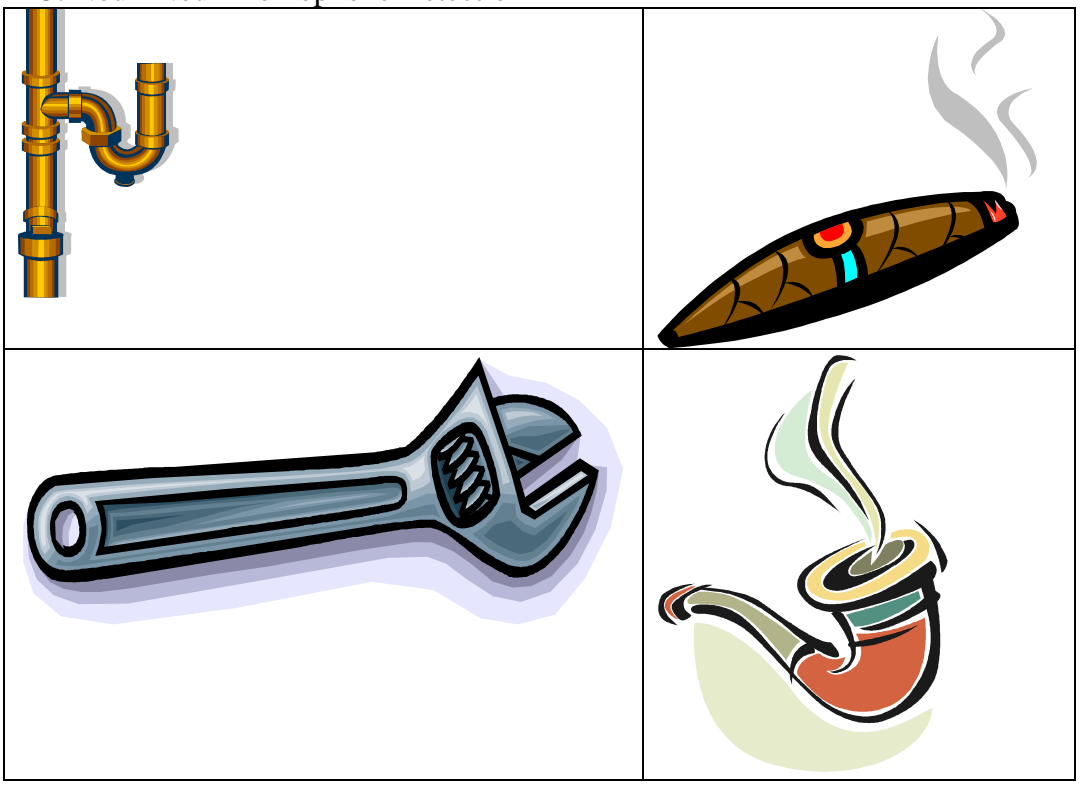
postHD1NN	**steak**	tomatoes	**stake**	cow
postHD2NN	**cold**	mittens	**cold**	tissues
postHD3NN	**pipe**	cigar	**pipe**	wrench
postHD4NN	**horn**	saxophone	**horn**	rabbit
postHD5NN	**night**	horse	**knight**	star
postHD6NN	**glasses**	eyes	**glasses**	pitcher
postHD7NN	**bow**	arrow	**bow**	scissors
postHD8NN	**flour**	leaf	**flower**	bread

K1. Noun-Noun Homophone Detection

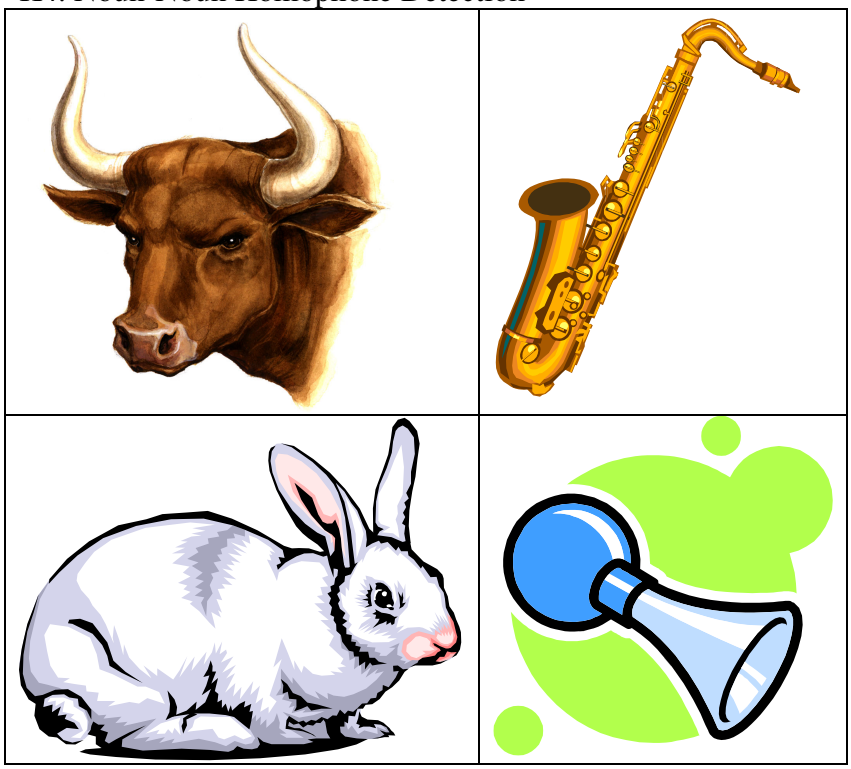


K2. Noun-Noun Homophone Detection

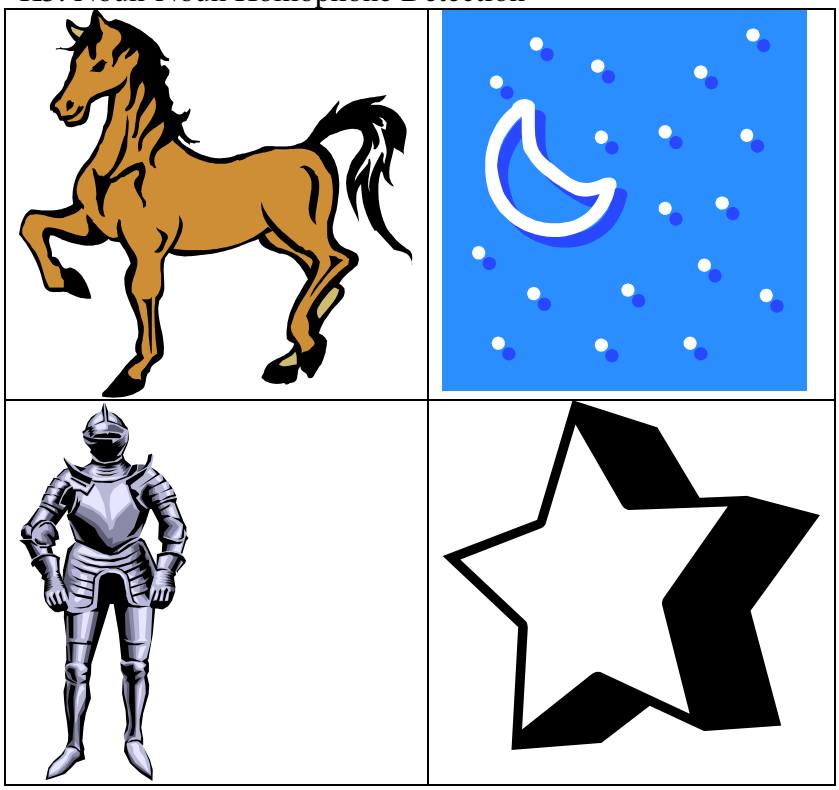
K3. Noun-Noun Homophone Detection



K4. Noun-Noun Homophone Detection

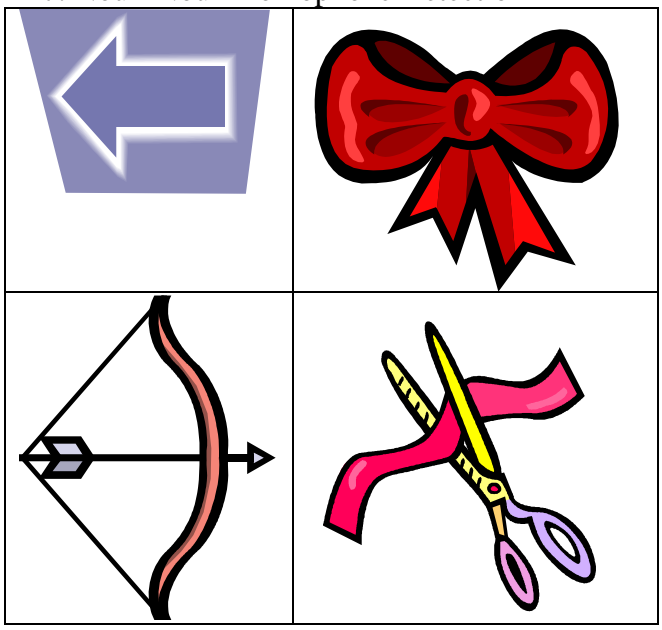


K5. Noun-Noun Homophone Detection

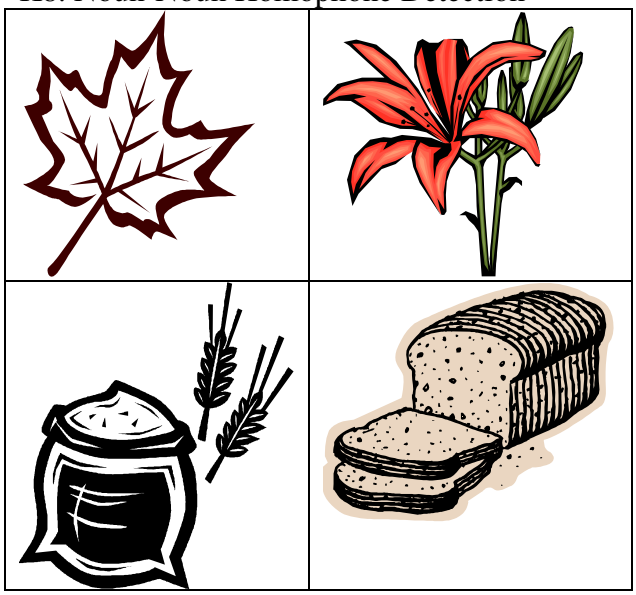


K6. Noun-Noun Homophone Detection

K7. Noun-Noun Homophone Detection



K8. Noun-Noun Homophone Detection



APPENDIX L

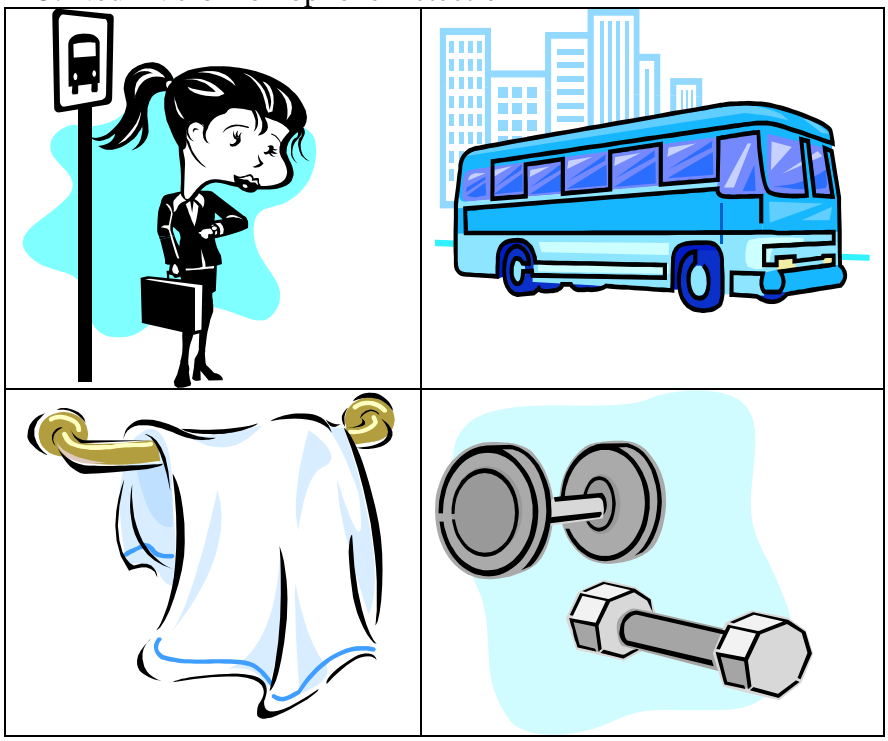
POST-TEST NOUN-VERB HOMOPHONE DETECTION TASK

postHD1NV	**ring**	sing	**ring**	hands
postHD2NV	**close**	key	**clothes**	shoe
postHD3NV	**wait**	bus	**weight**	towel
postHD4NV	**meet**	coffee	**meat**	sandwich
postHD5NV	**punch**	arm	**punch**	glasses
postHD6NV	**blew**	hat	**blue**	crayons
postHD7NV	**tie**	shoe	**tie**	shirt
postHD8NV	**sink**	shell	**sink**	faucet

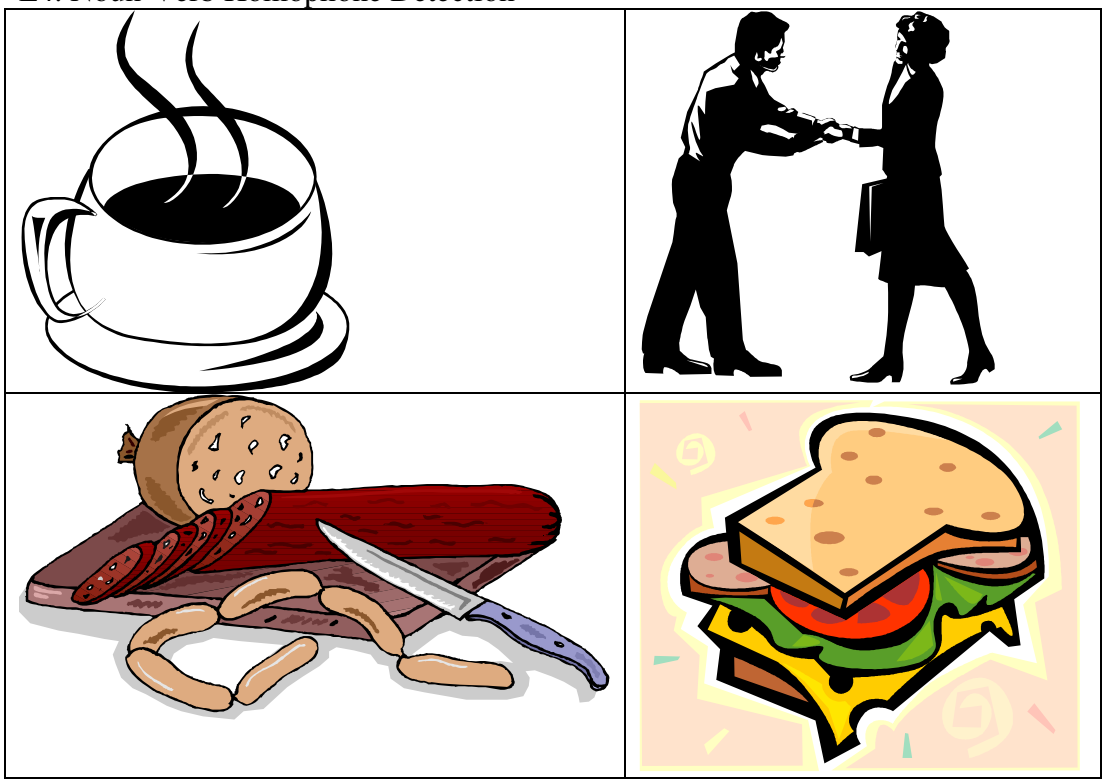
L1. Noun-Verb Homophone Detection

L2. Noun-Verb Homophone Detection

L3. Noun-Verb Homophone Detection



L4. Noun-Verb Homophone Detection

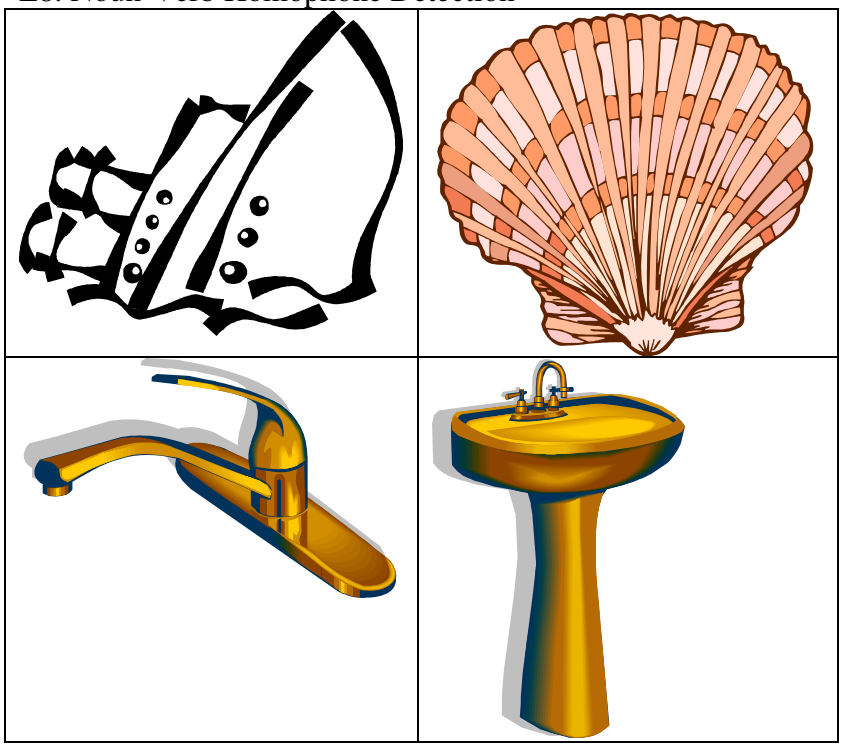


L5. Noun-Verb Homophone Detection

L6. Noun-Verb Homophone Detection

L7. Noun-Verb Homophone Detection

L8. Noun-Verb Homophone Detection



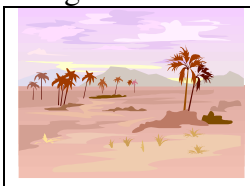
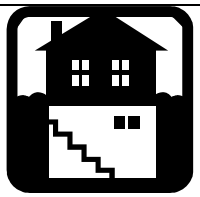
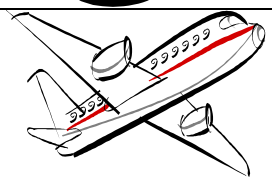
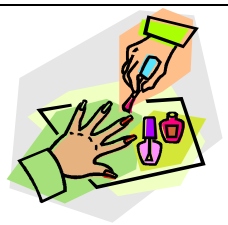
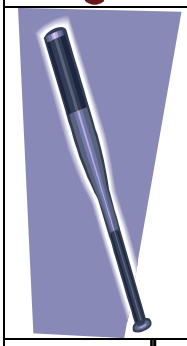
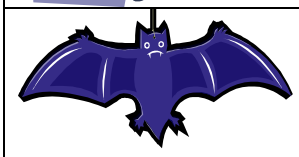
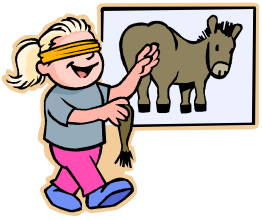
APPENDIX M

BINGO WITH NOUN-NOUN HOMOPHONE PAIRS

BAT
CELLAR/SELLER
STRAW
SON/SUN
NAILS
PRINTS/PRINCE
TAIL/TALE
PLAIN/PLANE

Bingo with Noun-Noun Homophone Pairs (1 of 9)

Bingo with Noun-Noun Homophone Pairs (2 of 9)

Bingo with Noun-Noun Homophone Pairs (3 of 9)

Bingo with Noun-Noun Homophone Pairs (4 of 9)

Bingo with Noun-Noun Homophone Pairs (5 of 9)

Bingo with Noun-Noun Homophone Pairs (6 of 9)

Bingo with Noun-Noun Homophone Pairs (7 of 9)

Bingo with Noun-Noun Homophone Pairs (8 of 9)

Bingo with Noun-Noun Homophone Pairs (9 of 9)

APPENDIX N

BINGO WITH NOUN-VERB HOMOPHONE PAIRS

RED/READ
ROAD/RODE
REINS/RAINS
SORE/SOAR
ROLL
TOE/TOW
WAVE
ROCK

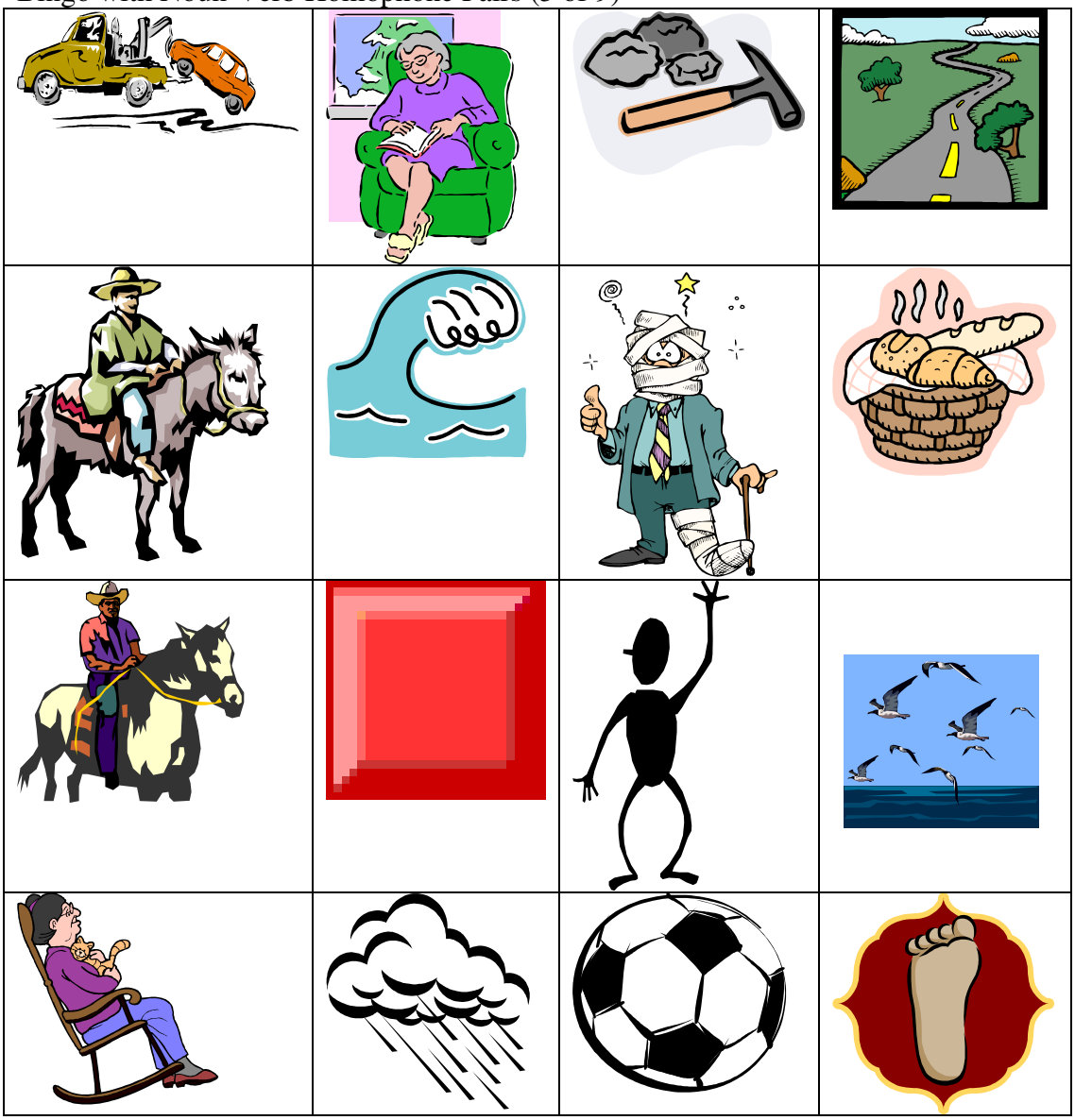
Bingo with Noun-Verb Homophone Pairs (1 of 9)

Bingo with Noun-Verb Homophone Pairs (2 of 9)

Bingo with Noun-Verb Homophone Pairs (3 of 9)

Bingo with Noun-Verb Homophone Pairs (4 of 9)

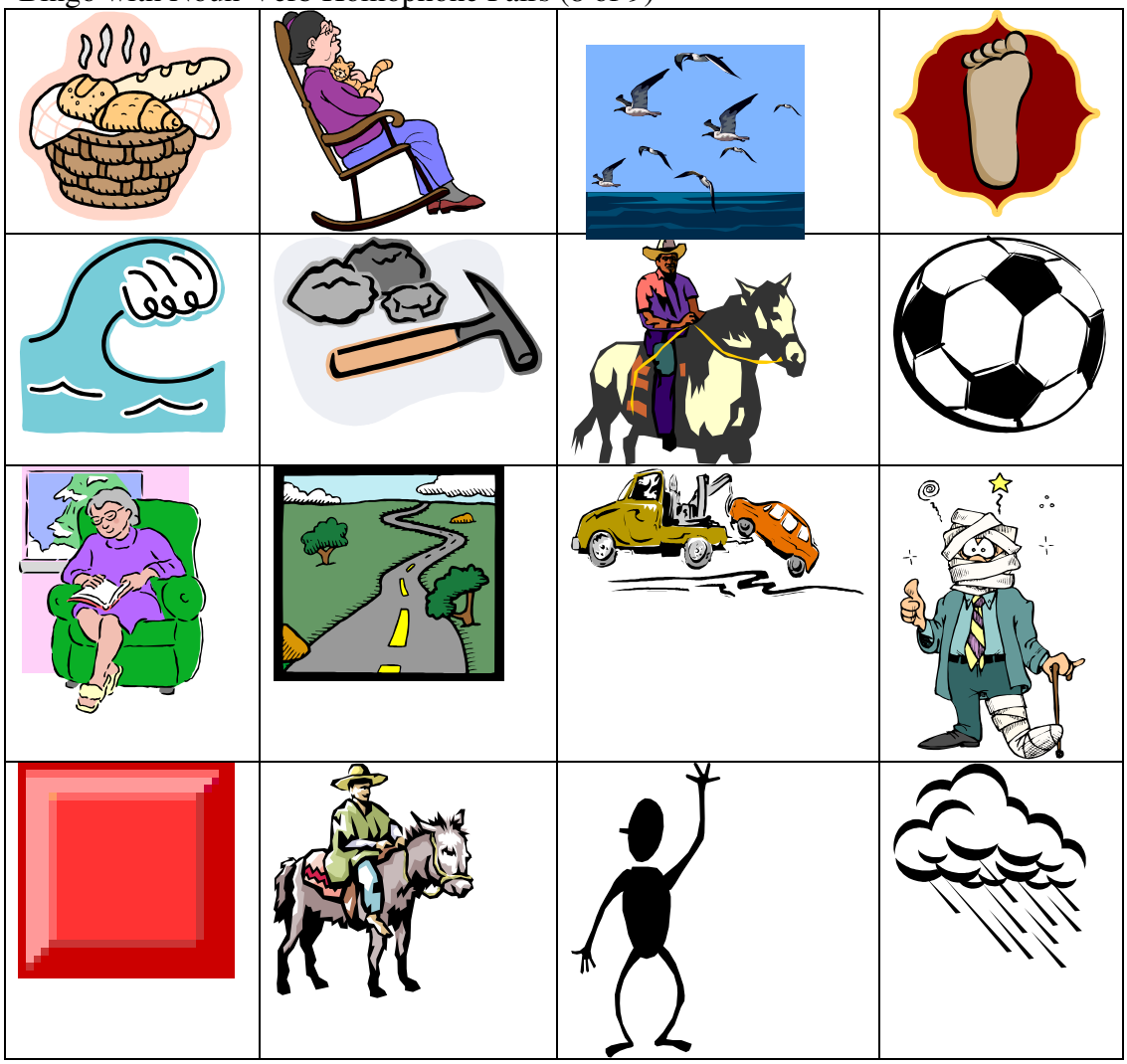
Bingo with Noun-Verb Homophone Pairs (5 of 9)



Bingo with Noun-Verb Homophone Pairs (6 of 9)

Bingo with Noun-Verb Homophone Pairs (7 of 9)

Bingo with Noun-Verb Homophone Pairs (8 of 9)



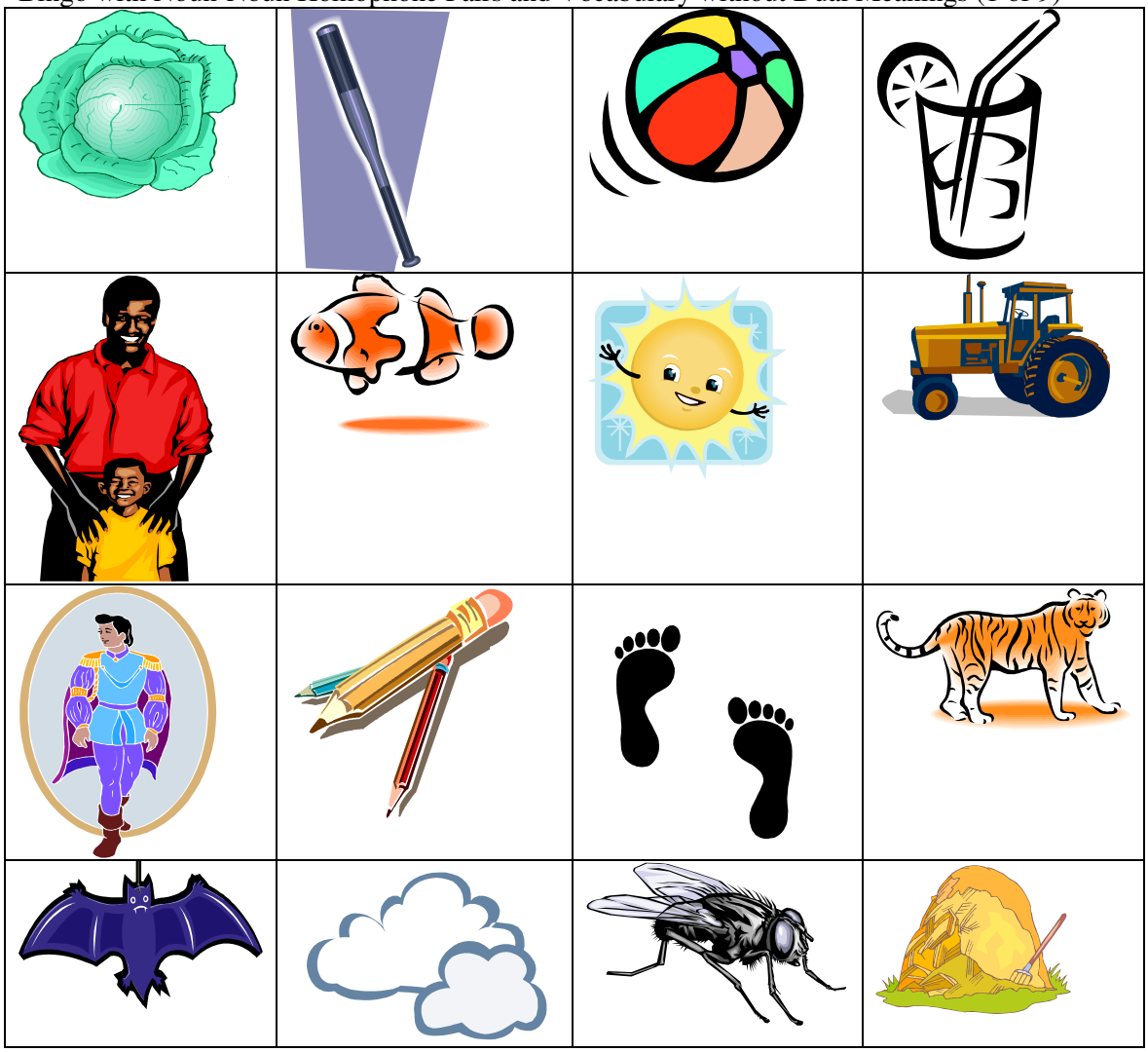
Bingo with Noun-Verb Homophone Pairs (9 of 9)

APPENDIX 0

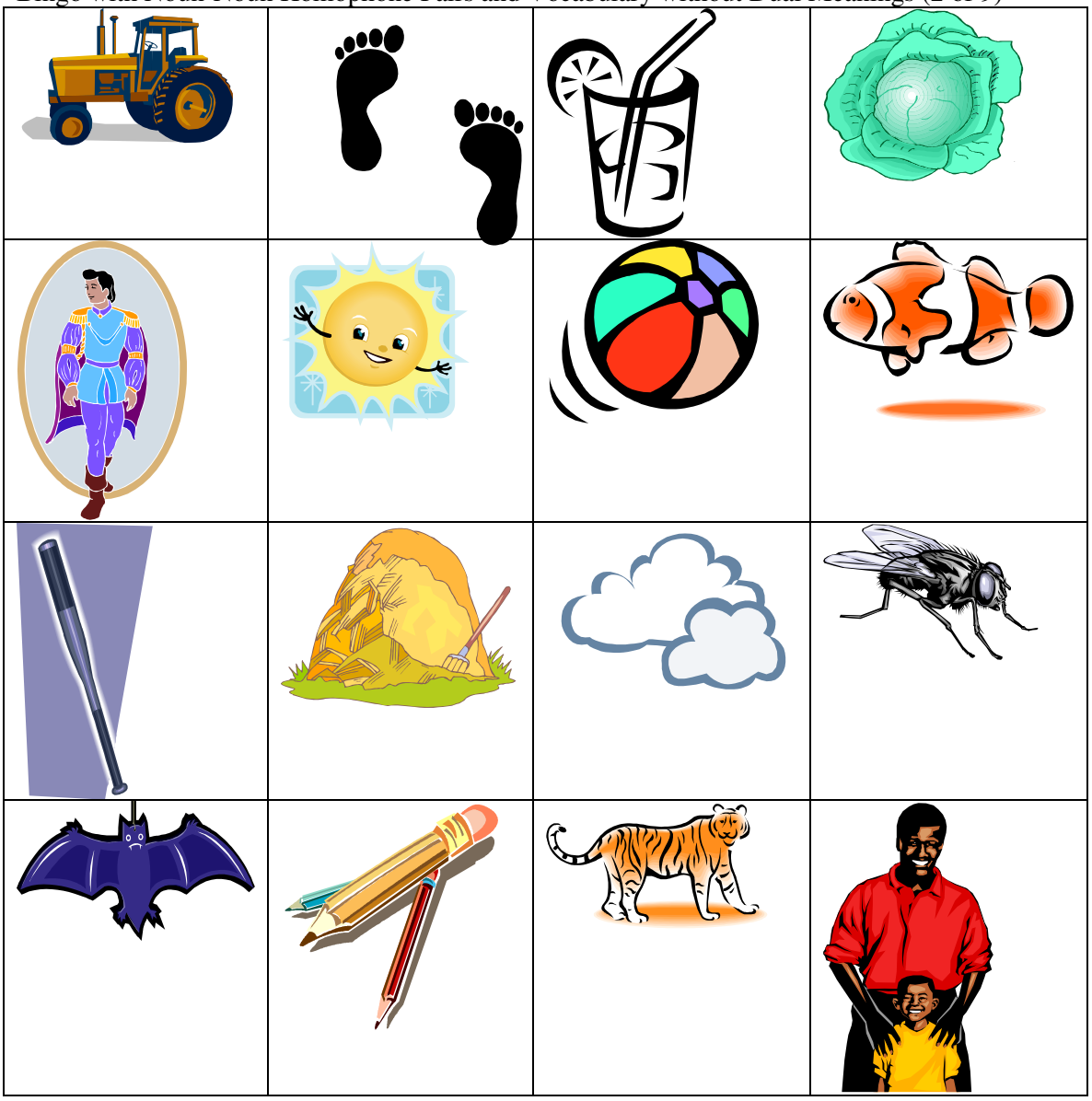
BINGO WITH NOUN-NOUN HOMOPHONE PAIRS AND VOCABULARY WITHOUT DUAL MEANINGS

BOARDS 1-4	**BOARDS 5-9**
BAT	PLAIN/PLANE
STRAW	TAIL/TALE
SON/SUN	CELLAR/SELLER
PRINTS/PRINCE	NAILS
cabbage	coconut
ball	elephant
fish	comb
tractor	web
bug	skunk
tiger	lightbulb
pencils	stamp
clouds	pretzel

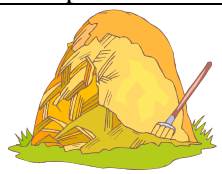
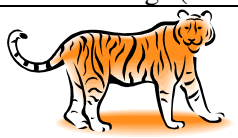
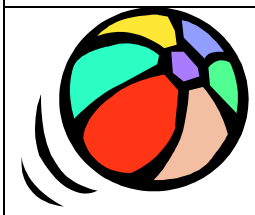
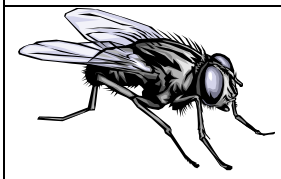
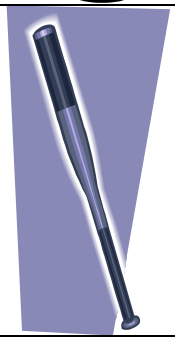
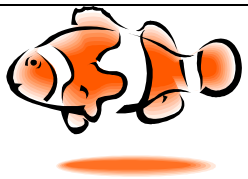
Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (1 of 9)



Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (2 of 9)

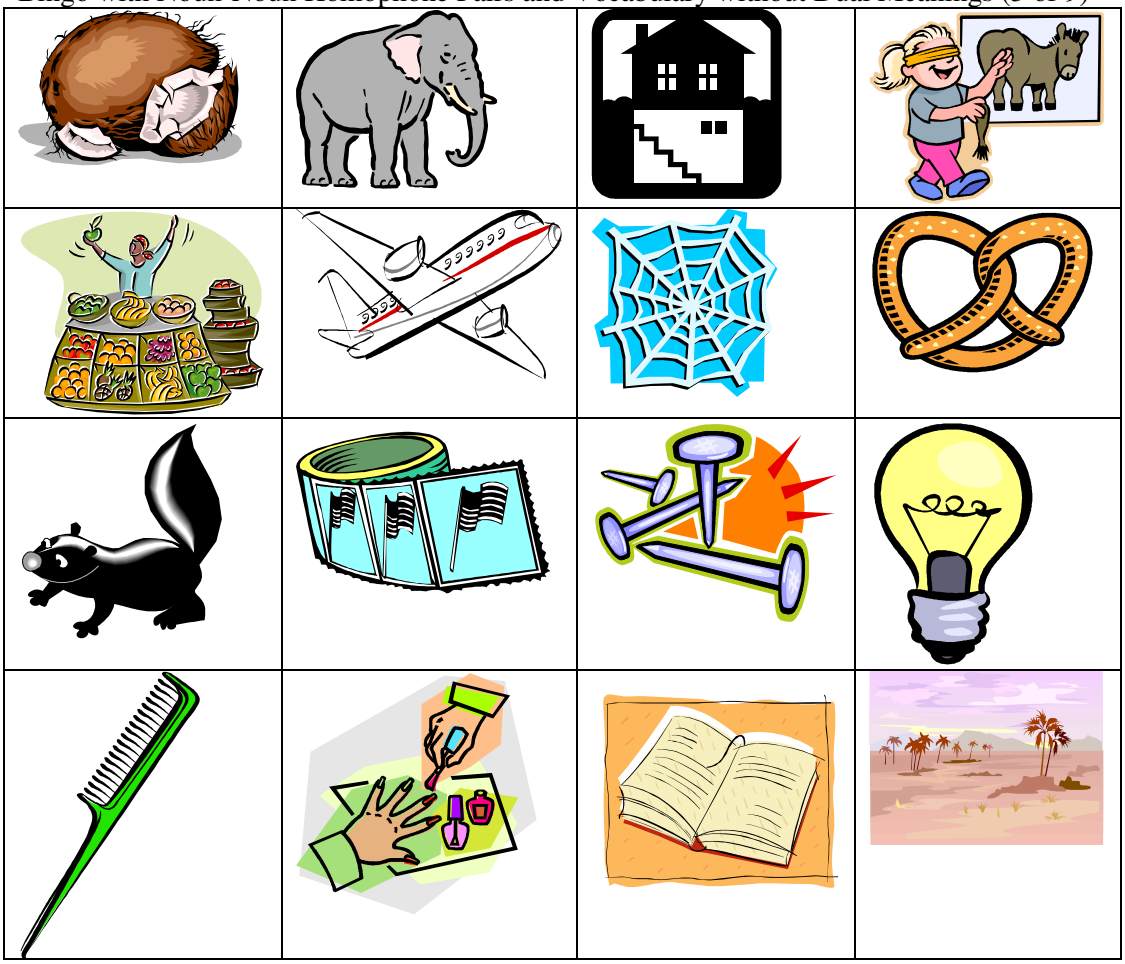


Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (3 of 9)

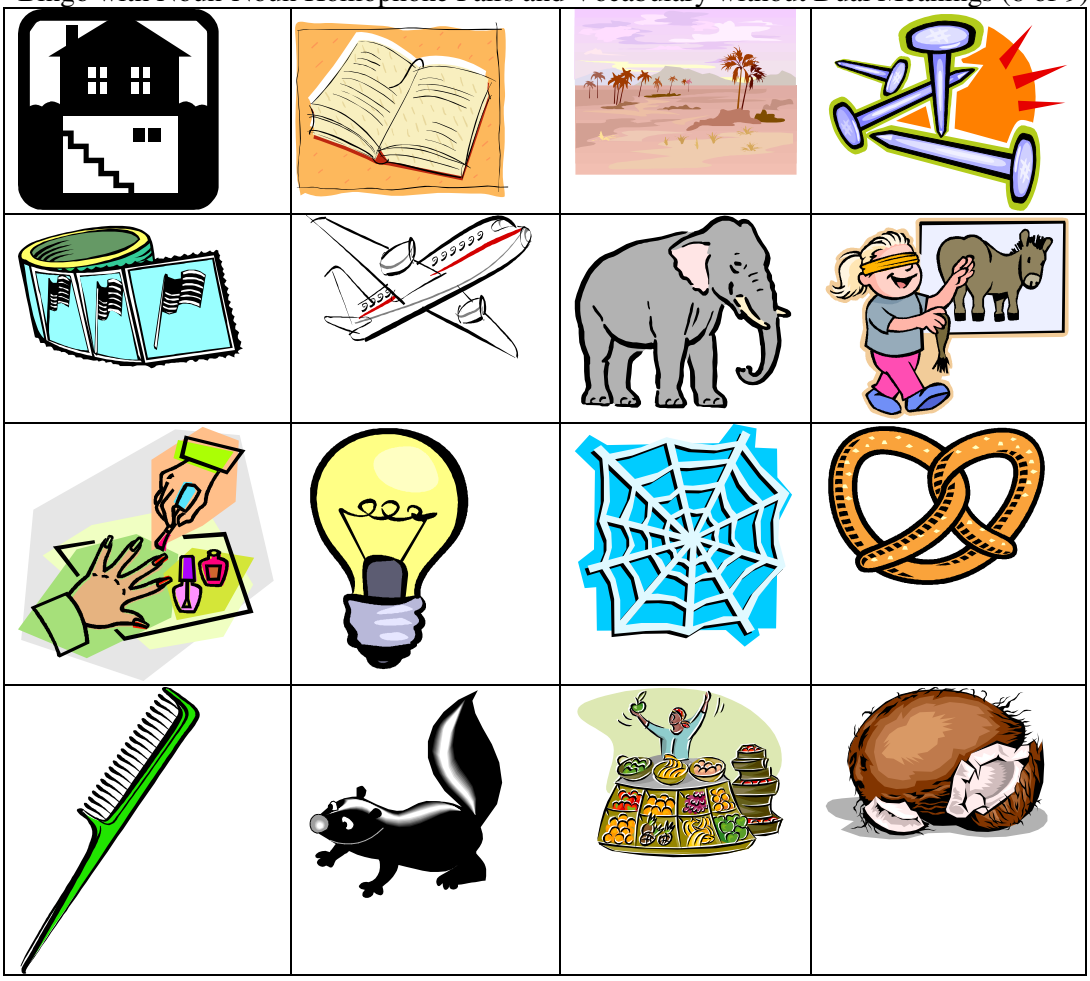
			
			
			
			

Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (4 of 9)

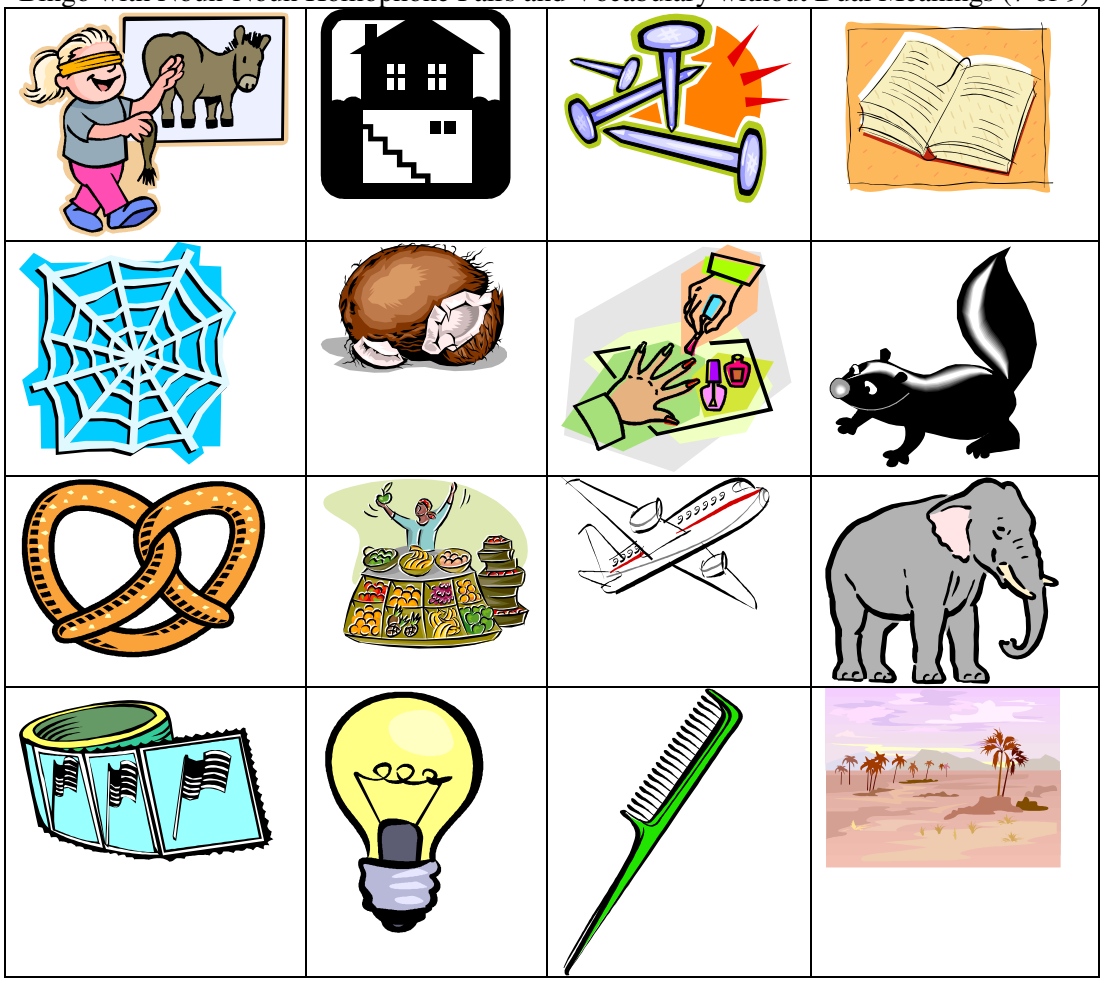
Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (5 of 9)



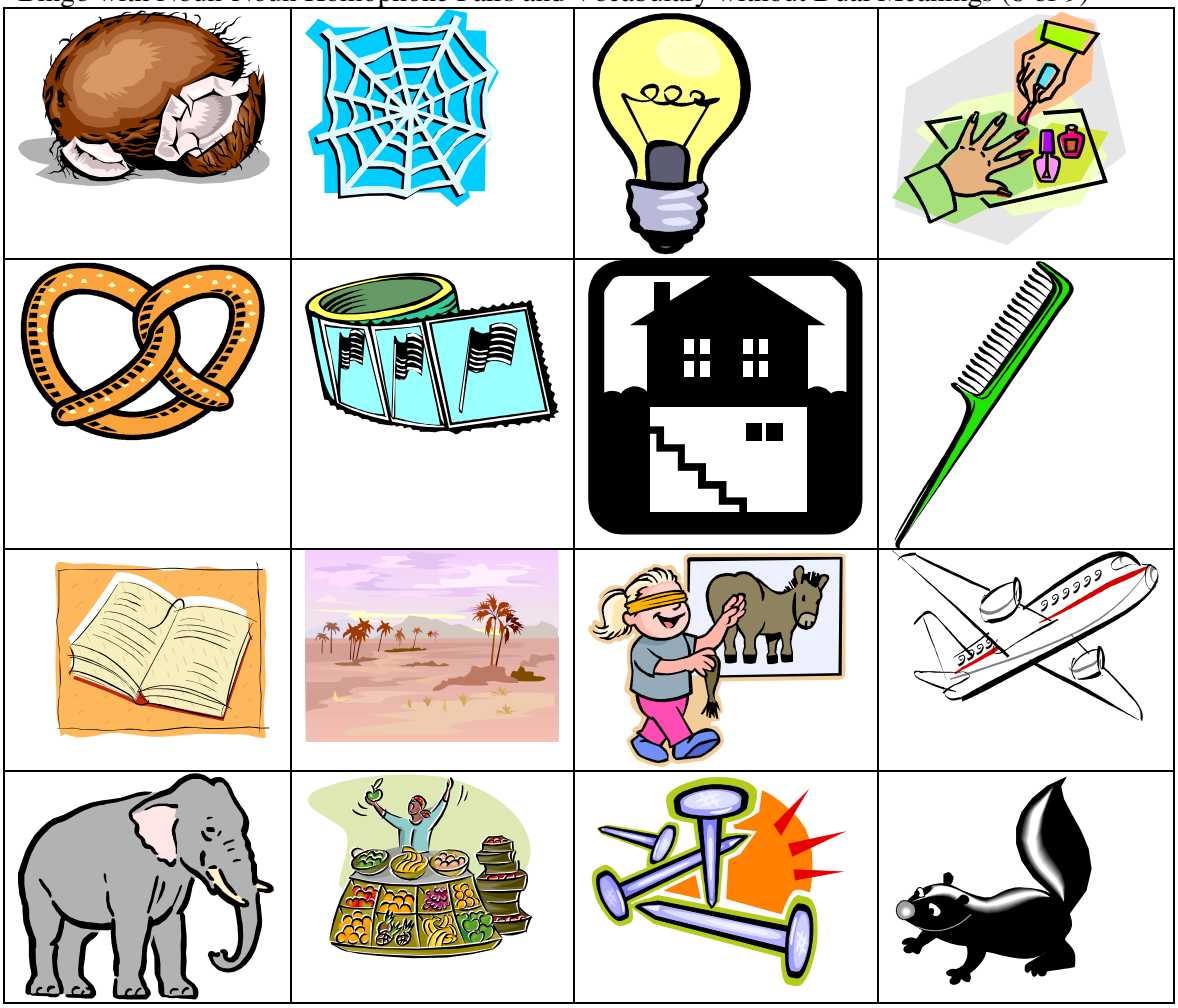
Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (6 of 9)



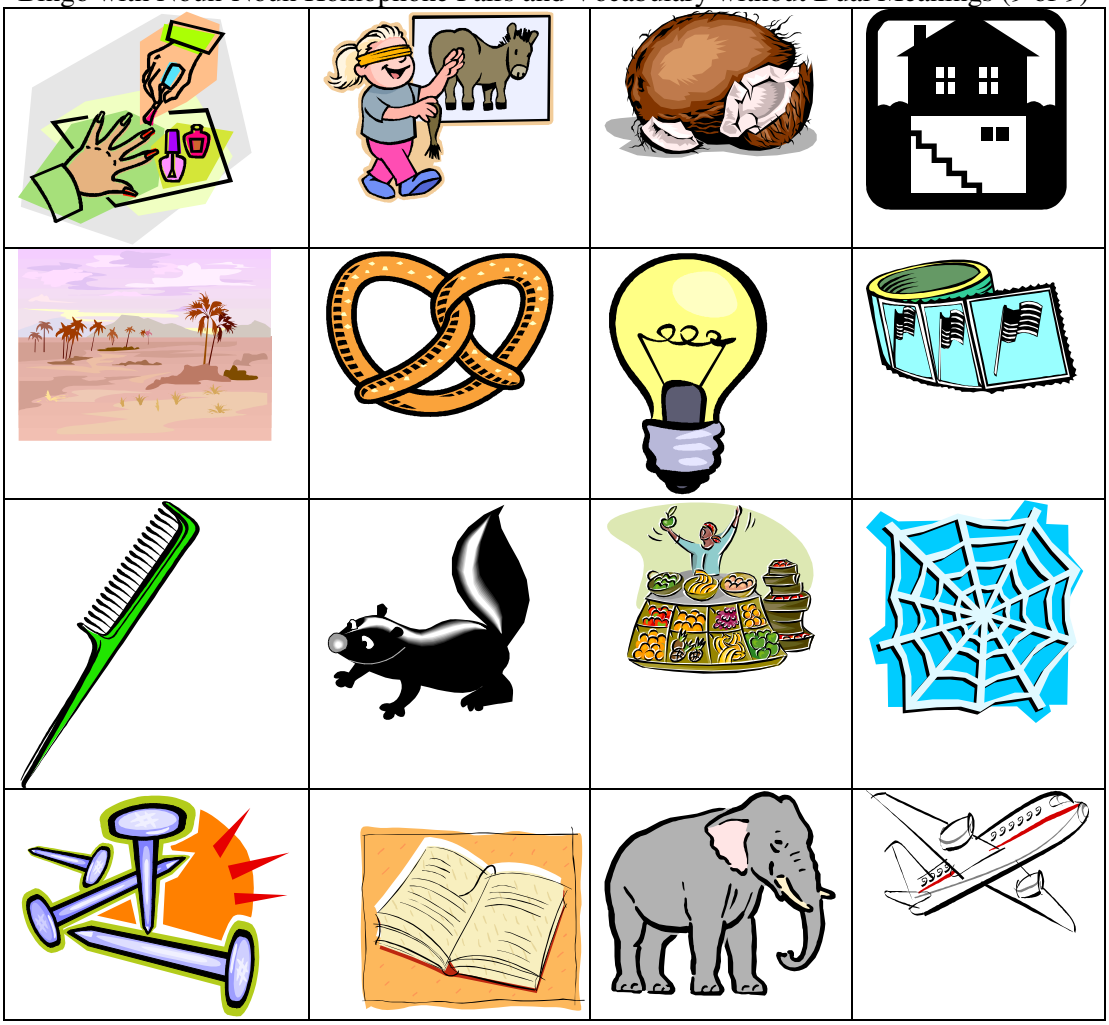
Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (7 of 9)



Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (8 of 9)



Bingo with Noun-Noun Homophone Pairs and Vocabulary without Dual Meanings (9 of 9)

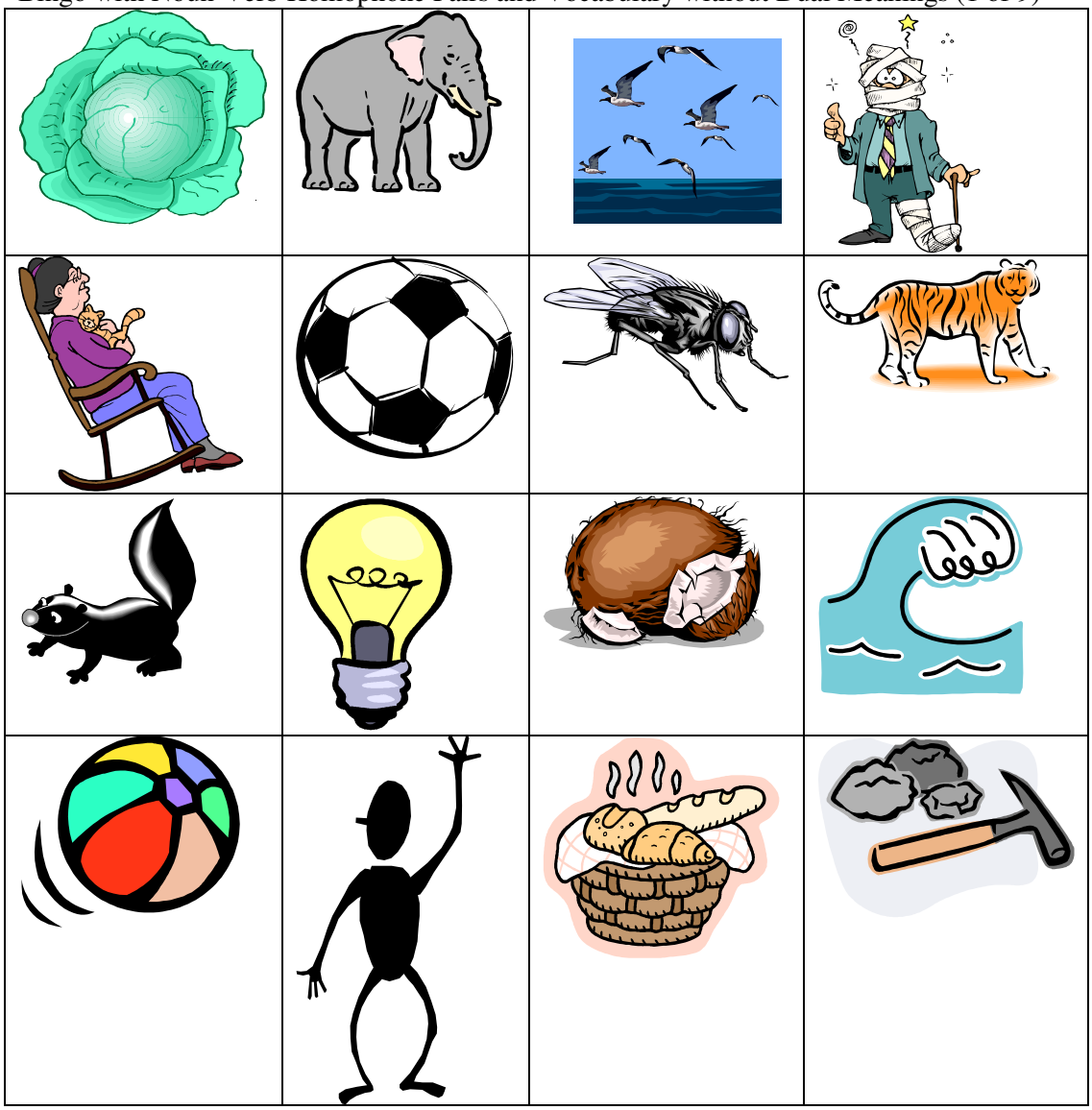


APPENDIX P

BINGO WITH NOUN-VERB HOMOPHONE PAIRS AND VOCABULARY WITHOUT DUAL MEANINGS

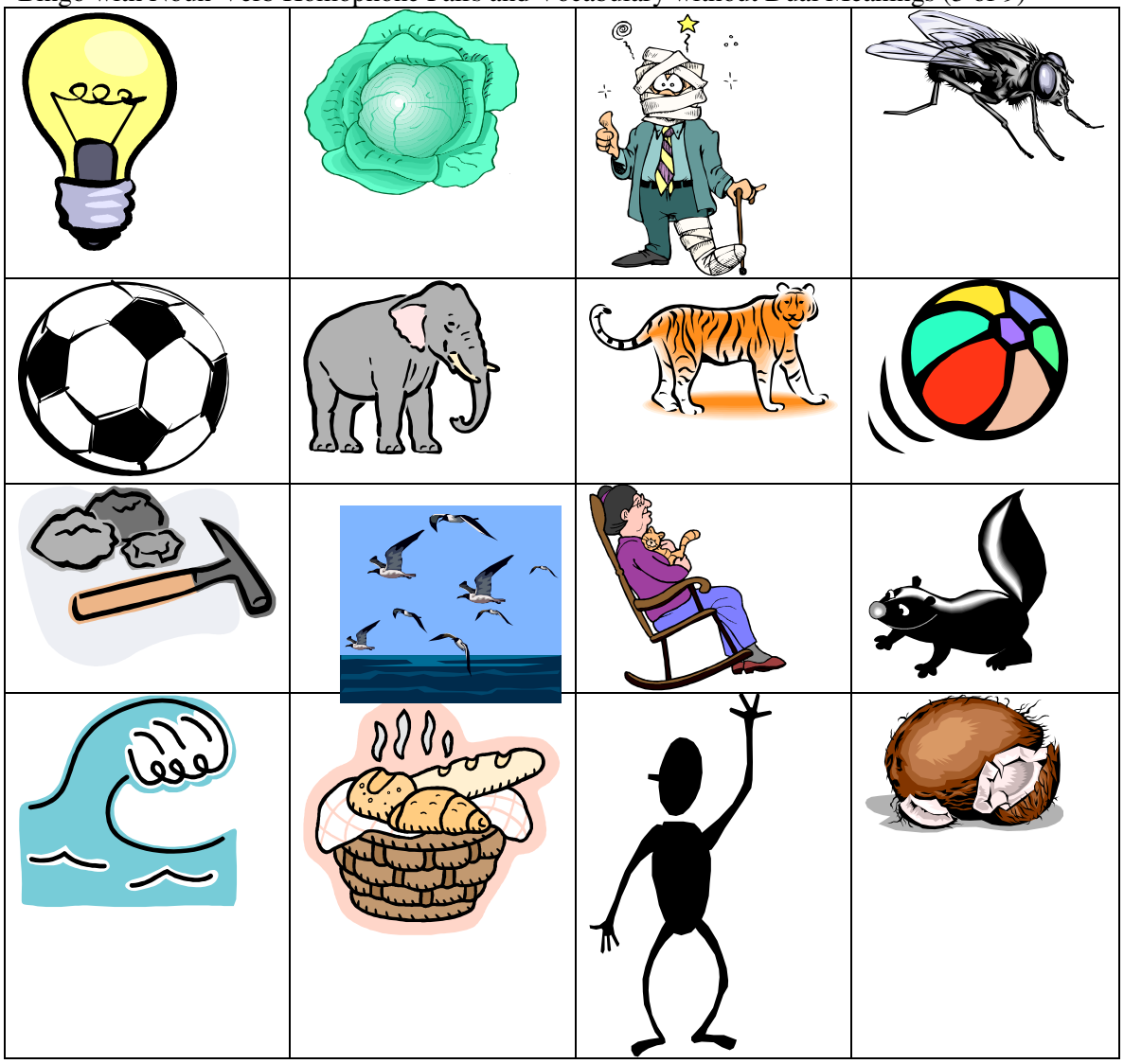
BOARDS 1-4	**BOARDS 5-9**
SORE/SOAR	RED/READ
ROLL	ROAD/RODE
WAVE	REINS/RAINS
ROCK	TOE/TOW
cabbage	fish
fly	pencil
coconut	comb
skunk	stamp
ball	tractor
tiger	clouds
elephant	web
lightbulb	pretzel

Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (1 of 9)

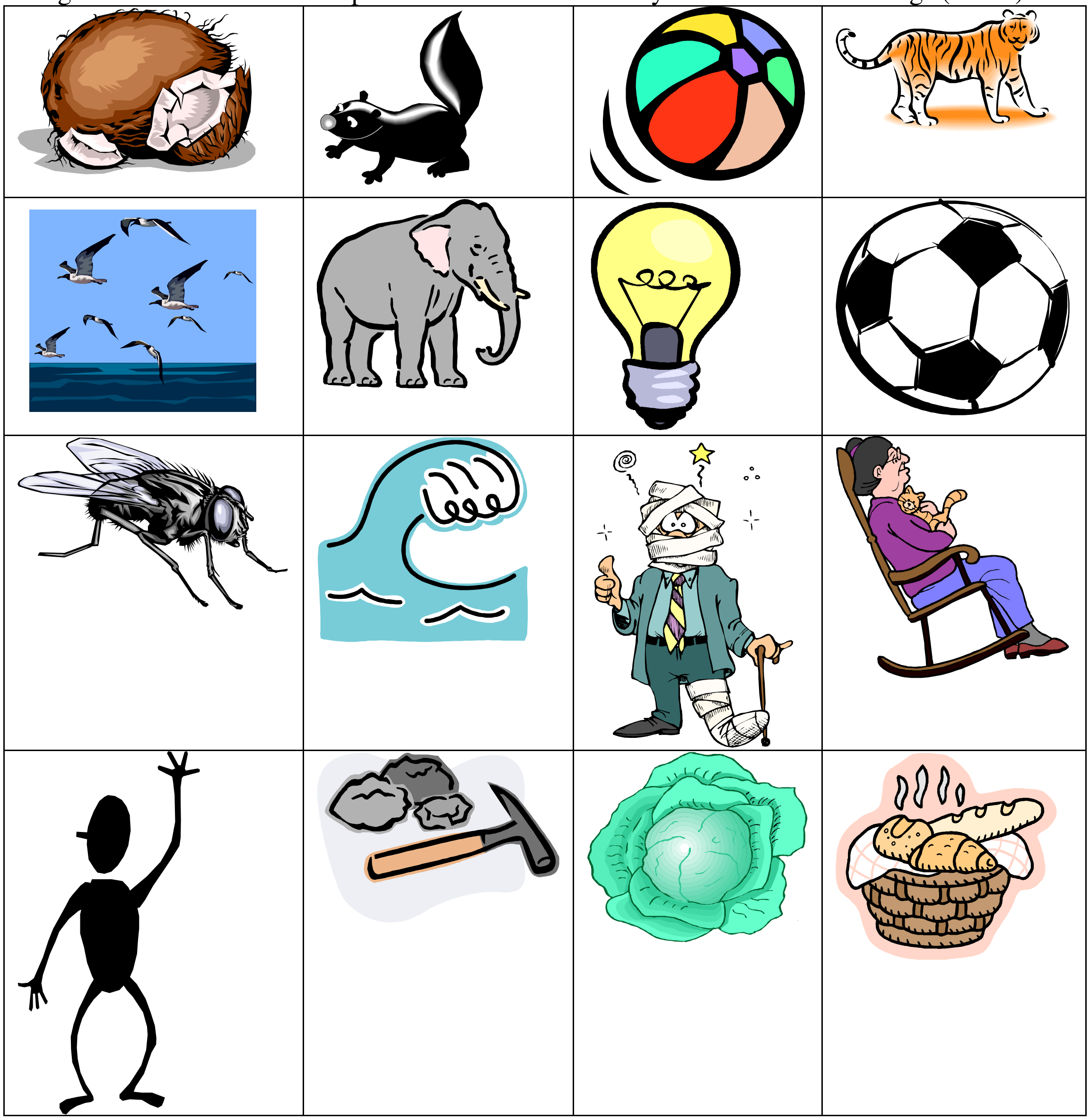


Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (2 of 9)

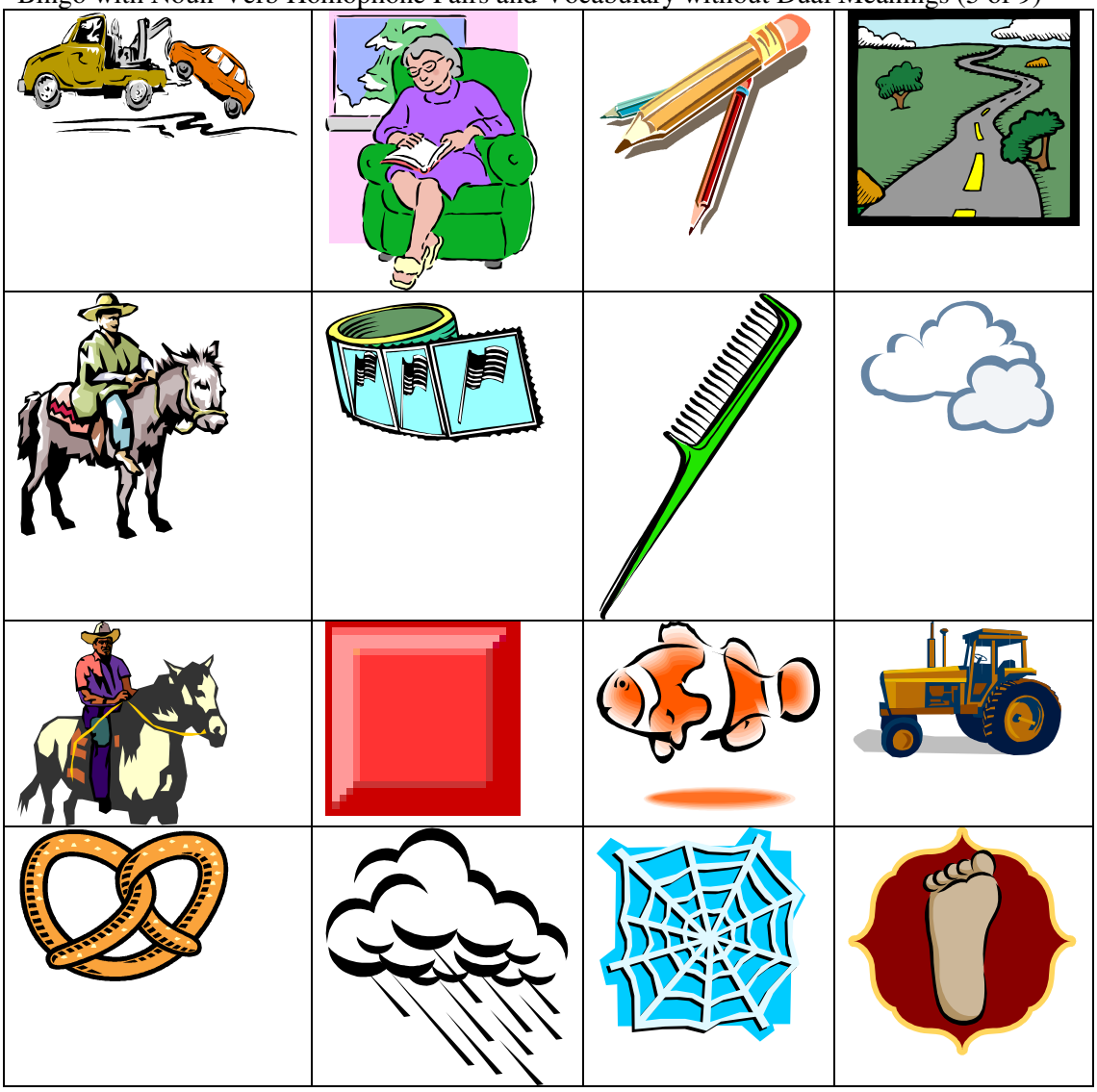
Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (3 of 9)



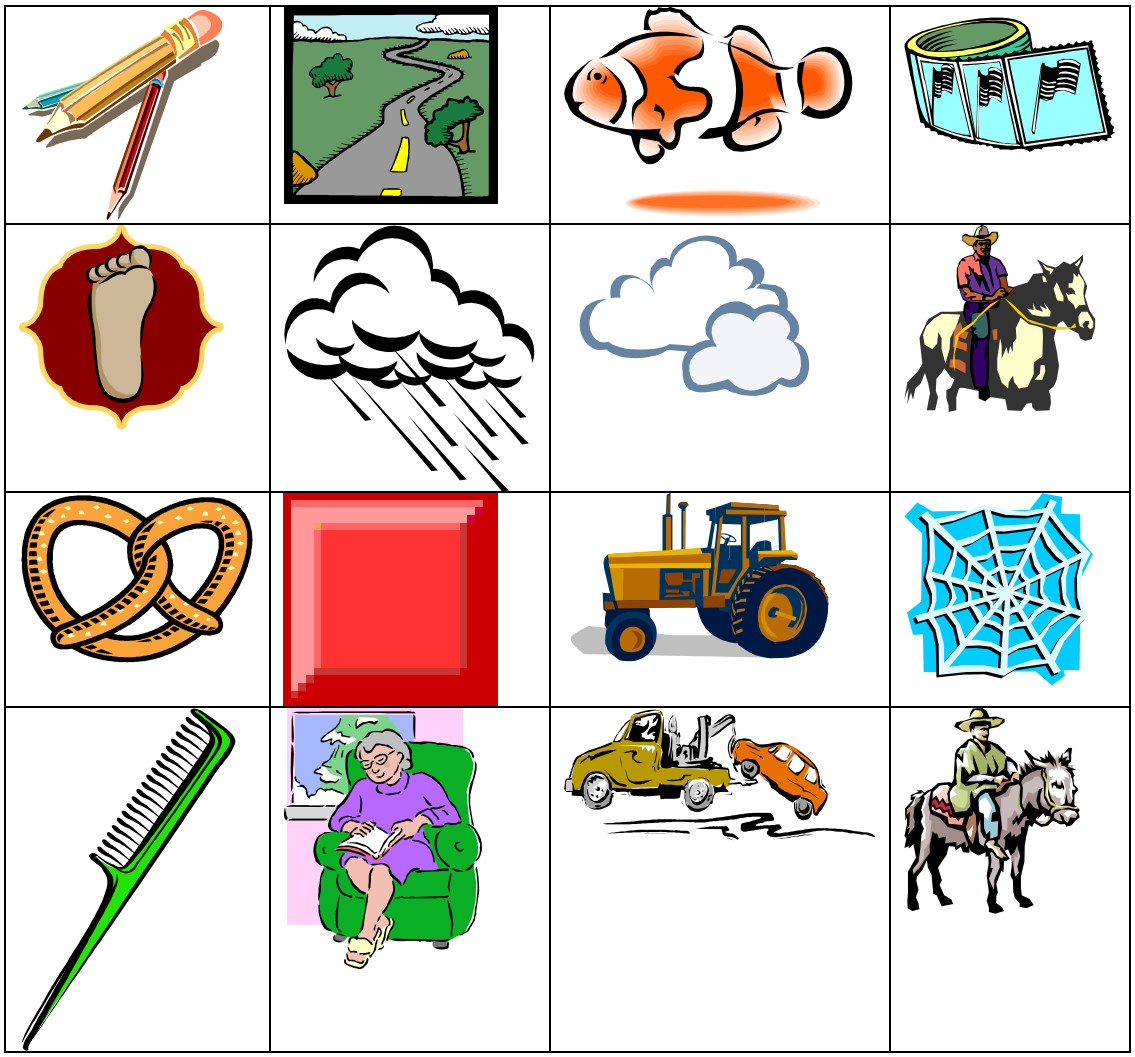
Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (4 of 9)



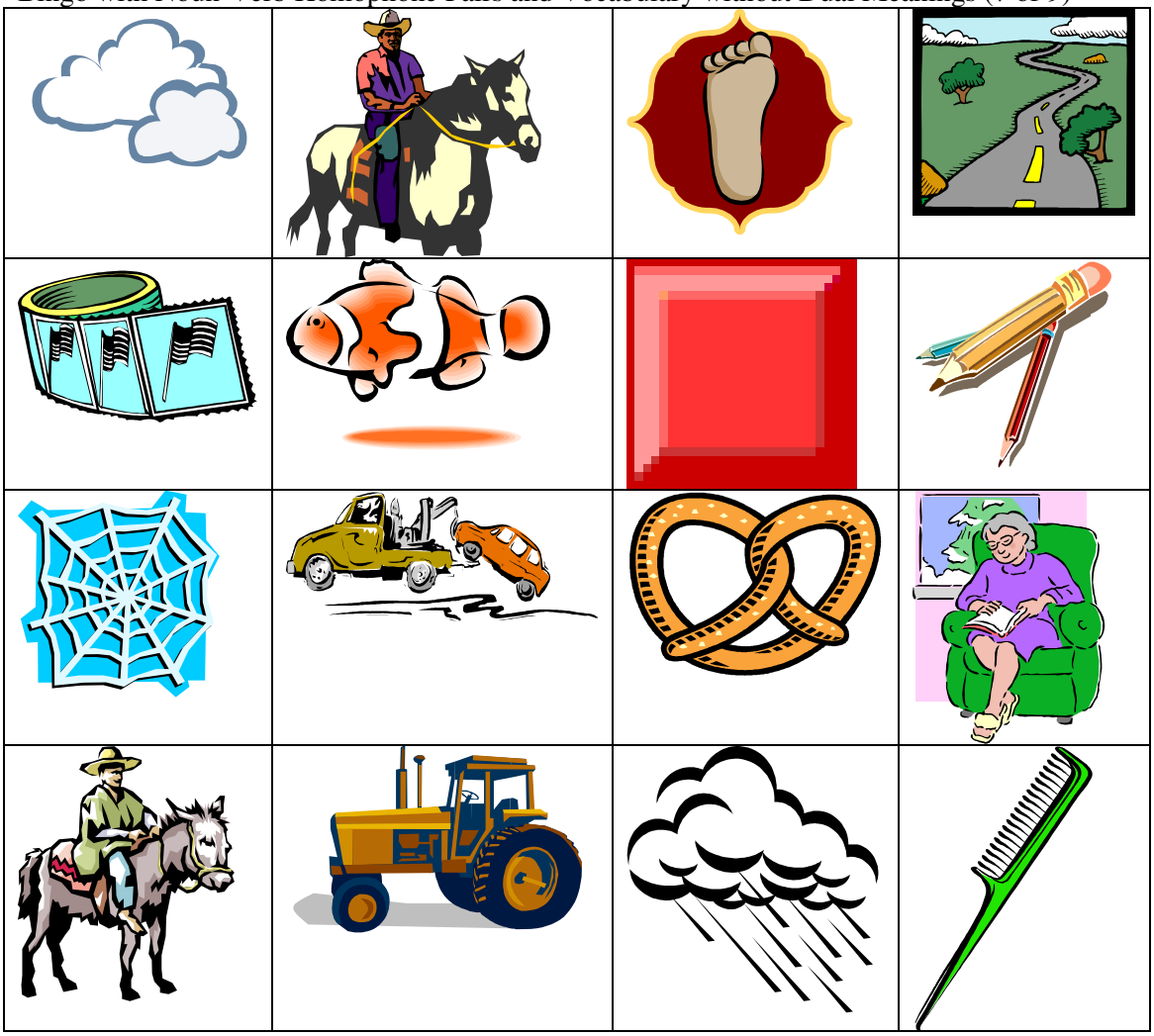
Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (5 of 9)



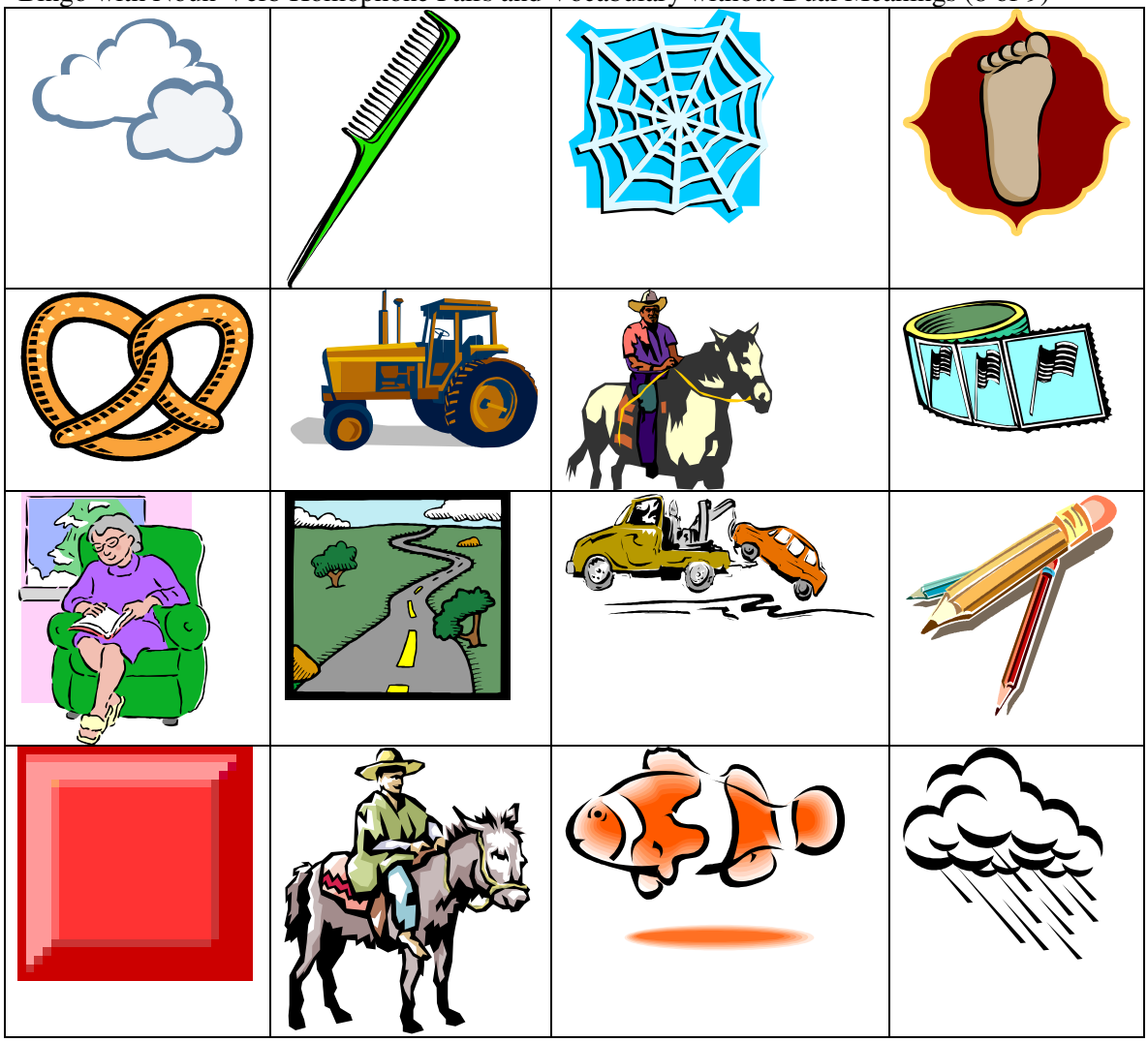
Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (6 of 9)



Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (7 of 9)



Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (8 of 9)



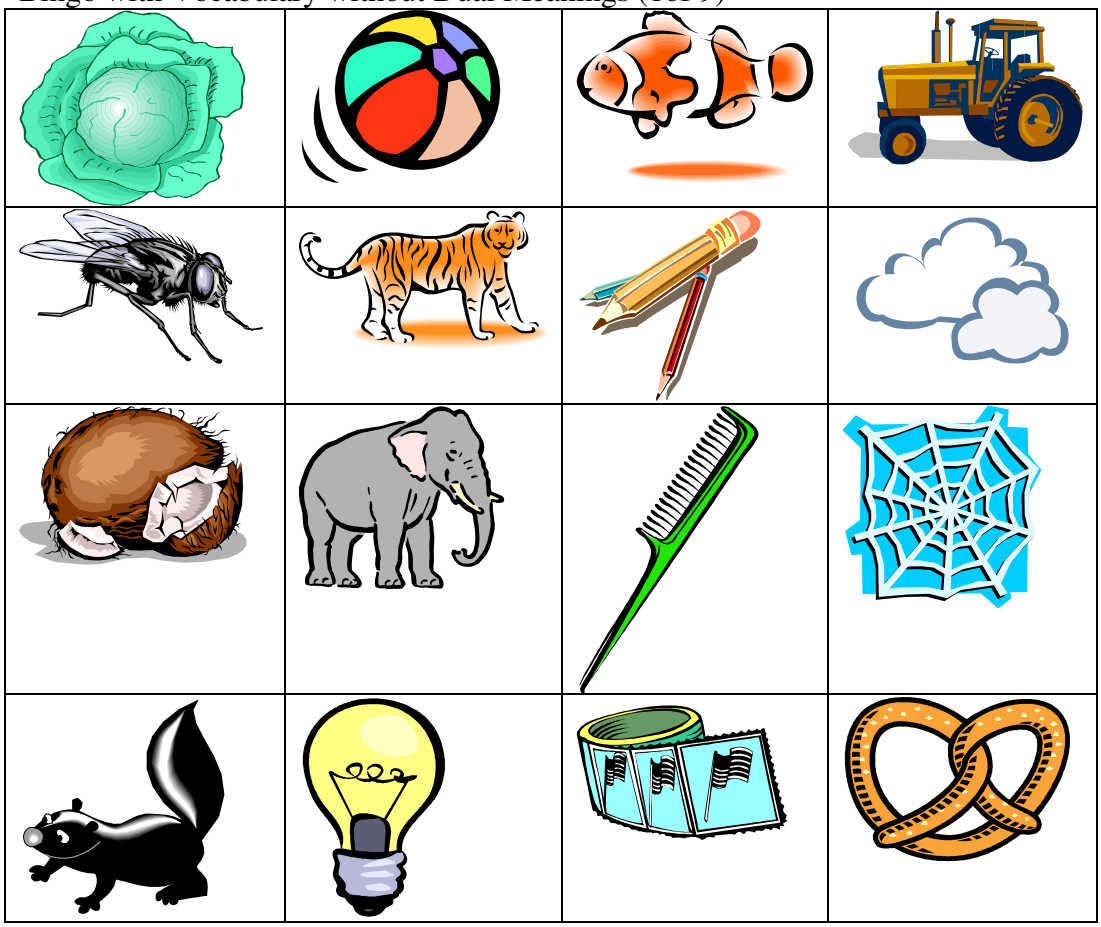
Bingo with Noun-Verb Homophone Pairs and Vocabulary without Dual Meanings (9 of 9)

APPENDIX Q

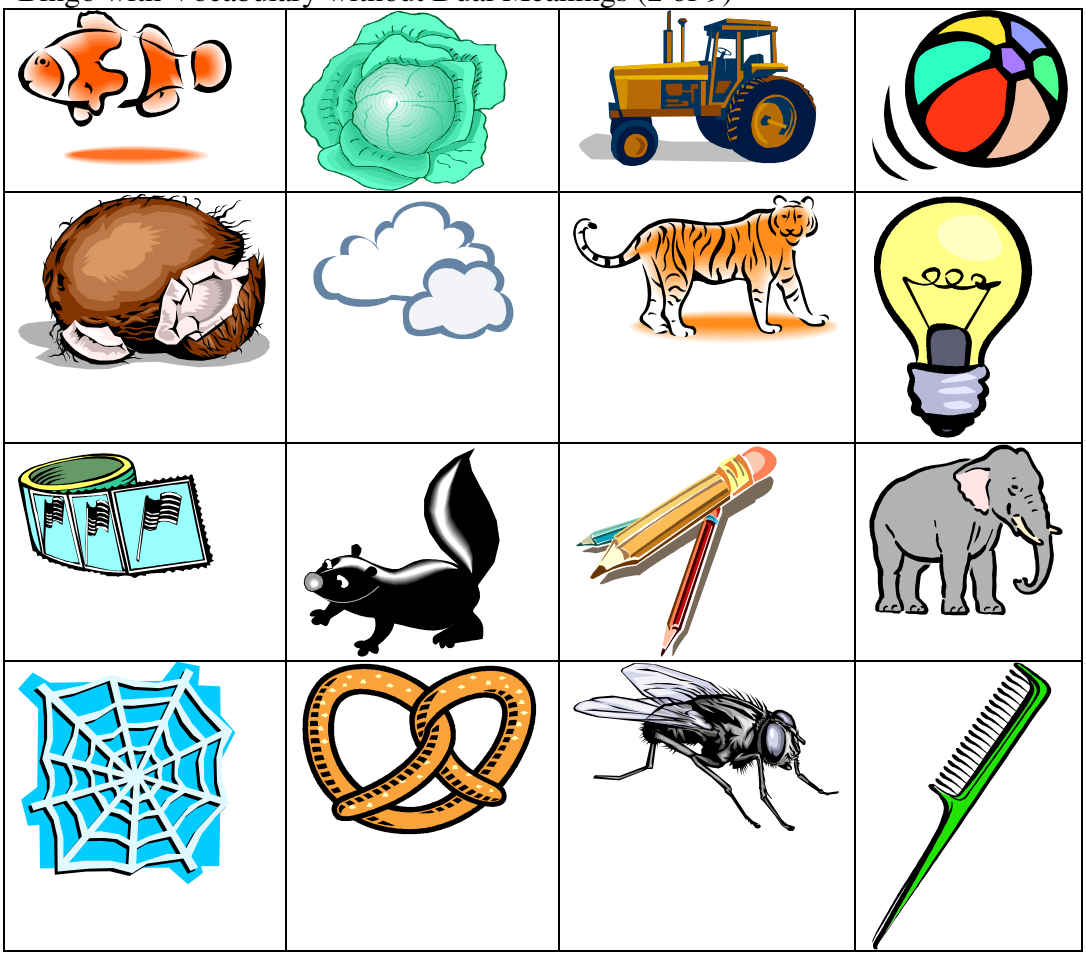
CONTROL BINGO WITH VOCABULARY WITHOUT DUAL MEANINGS

cabbage
ball
fish
tractor
bug
tiger
pencils
clouds
coconut
elephant
comb
web
skunk
lightbulb
stamp
pretzel

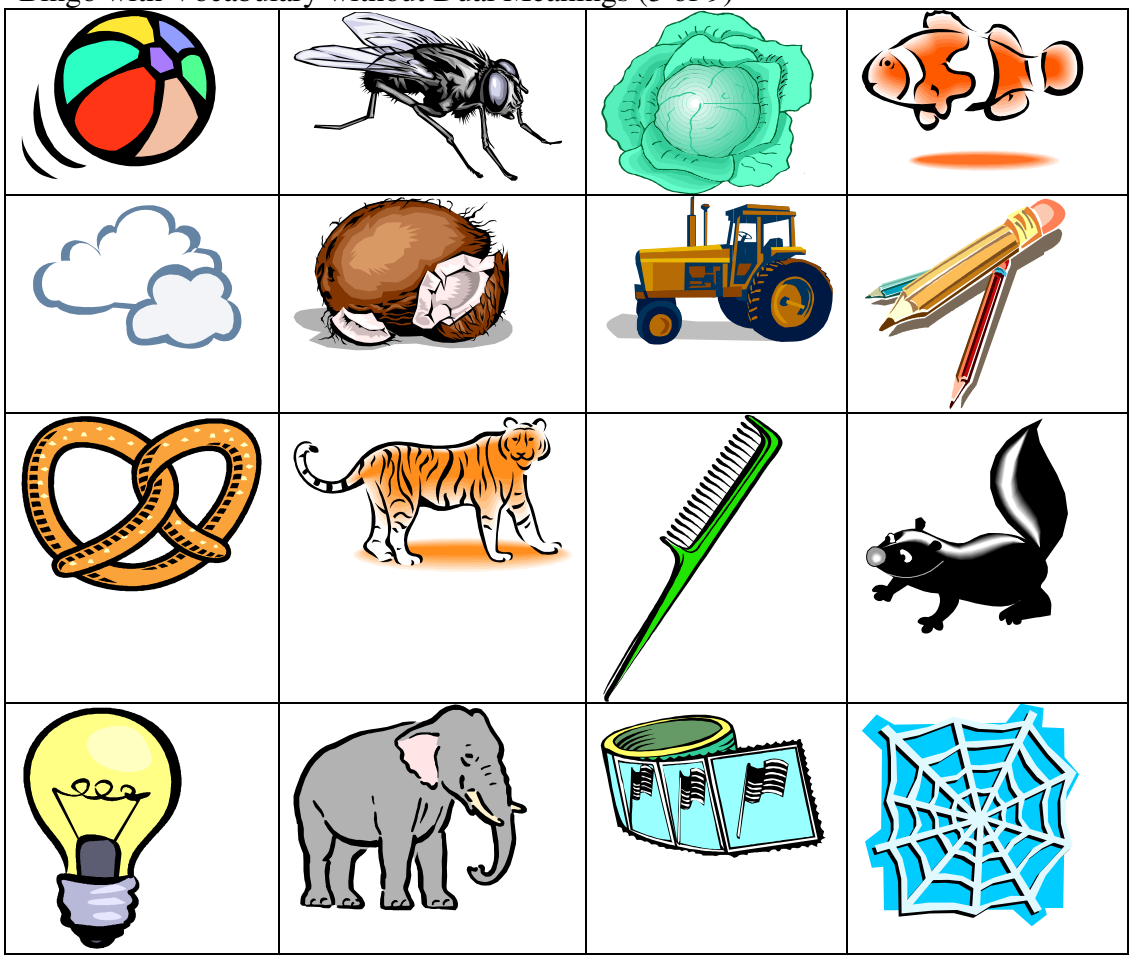
Bingo with Vocabulary without Dual Meanings (1of 9)



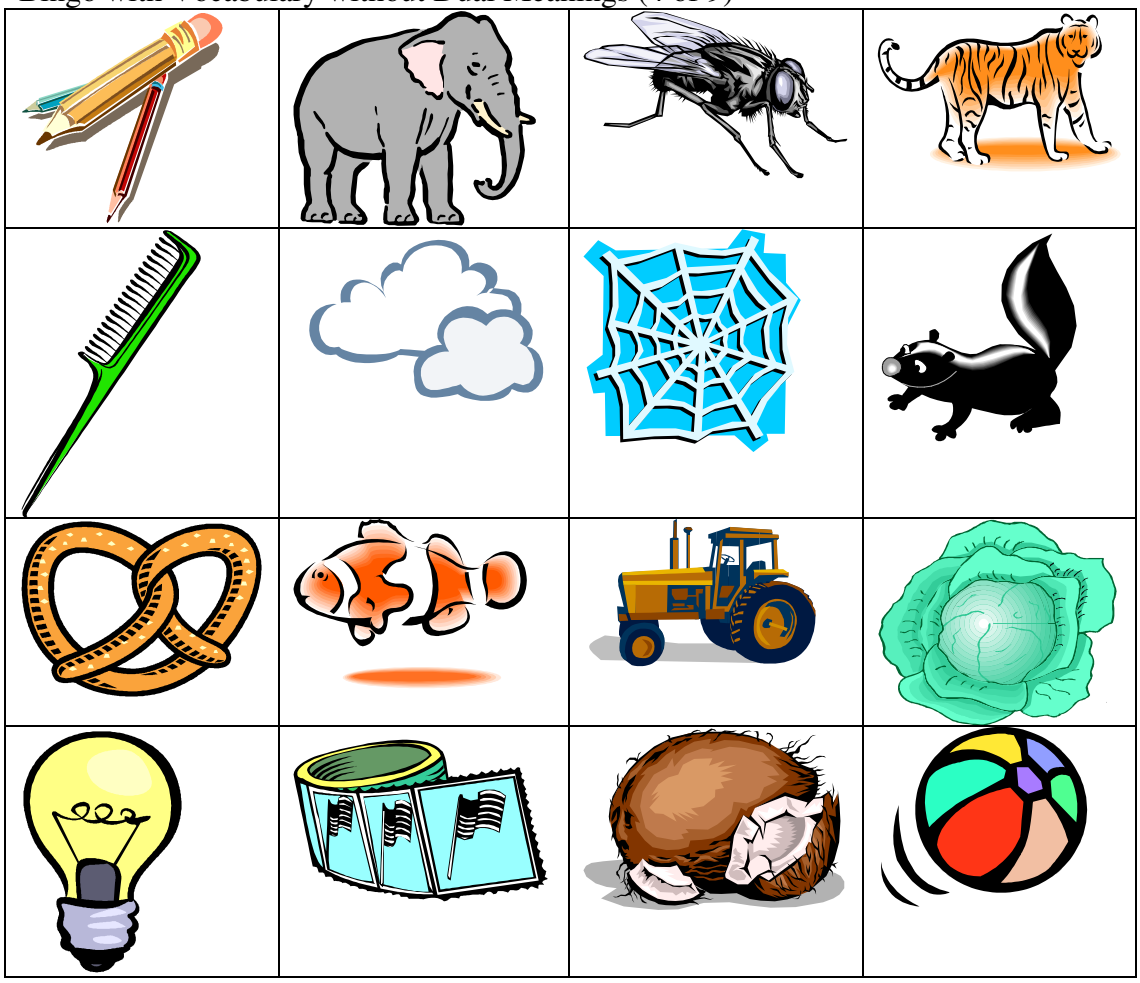
Bingo with Vocabulary without Dual Meanings (2 of 9)



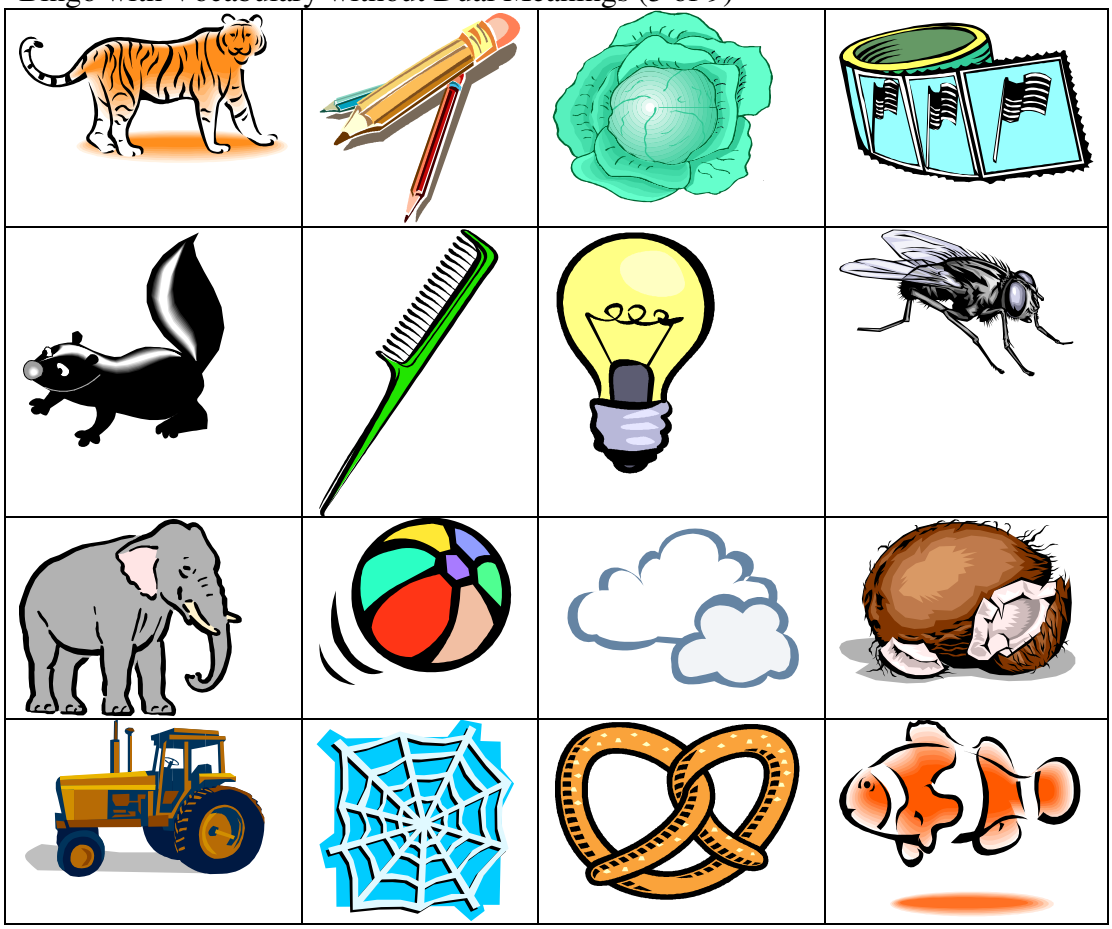
Bingo with Vocabulary without Dual Meanings (3 of 9)



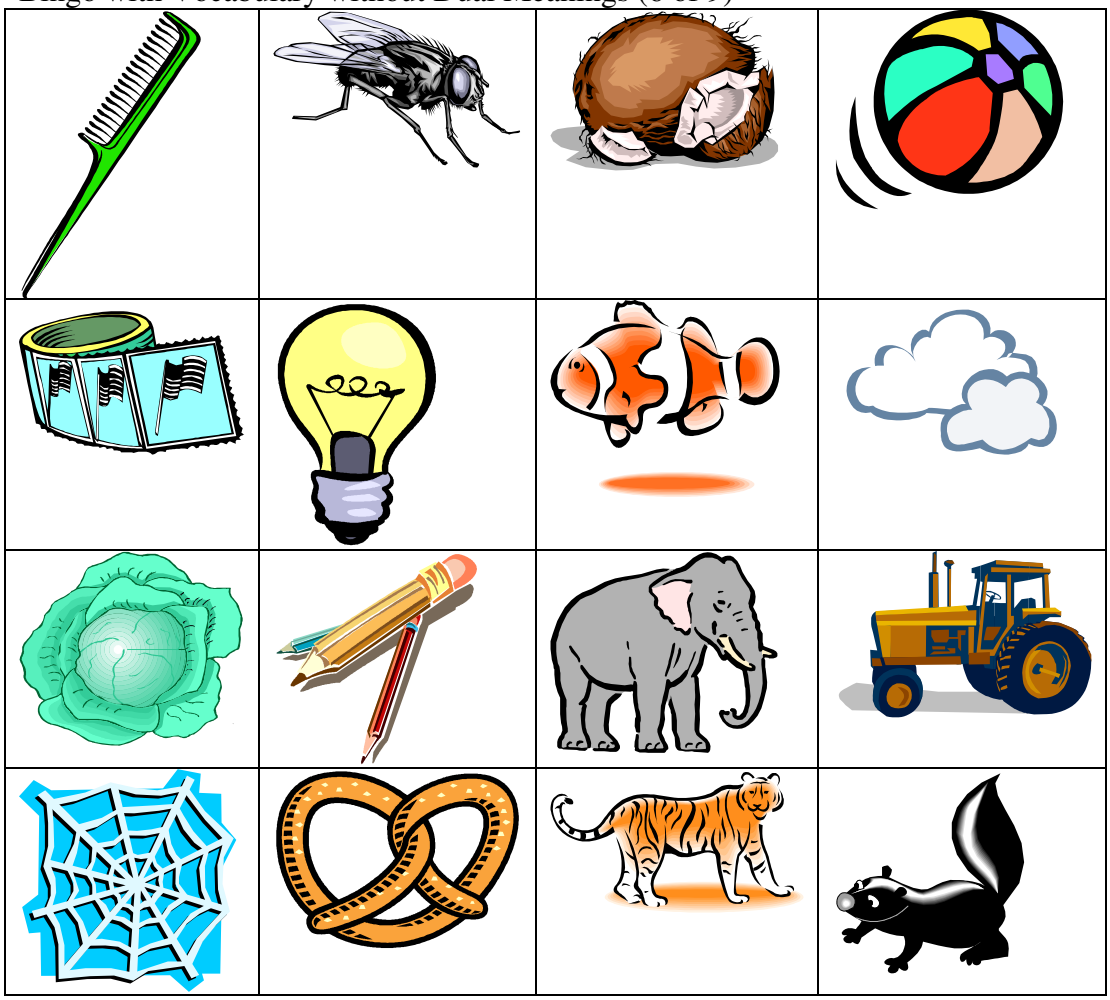
Bingo with Vocabulary without Dual Meanings (4 of 9)



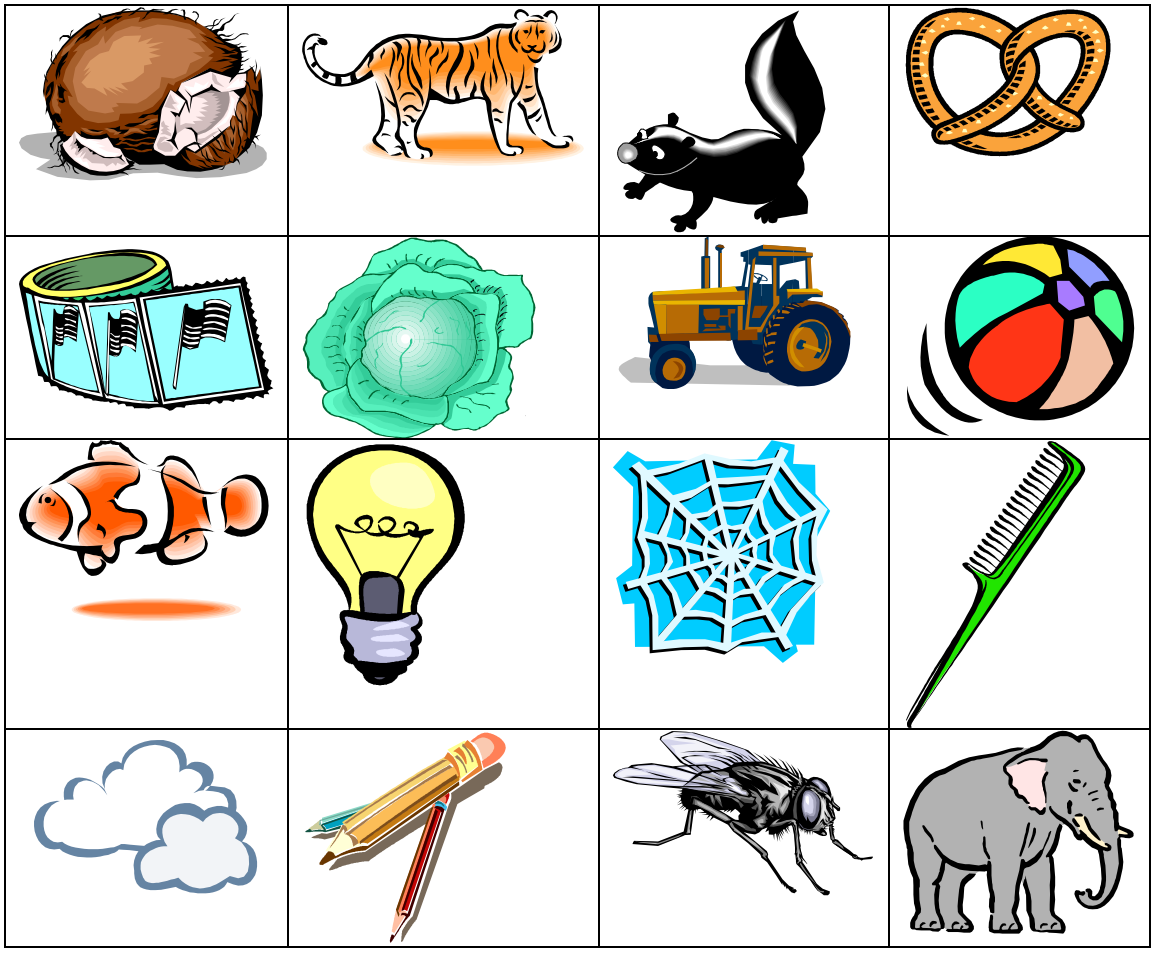
Bingo with Vocabulary without Dual Meanings (5 of 9)



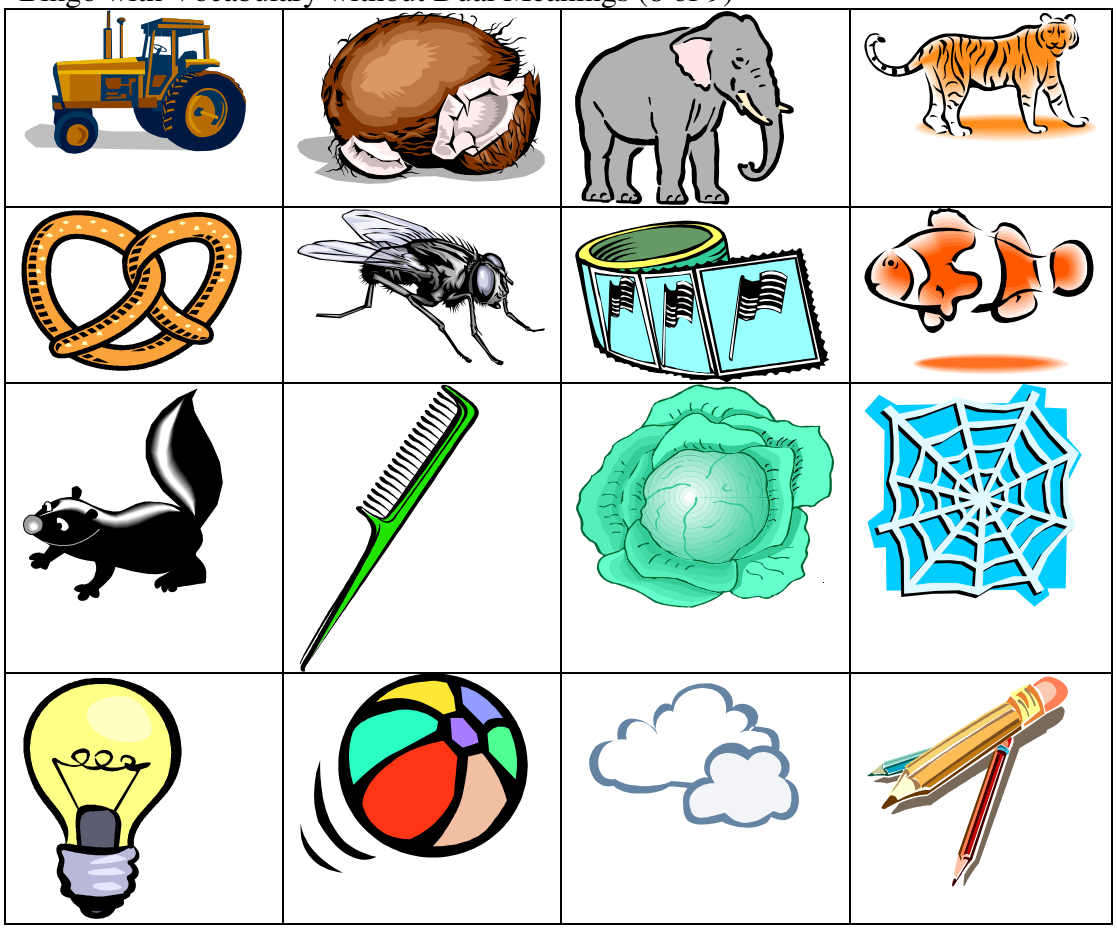
Bingo with Vocabulary without Dual Meanings (6 of 9)



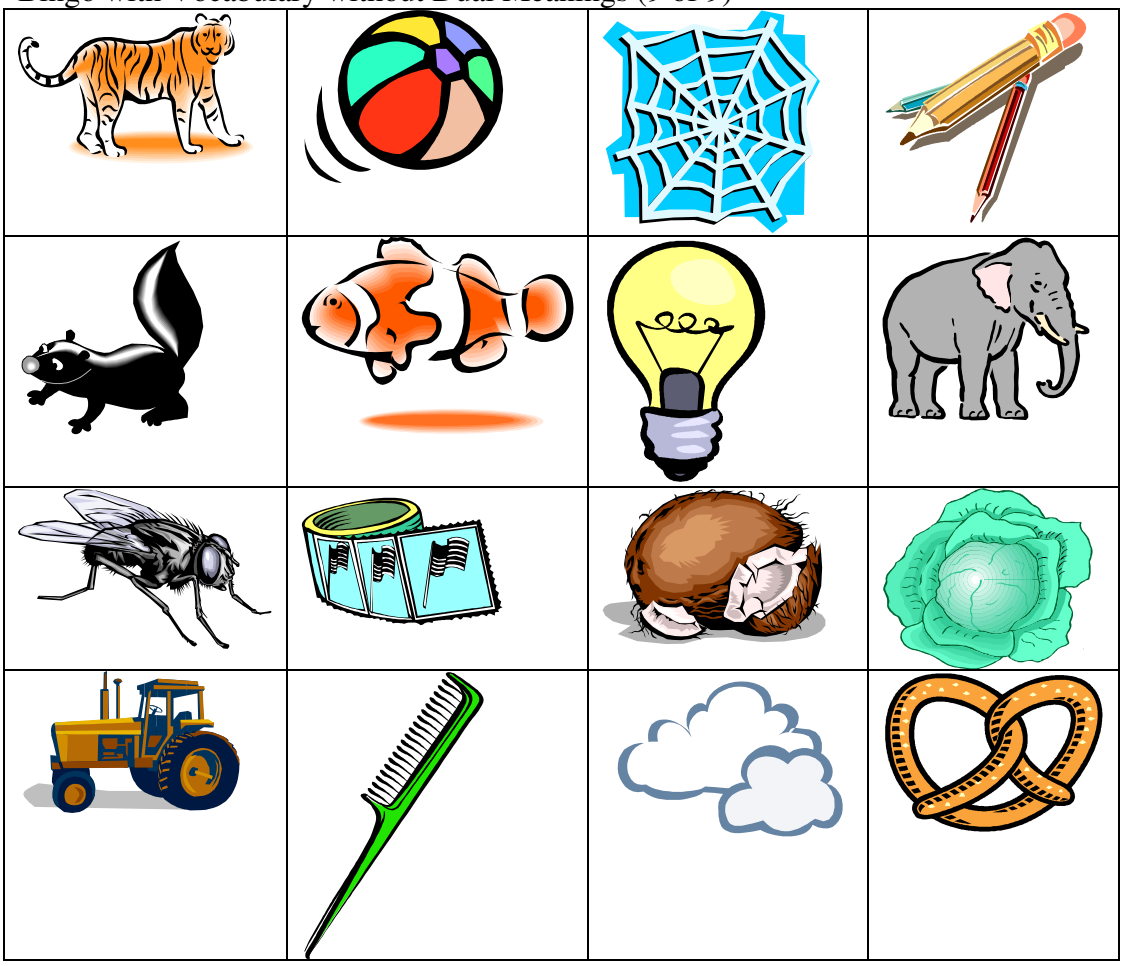
Bingo with Vocabulary without Dual Meanings (7 of 9)



Bingo with Vocabulary without Dual Meanings (8 of 9)



Bingo with Vocabulary without Dual Meanings (9 of 9)



APPENDIX R

INDIVIDUAL PARTCIPANT PERFORMANCE

Table R1a

Control Group Individual Pre- and Post-Test Noun/Noun Homophone Detection (NNHD), Noun/Verb Homophone Detection (NVHD), Lexical Ambiguity Detection (LAD), and Improvement (IMP) Scores

#	Pre-NNHD	Post-NNHD	NN IMP	Pre-NVHD	Post-NVHD	NV IMP	Pre-LAD	Post-LAD	LAD IMP
1	31	31	0	30	32	2	22	30	8
2	23	31	8	30	31	1	26	27	1
3	20	28	8	25	25	0	24	23	-1
4	14	23	9	26	29	3	12	4	-8
5	22	20	-2	13	24	11	6	4	-2
6	0	6	6	4	11	7	13	10	-3
7	18	30	12	24	15	-9	4	10	6
8	4	21	17	6	8	2	10	18	8
9	2	7	5	0	7	7	0	2	2
10	29	30	1	26	32	6	9	14	5
11	24	25	1	18	26	8	25	9	-16
12	31	27	-4	32	30	-2	7	0	-7
13	30	26	-4	25	31	6	22	5	-17
14	16	22	6	9	21	12	8	2	-6
15	17	22	5	14	29	15	2	0	-2
16	22	21	-1	24	24	0	10	6	-4
Mean	18.94	23.13	4.19	19.13	23.44	4.31	12.5	10.25	-2.25
Median	21	24	5	24	25.5	4.5	10	7.5	-2
Range	0-31	6-31	-4-17	0-32	7-32	-9-15	0-26	0-27	-17-8

= participant number

Table R1b

Experimental Group Individual Pre- and Post-Test Noun/Noun Homophone Detection (NNHD), Noun/Verb Homophone Detection (NVHD), Lexical Ambiguity Detection (LAD), and Improvement (IMP) Scores

#	Pre-NNHD	Post-NNHD	NN IMP	Pre-NVHD	Post-NVHD	NV IMP	Pre-LAD	Post-LAD	LAD IMP
17	25	32	7	27	32	5	28	28	0
18	28	32	4	24	32	8	27	28	1
19	32	32	0	30	32	2	21	32	11
20	30	30	0	31	32	1	18	29	11
21	22	30	8	28	28	0	8	26	18
22	31	32	1	28	32	4	27	29	2
23	13	31	18	7	32	25	8	25	17
24	28	32	4	26	32	6	8	32	24
25	22	32	10	16	31	15	13	29	16
26	25	31	6	26	31	5	20	25	5
27	24	31	7	21	31	10	23	29	6
28	24	30	6	15	31	16	13	30	17
29	17	30	13	17	32	15	8	28	20
30	30	32	2	32	32	0	25	32	7
31	20	29	9	10	30	20	0	21	21
32	19	30	11	18	28	10	14	27	13
Mean	24.38	31	6.63	22.25	31.13	8.88	16.31	28.13	11.81
Median	24.5	31	6.5	25	32	7	16	28.5	12
Range	13-32	29-32	0-18	7-32	28-32	0-25	0-28	21-32	0-24

= participant number

APPENDIX S

PRE-TEST PERFORMANCE

Table S1a

Control Group PPVTIII Raw Scores, Standard Scores, and Percentile Scores

Participant	Age	Raw	Standard	Percentile
1	5;11	112	126	96
2	6;1	88	106	66
3	6;3	99	112	79
4	6;2	93	108	70
5	5;9	79	103	58
6	6;1	87	105	63
7	5;10	80	102	55
8	5;8	67	93	32
9	6;6	110	117	87
10	5;11	92	111	77
11	6;2	91	106	66
12	6;4	101	112	79
13	6;6	80	94	34
14	5;11	111	125	95
15	6;4	83	98	45
16	6;1	91	108	70
Average	6;1	91.50	107.88	67.00

Table S1b

Experimental Group PPVTIII Raw Scores, Standard Scores, and Percentile Scores

Participant	Age	Raw	Standard	Percentile
17	5;11	96	114	82
18	6;1	80	100	50
19	5;11	92	111	77
20	6;0	80	100	50
21	5;8	90	111	77
22	6;2	92	107	68
23	511	107	122	93
24	6;3	108	119	90
25	5;10	88	108	70
26	6;0	87	105	63
27	6;0	87	105	63
28	5;5	78	106	66
29	6;1	91	108	70
30	6;3	115	125	95
31	5;9	71	97	42
32	5;8	85	107	68
Averages	6;0	90.44	109.06	70.25

Table S2

Pre-Test Score Per Word of Experimental and Control Groups on

Noun/Noun Homophone Detection Task (NNHDT) (Highest Possible Score = 4)

Pre-test NNHDT	Experiment Mean	Experiment Median	Experiment Range	Control Mean	Control Median	Control Range
Cellar/Seller	2.19	2	0-4	1.88	2	0-4
Bat/Bat	3.75	4	3-4	3.00	4	0-4
Straw/Straw	2.88	3	0-4	2.38	3	0-4
Nails/Nails	3.56	4	2-4	2.69	3.5	0-4
Tail/Tale	2.63	3	0-4	2.19	3	0-4
Prince/Prints	2.75	3.5	0-4	2.38	3	0-4
Sun/Son	3.44	4	0-4	2.56	3	0-4
Plain/Plane	3.19	4	0-4	1.88	2	0-4
Total	24.38	24.5	13-32	18.94	21	0-31

Table S3

Pre-Test Score Per Word of Experimental and Control Groups on

Noun/Verb Homophone Detection Task (NVHDT) (Highest Possible Score = 4)

Pre-test NVHDT	Experiment Mean	Experiment Median	Experiment Range	Control Mean	Control Median	Control Range
Roll	2.56	3	0-4	2.44	2	0-4
Read/Red	2.63	3	0-4	2.50	3	0-4
Rains/Reins	2.38	3	0-4	2.38	2.5	0-4
Soar/Sore	2.88	3	0-4	2.38	3	0-4
Wave	2.81	3.5	0-4	2.81	3.5	0-4
Toe/Tow	2.81	3	0-4	2.00	2.5	0-4
Rock	3.31	4	0-4	2.50	3.5	0-4
Road/Rode	2.88	4	0-4	2.13	2.5	0-4
Total	22.25	25	7-32	19.13	24	0-32

Table S4

Pre-Test Score Per Sentence of Experimental and Control Groups on Lexical Ambiguity Detection Task (LADT) (Highest Possible Score = 4)

Pre-test LADT	Experiment Mean	Experiment Median	Experiment Range	Control Mean	Control Median	Control Range
Cellar/Seller	1.63	2	0-4	1.31	2	0-3
Bat/Bat	2.81	3	0-4	2.63	3	0-4
Straw/Straw	3.13	4	0-4	1.69	2	0-4
Nails/Nails	2.13	2.5	0-4	1.56	2	0-4
Tail/Tale	2.00	2	0-4	1.19	0	0-4
Prince/Prints	0.88	0	0-3	1.31	0	0-4
Sun/Son	2.06	2.5	0-4	1.44	1	0-4
Plain/Plane	1.69	2	0-4	1.38	0	0-4
Total	16.31	16	0-28	12.50	10	0-26

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