



High-Amplitude Sucking Procedure

The high-amplitude sucking technique (HAS), also called non-nutritive sucking, is an experimental method appropriate for testing infants from birth to age 4 months. The HAS technique capitalizes on infants' sucking reflex: Infants hear a sound stimulus every time they produce a strong or high-amplitude suck. The number of high-amplitude sucks produced is used as an index of interest. Variants of the procedure can be used to test infants' discrimination of and preference for a variety of language stimuli. The use of HAS in the field of language acquisition was pioneered by Peter D. Eimas and his colleagues in their 1971 study of categorical discrimination, where they showed that 1- to 4-month-old infants are more sensitive to an acoustic difference that crosses an adult consonant boundary than to one that does not. In the more than 40 years since this initial study, the HAS technique has been foundational in understanding speech perception in very young infants. Recently, the popularity of HAS has declined in favor of newer brain-based techniques that do not require an overt behavioral response.

HAS studies with neonates are conducted in the hospital within a few days after birth, while studies with older infants are conducted in the laboratory. In a quiet room, infants are seated either in an infant-appropriate chair or on an experimenter's lap. Infants

are offered a sterilized pacifier, which is connected to a pressure transducer. The pacifier is held in place either by the experimenter or by a mechanical arm. The pressure transducer relays information to an adjacent computer about the frequency and intensity of the infants' sucking. A silent baseline period lasting 1 to 2 minutes is used to measure the infants' average frequency and intensity of sucking when no stimulus is played. Subsequently, experimental stimuli are played when infants deliver a high-amplitude suck, for example, those falling in the upper one-third of their sucking range. There are two basic variants of the HAS procedure: discrimination and preference.

Discrimination

To test infants' discrimination of different classes of stimuli (e.g., different syllables or different languages), infants are habituated to one type of stimulus. During the habituation phase, each time the infants produce a high-amplitude suck, a sound is played over loudspeakers. This continues until infants' sucking has declined to a predetermined level, for example, a 20 percent reduction in the number of high-amplitude sucks produced per minute. Habituation typically lasts between 5 and 15 minutes. Once the habituation criterion has been met, infants proceed to the test phase, which typically lasts for 2 to 5 minutes. Infants in the control condition continue to hear more stimuli of the same type as heard during habituation. Infants in the experimental condition hear stimuli of

a new type. If infants can discriminate between the two stimulus types, sucking is expected to increase for infants in the experimental condition but not for infants in the control condition.

Preference

To test infants' preference for different stimuli (e.g., preference for the native language over a foreign language or for a familiar voice over an unfamiliar voice), two different stimuli are available on alternating minutes. For example, during minute 1, infants hear stimulus A each time a high-amplitude suck is produced (e.g. French sentences), and during minute 2, infants hear stimulus B each time a high-amplitude suck is produced (e.g. English sentences). The two types of stimuli are presented alternately, typically for a total of 10 minutes. The number of high-amplitude sucks produced during each minute type is compared. Infants demonstrate a preference for one stimulus over the other if they suck reliably more during one minute type than during the other.

The basic mechanism underlying the HAS procedure is thought to be operant conditioning. Infants suck more to interesting stimuli because they learn that a high-amplitude suck will produce a rewarding sound. It has also been suggested that high-amplitude sucking is a simple index of infant arousal. Some variants of the HAS procedure thus do not involve a contingency between sucking and sound presentation. However, both proposed mechanisms yield the same prediction, that infants will suck more in response to interesting than to disinteresting stimuli.

The HAS procedure presents several methodological challenges. First, infants must be awake and willing to suck to begin the study, yet neonates spend much of their time sleeping and can be difficult to wake. Further, among infants that do begin the procedure, attrition rates are often high. Common reasons for attrition include loss of interest in sucking partway through the study, falling asleep during the study, the pacifier slipping out of the infant's mouth, and crying. Finally, there are no commercially available HAS systems, thus this procedure requires custom hardware and software. Due to these methodological challenges, there has been a decline in the use of the HAS procedure in favor of noninvasive neuroimaging techniques. These include near-infrared spectroscopy and event-related potentials, which are appropriate for very young infants but do not require an overt behavioral response.

Despite its limitations, the HAS procedure has been important to the field of language acquisition and has been instrumental in advancing knowledge of speech and language perception in very young infants. For example, HAS studies have shown that very young infants can discriminate numerous languages and speech sounds from each other and can discriminate different voices, syllables, stress patterns, and pitch contours. Further, neonates show a preference for their native language, for their mother's voice, for passages familiarized during pregnancy, for speech over non-speech, and for content words (e.g., nouns or verbs) over function words (e.g., prepositions and articles).

Krista Byers-Heinlein
Concordia University

See Also: Electrophysiology Methods in Language Development; Neonatal Preference for Speech; Neonatal Speech Perception; Neural Basis of Language Development.

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Home Environment (Effects on Language and Literacy Development)

Over the past 30 years, increasing attention has been paid to the effects of home environments on children's language and literacy development. Home language environment generally refers not only to the home and

the physical resources it provides (e.g., books, newspapers, and writing materials) but also to the social interactions and relationships that occur within home contexts. Various terms have been used to refer to the relationships among home literacy environments and children's literacy and language development including *family literacy and language practices*, *home literacy environments*, *literacy in families*, *home-based literacy and language processes*, *literacy and language among family members*, and *home literacy experiences*. Some researchers focus on specific dimensions of the home literacy and language environment, including parent-child joint book reading experiences or parent-child storybook reading.

Family literacy is perhaps the most common term used to reference the literacy and language practices that occur in children's homes. Denny Taylor originated the term in her dissertation; subsequently, *Family Literacy* became the title of the book she published in 1983. While the book did not present a formal definition of family literacy, it explored how literacy styles and values were practiced within families. She noted that family members were often minimally aware of these practices and their possible significance for children's language and literacy learning. As Taylor explained, literacy operated as a social process within everyday people's lives—a part of the very fabric of family life.

National policies and federally supported programs have historically identified family literacy as a potential solution to the economic and social disparities that divide diverse groups of people in the United States. During the late 1980s and early 1990s, various family literacy programs were established including Even Start, a federally sponsored intergenerational family literacy program designed to provide literacy services to low-income adults and children, and the Head Start Family Literacy Initiative, designed to help parents develop literacy skills that would enable them to act as their children's first teachers. While the early 2000s were characterized by a general shifting of social responsibility from the public sector to individuals by reducing public services for families, strong rhetoric continues to support literacy as a potential cure for poverty and social ills as evidenced in the following quote from Sharon Darling, "Certainly, one of the underlying causes of unemployment, underemployment, and poverty is low literacy skills."

Among the scholars who focused on language and literacy learning in children's homes is Shirley Brice Heath. Heath conducted an ethnography of language

and literacy practices in homes that has become the most widely cited text in the field of family literacy. Based on her longitudinal work in European American and African American working-class communities, Heath identified differing language and literacy practices and noted how the literacy and language practices in both of these communities differed from those found in the homes of white, middle-class students.

These qualitative, descriptive studies inspired quantitative researchers to identify causal variables and construct predictive models that draw on home environment practices to explain the differential school success of children from diverse backgrounds. Significant numbers of quantitative studies began to appear during the early 1990s. These studies generally relied on traditional measures of literacy achievement (i.e., Peabody Picture Vocabulary Test-Revised [PPVT-R], Illinois Test of Psycholinguistic Abilities, Woodcock, Metropolitan Readiness, and the Stanford Achievement Test) to measure literacy and language development over time. Several of these prominent quantitative researchers highlighted relationships between storybook reading and later reading achievement in school.

As V. Totsika and K. Sylva report, the *Home Observation for Measurement of the Environment* (HOME) is without doubt the most commonly used environmental assessment instrument in developmental research that focuses on the quality and quantity of stimulation and interaction provided to children in home environments. Developed by Bettye Caldwell during the 1960s, this assessment has been through multiple revisions and refinements. While designed as a screening mechanism to identify children whose home environments might not be providing adequate support, the assessment has been used as a predictor of cognitive development and attachment status and to assess the impact of disability, poverty, existing medical problems, maternal psychopathology, and parental substance abuse on children's development and readiness for school. Researchers have also used the HOME as a pre- and post-measure to evaluate the effects of family interventions. While the HOME continues to be used, some researchers, particularly those working with diverse populations of children, have moved away from or supplemented these types of static assessments to focus on the local literacy and language practices occurring in diverse homes that might not be captured by any single assessment.

The effect of home environment on language and literacy development has become a common

explanation for the differential success of children from differing cultural and linguistic backgrounds. While diversity in terms of culture, social class, race, ethnicity, and language generally characterize the populations that are the focus of family literacy research, it is unclear whether educators and researchers have grappled with the full significance of this diversity. Some scholars have expressed concern that issues related to diversity have contributed to the construction of binaries that explain the effects of home literacy environments on language and literacy development. The terms *strengths* and *deficits* are generally used to reference the most frequently cited binary within family literacy scholarship. In short, families are presented as either possessing literacy and language strengths or lacking literate or linguistic abilities.

Quantitative studies tend to treat difference as a methodological variable that correlates with specific literacy practices and eventual school progress. These predictive and causal research studies documented the degree to which children met accepted benchmarks of school progress—passing tests, advancing through grade levels, moving through defined scope and sequences, meeting standardized benchmarks, and mastering sets of information. Not only do these methods define success in terms of school-sanctioned expectations, but they also invoke linear and assumedly universal trajectories that are shared by all normally progressing students. These studies are clearly aligned with institutional norms and expectations and strive to help all children master the skills and abilities that are valued within school contexts and accepted as evidence of language and literacy development and learning. Because these approaches focus on providing children with scientifically identified experiences that correlate with school success, they are sometimes described as deficit approaches based on their focus on addressing the deficiencies that children are assumed to bring to language and literacy learning.

In contrast, strength-based approaches focus on the language abilities and literacy practices that exist in diverse households. These studies are less interested in ensuring that children meet static and assumedly universal benchmarks for achievement. Instead, they argue that rich and sophisticated language and literacy practices exist in all homes and that it is the responsibility of schools and teachers to recognize and nurture those skills in support of the children's language and literacy development. These researchers highlight

the interests and abilities of families, arguing that it is the educators' responsibility to understand the families they serve and to recognize their strengths. In addition, strength-based perspectives argue that educators in diverse communities may pursue particular goals unique to their local communities. These goals are understood as changing and evolving and may or may not reflect specific school expectations. Educators working from strength-based perspectives argue that family literacy programs must identify their purposes through ongoing discussion and negotiation with families; the perspectives of family members are key to designing programs that are both effective and durable. As Patricia Edwards explains, collaborations between home and school engage families and students in lived experiences that are not a preparation for democratic involvement but are themselves transformative and educative.

These debates relate to the nature of literacy and goals of language and literacy learning and suggest divergent approaches to supporting families and their children. Approaches grounded in causal studies that are designed to identify home literacy and language practices that correlate with later school success have informed the development of family literacy programs designed to train parents to provide their children with the types of experiences that have been identified as enhancing literacy learning in schools. In particular, these programs provide parents with explicit instruction in storybook reading, talking with their children, home writing activities, and games and activities to help children learn basic reading and writing skills. Parents are often provided with books and materials that they can use at home with their children.

In contrast, approaches that highlight the strengths and abilities of families focus on helping teachers to develop relationships with families in order to learn about families and identify funds of knowledge that can inform classroom learning. These programs advocate that teachers act as ethnographers to learn about language and literacy practices in local communities. Funds-of-knowledge approaches are based on the premise that people are competent, they have knowledge, and their life experiences have given them knowledge. Teachers engage in interviews, observations, and analyses of artifacts to identify the strengths that students and their families bring to classrooms. Norma Gonzalez and her colleagues have provided examples of how practitioners, within the limits of

their very real structural constraints, can realistically carry out emancipatory and liberatory pedagogies. While the methods for learning about families are generalizable, the instructional practices based on families' funds of knowledge are always local.

The tensions that have characterized conceptions of language and literacy research and practice in home environments are revealing and present possibilities for future research and practice. Deficit and strengths approaches share a commitment to helping all children succeed in school. As some educators and researchers have argued, there is also value in compromise.

Specifically, educators must recognize and consider the literacy demands that children will encounter in school if children are to be successful while also recognizing the possibilities that are offered by encouraging educators to consider the language and literacy practices that characterize home language and literacy environments. As Allan Luke maintained, educators must set aside issues of truth for the moment and form a provisional political coalition that addresses the possibilities presented by both deficit-based and strength-based approaches.

Catherine Compton-Lilly
University of Wisconsin–Madison

See Also: Cross-Cultural Factors in Communicative Development; Dialect Usage and Language Development; Effects of Head Start Early Intervention on Language Development; Effects of Schooling on Language Development; Literacy Instruction Methods; Reading, Development of; Socioeconomic Factors.

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Home Sign

Deaf children who are born to deaf parents and exposed to sign language from birth learn that language as naturally as hearing children learn the spoken language to which they are exposed. Children who lack the ability to hear thus do not have deficits in language learning and can exercise their language-learning skills if exposed to usable linguistic input. However, 90 percent of deaf children in the world are born to hearing parents who are unlikely to know a sign language and typically want their child to learn spoken language. Although these deaf children have intact language-learning skills, they have no linguistic input to apply their skills to. Under these circumstances, deaf children use gestures—called home signs—to communicate with the hearing individuals in their worlds. Home sign systems thus arise under two conditions—when a child's hearing losses are so profound that the child is unable to learn spoken language, even when given hearing aids and intensive instruction, and when the child's hearing parents do not expose the child to sign language.

Despite the fact that they are fashioned without access to a language model, home signs display many of the basic properties of natural languages. Home signers' gestures form a lexicon. These lexical items are themselves composed of parts akin to a morphological system. Moreover, the lexical items combine to form structured sentences akin to a syntactic system. The gestures in the sentences follow word-order patterns and can be chunked into constituents. In addition, home signs contain lexical markers that modulate the meanings of sentences (negation and questions) as well as grammatical categories (nouns and verbs, subjects and objects). Finally, home sign is used not only

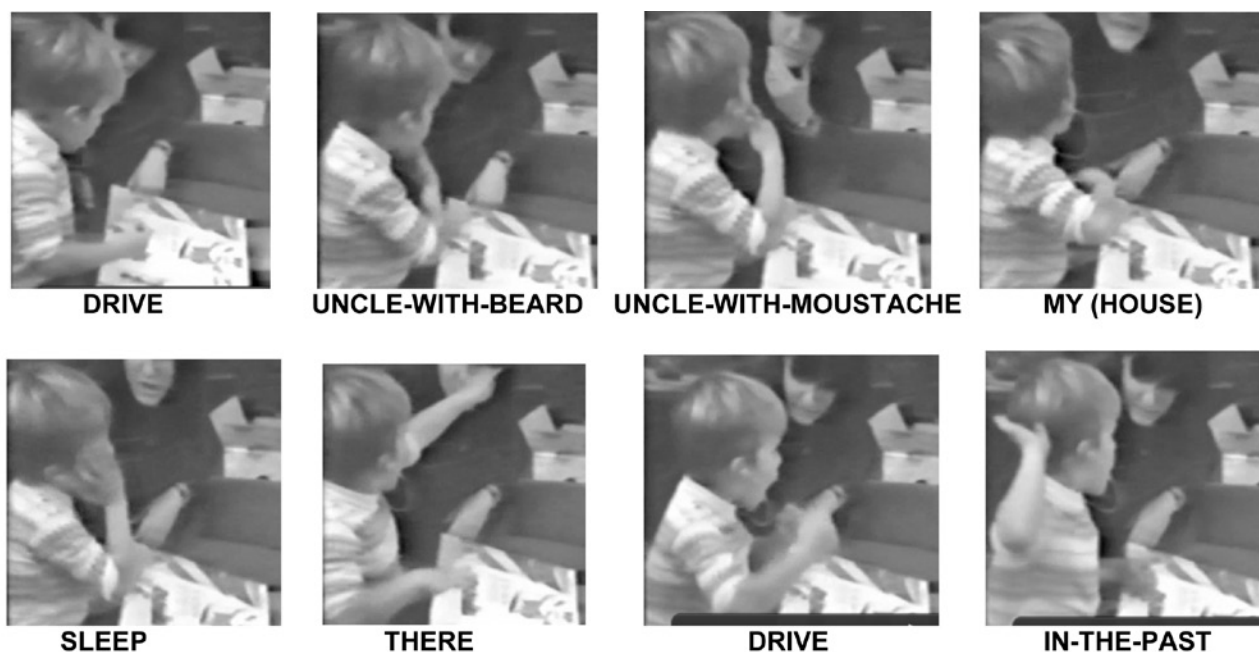
to make requests of others but also to comment on the present and nonpresent (including the hypothetical) world and to “talk” to oneself—that is, to serve the functions that all languages, signed or spoken, serve. Home sign thus differs from the gestures that hearing children produce as they learn language, which are typically single pointing gestures or an occasional iconic gesture. Hearing children rarely combine their gestures into strings and thus do not produce the gesture sentences that characterize home sign.

Home signers are not exposed to codified language input and, in this sense, differ from children whose hearing parents use baby signs with them. Baby signs were developed to give parents a way to communicate with their hearing children before they are ready to talk. But, home signers are exposed to the spontaneous gestures that hearing people produce when they talk, which could, in principle, serve as a model for their gestures. However, co-speech gestures, as they are known, differ from home sign not only in function but also in form. In terms of function, co-speech gesture works along with speech to communicate; home sign assumes the full burden of communication. In terms

of form, co-speech gesture relies on mimetic and analog representation to convey information; home sign (like sign language) relies on segmented forms that are systematically combined to form larger wholes. The co-speech gestures that home signers see are thus different from the gestures that they themselves produce.

Two important characteristics of home sign follow from these facts: (1) the linguistic properties found in home sign cannot be traced to the gestures that the home signers’ hearing parents produce when they talk, and (2) home sign systems are not shared in the way that conventional communication systems are shared. The deaf child’s hearing parents produce co-speech gestures, which form an integrated system with the speech they accompany and thus are not free to take on the properties of the child’s home signs. As a result, although parents respond to their child’s home signs, they do not adopt them. Home sign is thus a produced but not a received system and, in this sense, differs from conventional sign languages and even from village sign languages (sign systems that evolve within a community containing more than one deaf individual).

Figure 1 A home signer gesturing about the time his uncle came to visit



The home signer first produces a “drive” gesture to indicate that they drove to the airport to pick up the uncle (indicated through two gestures, “beard” and “moustache”). He then gestures that they brought the uncle to his house (indicated by a point at his chest, “my”) and that the uncle stayed in the house (“sleep” “there”). After a pause, the home signer indicates that the event happened a while ago (“drive” “in-the-past”).

Home signs may, however, hold a special place in the analysis of sign languages. It is likely that many, if not all, current-day sign languages have their roots in home sign. Home signs have much in common even if they are developed in very different circumstances around the globe.

These shared properties reflect either the linguistic capacities that all human beings share or constraints imposed by the manual modality itself. Understanding the differences between modern-day sign languages and home sign provides insight into pressures that move languages away from their original starting points. Home sign thus offers a glimpse into the most fundamental properties of language and provides an anchor point against which to examine the trajectories sign languages (and perhaps all languages) take as they evolve.

Susan Goldin-Meadow
University of Chicago

See Also: Baby Sign Systems; Gestures in Communicative Development (Overview); Language Development in Deaf Children; Pointing; Sign Language Acquisition; Symbolic “Gesture Names.”

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Humor

Humor is relevant in language development for several reasons. Humor is communicative in nature as humor is almost always shared. Humor can serve as an introduction to pragmatics as humor has both a literal and intended meaning. Children’s sense of humor reflects their level of language development as one can only understand jokes in relation to mastered concepts. It is thus not surprising that children with communication and language disorders often show humor deficits. Finally, humor may be useful in encouraging language development.

Incongruity Theories

Several cognitive models of humor espouse that humor is the product of noticing and appreciating incongruities, that is, things that are unexpected, unusual, or out of the ordinary. These theories suggest children’s humor develops alongside their cognitive abilities. From a language point of view, as children’s language abilities develop, their appreciation for jokes involving language abilities also develops. In 1979, P. E. McGhee theorized that from 2 years, toddlers produce mislabeling jokes, such as calling an apple a banana, once they have expanded their vocabularies. He also theorized that, from 3 years, children appreciate jokes involving incongruous attributes, that is, jokes involving playing with concepts, such as suggesting wheels are square. These types of jokes could thus be expressed when children can verbalize their understanding of concepts.

Research supports this theory to some extent. A case study found one child produced mislabeling jokes from 15 months (e.g., calling a hummingbird a duck). Interestingly, these jokes were made on average 50 days after the words inherent to the jokes were first used. The child also produced jokes based on conceptual incongruity from 18 months (e.g., saying a horse says “baa”). Parents of children between 0 and 4 years report children make conceptual incongruity jokes from 2 years and mislabeling jokes from 3 years,

and observation of parent–child humorous play with 2- and 3-year-olds found similar results. This may be because mislabeling jokes actually involve having a high level of metalinguistic awareness as they involve playing with language itself in a way that incongruity jokes do not. Thus, the ability to verbally express incongruities may allow children to create verbal jokes in general, while further advances in metalinguistic awareness may allow children to make mislabeling jokes.

From 4 or 5 years, children's incongruity humor can develop into more specific forms, such as hyperbole. In observational work, children were found to make jokes such as, "I could eat a whole doctor's office, even the people," demonstrating the ability to play with language to exaggerate.

In 1972, T. R. Shultz theorized that humor involves both incongruity and resolution, where the joke makes sense in a new context. Puns are the first example of this. Puns involve noticing a sentence is at first incongruous but, with a second interpretation, makes sense (resolution). Children typically appreciate puns from around 8 years. This is linked to their ability to understand conservation. In experiments, children from 6 to 12 years were told the beginning of a joke and asked to choose the funniest punch line. For example, one joke began, "Why did the cookie cry," with possible answers: (1) because its mother had been a wafer so long (incongruity and resolution), (2) because its mother was a wafer (incongruity), (3) because it was left in the oven too long (resolution). Children chose the incongruity and resolution answer from 8 years, but chose either answer involving incongruity equally at 6 years. Additionally, older children better explained their understanding of the jokes.

Humor and Pragmatics

Humor often falls outside central theories of language as it is nonliteral in nature, such that what is said is generally not what is meant, similar to metaphor, irony, and lying. Pragmatics have been invoked to explain how we process humor. In 1989, H. P. Grice attempted to account for non-natural communication, including jokes, by specifying that the speaker must communicate his or her intention to joke to the listener for the act to be communicative. From a processing point of view, a Relevance Theory account of humor suggests that, when we process a humorous utterance, we already know the intention behind the utterance is to be humorous. If the intention to joke

was not conveyed, people may take the joke literally, and the message would be misunderstood.

Thus, humor can serve as an introduction to pragmatics. Indeed, parents support this pragmatic understanding early on. When reading a book containing jokes versus literal information, parents used more language showing disbelief. For example, if joking that ducks say "moo," parents said things like, "Ducks don't really say moo!" Parents thus essentially explained the jokes, conveying both the literal and pragmatic meanings. Using the same paradigm, when telling jokes versus speaking literally, parents exaggerated their use of child-directed speech (CDS) and used a rising linear contour. CDS can help toddlers to better hear and hence understand what has been said, while a rising linear contour can indicate the dual status of the statement. The sentence itself contains a literal interpretation, while the rising contour makes the sentence sound questionable and hence untrue.

From 30 months, toddlers demonstrate their understanding of pragmatics in mislabeling jokes. An experimenter either mislabeled familiar objects (e.g., calling a shoe an *oogy boo*), and gave humorous cues (laughter), or gave sincere cues ("There!"). Toddlers more likely gave wrong labels themselves when the experimenter laughed. Similarly, one experimenter requested a familiar object from another experimenter (e.g., spoon), and the other experimenter gave the wrong object (e.g., toy pig), either laughing or saying, "There!" Again, toddlers more likely gave the wrong object when the experimenter laughed.

In another experiment, an experimenter falsely named three objects, with a neutral expression, mixed in with seven correctly labelled objects. When asked why the experimenter said what he or she had said, 2- and 3-year-olds readily attributed the false statement to mental states, often stating the experimenter was joking or being silly. Thus, toddlers understand humor involves doing or saying something wrong on purpose.

In a further set of experiments, children heard stories in which a character said a falsehood (e.g., they had made a picture, which they had not, or had eaten their peas, when they had not), either in a context suggesting joking (the person who told the falsehood knew their audience knew they were telling a falsehood) or a context suggesting lying (the person who told the falsehood thought their audience did not know they were telling a falsehood). Children correctly identified the jokers and liars from around 5 years. This requires an even higher level of pragmatic

understanding as both concepts involve intentionally saying the wrong thing but for different reasons.

Humor and Communicative or Language Disorders

Humor deficits are found in children with communicative and language disorders. Autism Spectrum Disorder (ASD) is characterized by communication deficits, including deficits in pragmatic skills. Children with ASD also display differences in humor development. For instance, according to parent reports, in toddlerhood, children with ASD appreciate nonsocial humor (e.g., slapstick) but not social humor (e.g., funny faces), contrary to typically developing (TD) children and children with Down syndrome. Additionally, unlike TD toddlers in a study explained earlier, when adolescents with ASD (mean age 15 years) were asked why an experimenter mislabeled objects, adolescents with ASD did not refer to mental state explanations (e.g., that they were joking) but instead simply said the experimenter was wrong.

In another experiment, adolescents with ASD again showed humor impairments. Adolescents were shown a series of cartoons or the body of a joke, missing the punch lines. They were then asked to choose an ending out of four: straightforward, humorous, associative but unexpected, or neutral and unexpected. Adolescents with ASD were less able to identify joke endings for fully verbal jokes than TD peers but were equally good at identifying verbal endings for cartoon jokes.

Adolescents with language impairments also showed verbal humor deficits compared to TD peers. When tested on their understanding of lexical, phonological, morphological, and syntactic jokes, adolescents with language impairments were less able to comprehend the jokes. Interestingly, like children with ASD, children with specific language impairment often have deficits in mental state understanding (Theory of Mind), which could help explain the results.

Children with articulatory impairments also show specific impairments in humor comprehension. Children were asked to explain puns. Some of these puns related to their articulatory impairment. For instance, for children who had difficulty articulating the phoneme /s/, a phonological pun related to their impairment would be, "Why couldn't the crab learn to share? Because he was a shellfish." In contrast, a phonological pun not relying on the phoneme related to their impairment might be, "What is a firefighter's favorite

game? Follow the ladder." Children who misarticulated phonemes such as /s/ or /r/ were less able to explain puns relying on those specific phonemes.

Adolescents with a variety of head injuries covering many different brain areas also showed linguistic humor impairments on jokes involving morphological, semantic, and syntactic humor compared to TD controls. They were shown cartoons with written captions and asked to select why they were funny out of three possible answers. For instance, in a cartoon of cheetahs cheating on a test, a cheetah tells the teacher, "They're a bunch of cheetahs." Children had to identify whether this was funny because (1) the animals were really leopards, (2) the animals were cheetahs and were cheating, or (3) cheetahs don't go to school. Adolescents with head injuries performed more poorly on the task than TD adolescents.

In contrast, deaf children show no differences to TD children in appreciating nonverbal cartoons. Participants (6–21 years) rated cartoons without captions on how funny they were. There were no differences between groups. Deaf communities create jokes influenced by jokes in their surrounding hearing culture and their own visual experiences, and their jokes also reflect the culture of their deaf community. These jokes include metalinguistic jokes relating to sign language.

Encouraging Communication and Language Skills With Humor

Humor may help develop children's language skills. For example, jokes can be helpful in increasing children's reading comprehension. Seven- to 9-year-olds, with typical or below-average reading comprehension, discussed and resolved ambiguities in jokes over several sessions. Reading comprehension scores increased for both groups of children. This increase was accounted for by increases in metalinguistic comments.

Pun-generating games also help children with cerebral palsy who have communicative, language, or learning difficulties. Children played with STANDUP pun-generating software, which creates puns via an algorithm, over eight weeks. For instance, the software has produced puns such as "What do you get when you cross a monkey with a peach? An Ape-ricot." Using the software encouraged discussion and sharing jokes with others.

Stages of Verbal Humor Development

From 2 years, parents report toddlers start to invent their own novel jokes, and their repertoire includes

conceptual jokes where they describe unlikely or impossible events (e.g., saying dogs have three tails) and jokes covering taboo topics (e.g., poo jokes). Observational research supports this progression. Additionally, experimental research shows that, from 30 months, toddlers make up their own novel mislabeling jokes. In a study discussed earlier in which experimenters mislabeled familiar objects and marked them with laughter or “There,” there were also extension trials in which the experimenter no longer modeled the jokes. Toddlers in the laughter group continued to make up their own novel object labels (e.g., one child called a cup a “goojooboojoo”), while children in the sincere group named objects appropriately.

In experimental work, children of ages 4 to 13 years were asked what they might say to a friend or teacher who was sad in order to make them laugh. Four- to 8-year-olds primarily made jokes that violated language or logical norms, for example, “How does a chef make pasta? He uses his noodle.” Nine- to 13-year-olds produced more jokes involving decorum violations (e.g., defecation jokes) and politeness violations (e.g., sexist jokes). From 8 years, children also appreciate puns, showing they can consider two meanings of a word, phrase, or sentence at the same time. They also understand idioms embedded in incongruity-resolution humor, demonstrating a deeper understanding of nonliteral language. In an experiment, 8- to 10-year-olds were asked to explain jokes that had idioms embedded in them. For example, children could correctly explain the following joke: “I would like to become a space engineer.” “*Do you think you can pass the test?*” “*Sure, I took up space in school.*” They explained that the person went to school but did not listen or learn.

However, other explanations, such as *he was very big* (literal) or *he studied space things* (related) would not be classified as correct. Children were better able to explain the jokes as they got older. Furthermore, observational work shows that, between 10 to 12 years, children tell memorized jokes, funny stories, and perform practical jokes.

Elena Hoicka
University of Sheffield

See Also: Autism; Conversational Implicature; Lying; Interrelationship of Language and Cognitive Development (Overview); Meta-Linguistic Awareness; Metaphor; Nonliteral Language Use; Play and Its Role

in Language Development; Pragmatic Development; Theory of Mind and Language Development.

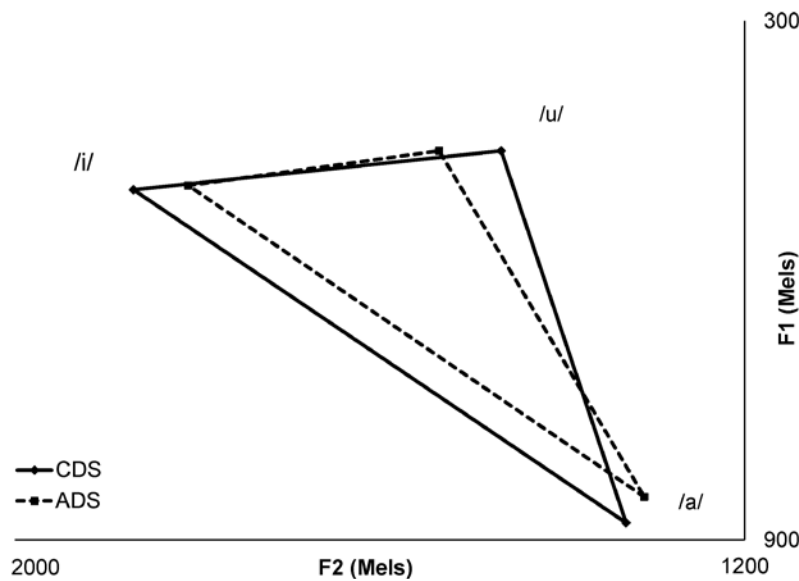
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Hyper-Articulation of Child-Directed Speech

Child-directed speech (CDS) is the speech style used by mothers, fathers, and others to talk to an infant or young child and is known to engage attention, regulate arousal levels, and facilitate language development. Typically, its production involves adopting a strategy of simplifying what is said and exaggerating how it is said, or more specifically, exaggerating its prosodic and phonetic features. Adjustments that make CDS linguistically distinctive from adult-directed speech (ADS) include shorter utterances, more repetition, simplified syntax, and smaller vocabulary. Prosodically, it has exaggerated intonation and positive emotion, and phonetically, it contains hyper-articulation of certain speech sounds.

Hyper-articulation refers to the exaggeration of the phonetic features of CDS that contribute to the clarification of its speech sounds. Hyper-articulation occurs in many situations where there is a perceived need to make speech more clearly understood, such

Figure 1 Vowel space plotted for the letters *i*, *u*, and *a*

as when talking to foreigners and hearing-impaired adults, or to overcome interference in noisy environments. The commonly studied measure of hyper-articulation in CDS is in relation to the corner vowels /i/, /a/, and /u/. This is achieved by plotting CDS and ADS corner vowels in vowel space and calculating the degree to which the formant frequencies of the CDS corner vowels extend beyond those in ADS.

Vowel space is a graphical means of showing where the location of a vowel lies in relation to other vowels or other tokens of the same vowel, and it is plotted with the vertical axis representing the first formant and the horizontal axis representing the second formant. Formants are those bands of energy that correspond to vocal tract resonances for particular vowel sounds. Their location in vowel space gives an indication of where the tongue body is placed during production, that is, whether it is high or low and whether it is in a front or back position. It should be noted that mouth shape also plays a role in translating vocal tract resonances into vowel sounds.

The tendency for mothers to hyper-articulate corner vowels in speech to young children between the ages of 2 and 12 months is a fairly reliable phenomenon across a number of languages. Hyper-articulation has been found in many languages, for example, in American English, Russian, and Swedish by Patricia Kuhl and colleagues; in Japanese by Jean Andruski and colleagues; and in Mandarin Chinese by Huei-Mei Lui

and colleagues. Kjellrun Englund and Dawn Behne, on the other hand, found no evidence of vowel hyper-articulation in Norwegian, but it is unclear whether Norwegian is an exception or whether their findings are due to methodological differences between studies. What is clear is that exposure to hyper-articulated vowels makes discrimination easier than exposure to the more centralized vowels used in speech to another adult. Vowel hyper-articulation assists word learning as revealed by Jae Yung Song and others. In this study, 19-month-olds recognized words better when vowels in words were hyper-articulated than when they were not. Furthermore, as shown by Huei-Mei Liu and

colleagues, there is a correlation between the degree of vowel hyper-articulation in mothers' speech and their infants' ability to discriminate native and nonnative speech contrasts.

The question remains: Are other phonetic features of speech, such as in consonants and lexical tones, also hyper-articulated? For consonants, this usually involves determining the degree of separation between voice onset times in voiced and voiceless stop consonants. The evidence for this is not strong. In her review, Melanie Soderstrom presents an array of findings on consonant hyper-articulation, which when taken together, suggest hyper-articulation of stop consonants is not a robust feature in CDS. For lexical tones, on the other hand, there is an exaggeration of the acoustic cues that signal the difference between lexical tones in Mandarin Chinese as revealed by Huei-Mei Lui and others. The acoustic exaggeration of phonetic units, such as vowels and tones, is purported to benefit young language learners by increasing the perceptual distance between phonetic units.

There are three possible reasons for hyper-articulation in CDS. First, there is the suggestion that the driving force for vowel hyper-articulation is the infants' capacity for developing speech, which is recognized, albeit unconsciously, by mothers. The basis for this proposal is a study by D. Burnham and others that found vowel hyper-articulation in CDS but not in the similarly intonated speech style directed to pets (who

do not develop language). Second, and contrary to this proposition, others such as Christa Lam and Christine Kitamura show that, when infants have a loss of hearing, the size of the vowel space is reduced in proportion to how well the infants can hear their mothers. This suggests that it is infant feedback, such as smiling and positive gaze, that plays a critical role. Third, and tangential to this hypothesis, is the claim that hyper-articulation might be an artifact of the affective salience in CDS. Mothers are certainly sensitive to the needs of their young audience, but whatever the mechanism, it seems hyper-articulation is designed to support language development in young children.

Christine Kitamura
University of Western Sydney

See Also: Child-Directed Speech (Features of); Dyadic Interaction and Early Communicative Development; Linguistic Tonal Systems; Phoneme Discrimination; Proto-Conversation and Song in Infant Communication; Speech Perception and Categorization.

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