Acquiring Linguistic Constructions

CHAPTER 6

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Acquiring Linguistic Constructions

From a cognitive science point of view, the central issue in the study of language development is the nature of children's underlying linguistic representations and how these change during ontogeny (development).

Outline

◦ History and Theory

◦ Early Ontogeny

◦ Later Ontogeny

◦ Processes of Language Acquisition

◦ Discussion – Linguistic Constructions in NARS

Linguistic communication

Human linguistic communication is:

- symbolic - symbols refer to objects in outside world or abstract objects

- grammatical - symbols are used together in patterns

- non-universal - no common language for all humans

History and Theory

Historically, language acquisition theories have swung between two approaches:

◦ Child-centered approaches

  ◦ 3 rule pivot grammar (Braine, 1963)

  ◦ Semantic Relations approach (mid 1970s)

◦ Adult-centered approaches

  ◦ Transformational Generative Grammar, Case Grammar, Generative Semantics, etc. (1960s and 1970s, Brown reviewed in 1973)

  ◦ Government and Binding theory, Lexical Functional Grammar (1980s)

  ◦ Chomskian generative grammar

Two Main Theories

Adult centered approach
  ◦ Words and Rules
  ◦ Formal Grammar

Child centered approach
  ◦ Cognitive-functional linguistics
  ◦ Usage-based linguistics

The author adopts a usage-based theoretical perspective on the process of language acquisition

Definition - Linguistic construction

A linguistic construction is prototypically a unit of language that comprises multiple linguistic elements used together for a relatively coherent communicative function, with subfunctions being performed by the elements as well.

Consequently, constructions may vary in their complexity depending on the number of elements involved and their interrelations.

◦ plural construction (N+s)

◦ passive construction (X was VERBed by Y)

Linguistic construction

A major part of human linguistic competence involves the mastery of all kinds of routine formulas, fixed and semi-fixed expressions, idioms, and frozen collocations:

◦ I wouldn't put it past him

◦ He's getting to me these days

◦ Hang in there

◦ That won't go down well with the boss

◦ She put me up to it

The theoretical problem for algebraic approaches such as generative grammar is what to do with these fixed and semi-fixed complex structures.

Discussion: How can NARS generate these fixed and semi-fixed expressions and idioms (and is it necessary to be able to generate them, or is it enough to know what they mean)?

Early Ontogeny

What children hear/early language

Utterances – single and multi-word

Schematization

Marking Syntactic Roles

Constructing Lexical Categories

What children hear/early lanuage

Children attempt to learn whole adult utterances, not just individual words.

Children must also acquire many (perhaps hundreds) of constructions based on input with many different construction types that are semi-randomly strewn.

The utterances children hear are grounded in highly repetitive item-based frames that they experience dozens, in some cases hundreds, of times every day

Repetition is key to language acquisition

Single-word utterances

Children learn object labels for some events
- "Bike!" as a request to ride a bicycle
- "Birdie" as a comment on a passing flight

They still need to learn to linguistically express the activity involved
- "Ride bike!"
- "See birdie"

Multi-word utterances

1. Word combinations:

◦ combine two words or holophrases in situations in which they both are relevant—with both words having roughly equivalent status. Ex: "Ball table."

2. Pivot schemas:

◦ one word or phrase that seems to structure the utterance in the sense that it determines the speech act function of the utterance as a whole, with the other linguistic item(s) simply filling in variable slot(s)—the first type of linguistic abstraction. Ex: "More milk," "More grapes," "More juice"

Multi-word utterances

3. Item-based construction:
- ◦ Learned for different verbs on a one-by-one basis
- ◦ use syntactic symbols such as morphology, adpositions, and word order to syntactically mark the roles participants are playing in these events, including generalized slots that include whole categories of entities as participants.
- ◦ Ex: Draw ___, Draw ___ on ___, Draw ___ for , ___ draw on ___
- ◦ Problem: children mostly cannot transfer their knowledge of word order from their existing item-based constructions to this new item until after their third birthdays

Schematization

If the child forms a generalized action or event schema with a variable slot for some class of items (e.g., Throw X), that slot and class of items are defined by their role in the schema, which is why Nelson (1985) calls them slot-filler categories.

This means that in the case of pivot schemas such as Throw X, X gone, and Want X, the slot could be thought of as something like "throwable things," "things that are gone," "things I want more of," and so forth.

Disucssion: How do we accomplish schematization in NARS (use interfaces)? We don't know exactly what the behavior will be for a particular object, but we know it will fit within a category.

Marking Syntactic Roles

Two major devices for marking syntactic roles:

- Word order
  - "Make the doggie bite the cat" vs "Make the cat bite the doggie"
  - Data shows that children do not fully understand word order as a verb-general, productive syntactic device for marking subjects and objects until after 3 years of age.
- Morphological marking
  - indicates the grammatical function of the marked word, phrase, or sentence
  - (cat vs. cats) or (to eat vs eats, ate, and eaten)
  - The most robust phenomenon is that children most often substitute accusative forms for nominative forms ("Me going") but very seldom do the reverse ("Billy hit I")

Marking Syntactic Roles

(Slobin, 1982) A central discovery was that children can more easily master grammatical forms expressed in "local cues" such as bound morphology as opposed to more distributed cues such as word order and some forms of agreement.

◦ Evident in Turkish-speaking children; Turkish is "child friendly" and it makes learning agent-patient relations easy

  ◦ salient, predictable, local and generalizable

Ultimately, it is a competition between these local cues and word order and the speaker must decide which takes precedence in which case:

◦ "The spoon kicked the horse"

Discussion: For Narsese, should we try to make the language more 'child friendly', or is it better for it to be more complicated to understand more complicated languages?

Constructing Lexical Categories

Another important part of the process of grammatical development is the construction of paradigmatic categories such as noun and verb.

Unlike syntactic roles, paradigmatic categories are not explicitly marked in language.

Langacker stresses that nouns and verbs are used not to refer to specific kinds of things but rather to invite the listener to construe something in a particular way in a particular communicative context.

We may refer to the very same experience as either "exploding" or "an explosion," depending on our communicative purposes. In general, nouns are used to construe experiences as bounded entities (like an explosion), whereas verbs are used to construe experiences as processes (like exploding).

Constructing Lexical Categories

After an individual understands the functional basis of nouns and verbs, formal features such as determiners and tense markers may be used to identify further instances.

Children initially understand paradigmatic categories very locally and mosaically, in terms of the particular kinds of things particular words can and cannot do communicatively.

◦ a novel name for a novel object in a syntactically neutral context can be combined with predicative terms: ("Look! A wuggie.", "Hug wuggie," "Wuggie gone," etc.)

These pattern-finding skills are not specific to language learning.

◦ Discussion: Do we/should we use existing pattern-finding skills to learn language in NARS?

Later Ontogeny

Abstract Constructions

Constraining Generalizations

Nominal and Verbal Constructions: Learning Morphology

Complex Constructions

Abstract Constructions

Identificationals
- It's a/the X; That's a/the X; or This's a/the X.

Attributives
- Here's a/the X; There's a/the X.

Possessives
- (It's) X's ____; That's X's/my ____; This is X's/your ____.

Abstract Constructions

Simple Transitives
- two participants and one somehow acts on the other

Simple Intransitives
- a single participant and activity

Ditransitives, Datives, Benefactives
- *To*-dative, *for*-dative, and double-object dative
- "Jody sent it to Julie" (it is known), "Bob sent Bill the X" (X is being introduced)

Locatives, Resultatives, and Causatives
- X up, X down, X in, X out, on X, off X, over X, and under X
- verb + particle constructions such as pick X up, wipe X off, and get X down

Abstract Constructions

Passives, Middles, and Reflexives

◦ "Bill was shot by John" takes the perspective of Bill and what happened to him, rather than focusing on John's act of shooting

◦ "Bill was shot" strengthens this perspective further

◦ "John shot Bill" takes the perspective of John and what he did to Bill.

Questions

◦ A simple declarative transforms into a question by moving, rearranging, or inserting grammatical items.

◦ Children learn questions as a collection of item-based constructions, moving only gradually to more abstract representations.

◦ Discussion: In mandarin, there is just a question word at the end 'ma'. How do we denote questions in Narsese?

Abstract Constructions

Analogy

◦ the essence of analogy is the focus on relations. When an analogy is made, the objects involved are effaced; the only identity they retain is their role in the relational structure

◦ an important part of making analogies across linguistic constructions is the meaning of the relational words (specifically special, temporal and causal relations)

◦ Ex: Two pictures - Car towing boat vs Truck towing car -> Children have no trouble ignoring the literal match of cars across the two pictures and choosing the truck

Children can make generalizations, perhaps based on analogy, across different item-based constructions. They also show that the material that goes in the "slots", in this case NP slots, plays an important role.

Children (after learning many of different abstract (item-based) constructions) seem to reorganize their knowledge of the independently learned patterns and extract a more abstract schema.

Constraining Generalizations

A major problem for generative theories is that as the rules and principles are made more elegant and powerful through theoretical analyses, they become so abstract that they generate too large a set of grammatical utterances (combinatorial explosion)

Theories must address the question of why children make just the generalizations they do and not others.

◦ He gave/sent/bequeathed/donated his books to the library.

◦ He gave/sent/bequeathed/*donated the library his books.

◦ She said/told something to her mother.

◦ She *said/told her mother something.

Discussion: What types of constraints do we need to apply in NARS NLP to avoid the combinatorial explosion problem in generating linguistic constructions?

Constraining Generalizations

Constraining processes:

◦ Entrenchment – frequency of hearing

◦ Preemption – hearing something unexpected

  ◦ "He made the rabbit disappear", instead of "He disappeared the rabbit"

◦ Knowledge of semantic subclasses of verbs

  ◦ Ex: a verb denoting a "manner of locomotion" such as walk and drive ("I walked the dog at midnight" or "I drove my car to New York") can be used in a transitive construction

  ◦ If it denotes a "motion in a lexically specified direction" such as come and fall ("He came her to school" or "She falled him down") it cannot be used in this way.

Nominal and Verbal Constructions

Nominal constructions (NPs)
- ◦ reference things in various ways (Bill, my father, the man who fell down)

Verbal constructions (VPs)
- ◦ predicate something about those things (is nice, sleeps, hit the ball)

Not all languages have these classes of words, and some words can fit into both
- ◦ I cut the bread, There's a cut on my finger
- ◦ I'm hammering in this nail with my hammer.

Using 'a' versus 'the'
- ◦ I want the cookie, I want a cookie
- ◦ I have a kite – introduces a new item; where is the kite? – referent is known

Distributional bias hypothesis
- ◦ distribution of tense and aspect markers with particular classes of verbs in children's speech follows the distribution the children hear in the language around them

Learning Morphology

U-shaped developmental growth
- Ex: mans, feets, sticked, putted
- The theory is that the item was learned initially in one form, the rule was then learned, which is applied to the item incorrectly, and finally the exception to the rule is learned.
- Children produce both the item learned initially and the item constructed with the rule, the one they utter is the one that wins the 'competition' between the two.

Discussion: humans tend to learn language in two parts - frequency analysis (such as in ML) and rule based (such as in rule-based programs); Is the best AI approach hybrid?

Complex Constructions

A way of talking about multiple events and states of affairs related to one another in complex ways.

Link clauses (either tightly or loosely related) together

1. Infinitival Complement Constructions
   ◦ wanna V, hafta V, gotta V, needta V, gonna V
   ◦ "Dolly wanna drink that"

2. Sentential Complement Constructions
   ◦ May, might, think, know, believe, see, say
   ◦ "I know she hit him" and "I think I can do it"

3. Relative Clause Constructions
   ◦ "Here's the toy that spins around"

Processes of Language Acquisition

◦ The Growing Abstractness of Constructions

◦ Psycholinguistic Processes of Development

◦ Production of Linguistic Utterances

◦ Individual Differences and Atypical Development

The Growing Abstractness of Constructions

Early on, children's linguistic representation is highly concrete
- Based in specific item-based constructions with some abstract slots

Grows more abstract over time (late preschool time period)
- As more and more relevant exemplars are encountered and assimilated to the construction

Psycholinguistic Processes of Development

Processes by which children construct a language:
- Intention-Reading and Cultural Learning
  - Do things the way others (intended to) do them; learning words and phrases, their meanings, and the functional roles of the pieces
- Schematization and Analogy
  - Linguistic schema leads to creative use of languages; categorizing items in a general sense
- Entrenchment and Competition
  - The more you hear or see something a certain way, the more you will repeat it in that way.
- Functionally Based Distributional Analysis
  - a process of grouping together, not items of perceptual or conceptual experience, but rather items used in linguistic communication

Production of Linguistic Utterances

Symbolic integration - fitting together an item-based construction and a novel item to go in the slot.

◦ The growth of working memory is an integral part of this process (Adams & Gathercole, 2000).

Three basic options for producing an utterance:

1. Retrieve a functionally appropriate concrete expression and just repeat it

2. Retrieve an utterance-level construction and simultaneously "tweak" it to fit the current situation

3. Produce an utterance by combining schemas

Individual Differences and Atypical Development

Children with larger working memories seem to learn and process language more efficiently (Adams & Gathercole, 2000).

The language learning environment in which children grow up is responsible for at least some of the individual differences in rate of development (Nelson 1977).

◦ Adult conversational replies that maintain the child's topic and to some extent her meaning while at the same time recasting it into a more adult like form, are important for linguistic development.

◦ Training/feedback are important

Atypical linguistic development is suggested to be correlated with a problem in working memory, the auditory domain, spatial perception and cognition, and/or perception of one kind or another.

Conclusion

Children need to be able to
- read intentions of others to acquire the productive use of meaningful linguistic symbols and constructions
- find patterns in the way people use symbols and thereby to construct the grammatical dimensions of language.

Language learning depends on other cognitive skills and cannot be an isolated skill; the way we learn and reason about other things is the way we should learn and reason about language.

Outstanding theoretical question: in addition, does children's language learning also incorporate an innate universal grammar and, if so, what functions this additional element might serve?

Discussion - Linguistic Constructions in NARS

◦ How can NARS generate fixed and semi-fixed expressions and idioms (and is it necessary to be able to generate them, or is it enough to know what they mean)?

◦ How do we accomplish schematization in NARS (use interfaces)? We don't know exactly what the behavior will be for a particular object, but we know it will fit within a category. (ex. Throwable things)

◦ For Narsese, do we/should we try to make the language more 'child friendly', or is it better for it to be more complicated to understand more complicated languages?

◦ Do we/should we use existing pattern-finding skills to learn language in NARS?

◦ In mandarin, there is just a question word at the end 'ma'. How do we denote questions in Narsese?

◦ What types of constraints do we need to apply in NARS NLP to avoid the combinatorial explosion problem in generating linguistic constructions?

◦ Humans tend to learn language in two parts - frequency analysis (such as in ML) and rule based (such as in rule-based programs); Is the best AI approach hybrid?