



Language acquisition, perception and production

Lecture 3 – Language acquisition

Language acquisition

- **Acquisition of**
 - **Phonology**
 - **Lexical / semantics**
 - **Syntax**

Language learning in the womb

- **When does language acquisition start?**
 - **DeCasper & Spence (1986)**
 - **Ask mother's read story last 6 weeks of pregnancy**
 - **After birth used non-nutrive sucking technique**
 - **Preferred heard story even if spoken by someone else**

After birth

- **After birth: 4 day old babies**
 - Mehler et al. (1988)
 - Played French speech to babies
 - Measured sucking rate until habituated
 - Then switched to Russian
 - Babies noticed switch in language!
 - Prosody
 - Intonation, stress, etc

Early Phonology

- **Children have to acquire the phonemes of their language.**
- **Children often make systematic errors in phonology (always replace k with t → tootie)**
- **This happens often even when children can repeat this sound , and get upset when the parent speaks like the child.**

Categorical perception in infancy

- Recall categorical perception involves identifying and discriminating sounds.
- Famous use of /ba/ and /pa/ that differ in Voice Onset Time (VOT).
- Onset time less than 25 ms → /b/
- Onset time more than 25ms → /p/
- Speech synthesizer can be used to accurately vary the VOT.
- Finding is that onsets around 0 and 20 ms are identified as /b/ and discrimination between these two is very hard → they are heard as the same (even though they are not).

- You hear these sounds as *categories*.

Categorical perception in infancy

- Eimas, Siqueland, Jusczyk, Vigorito (1971) examined categorical perception in 1 and 4 months olds.
- Infants were saturated with a particular sound (e.g., /ba/ with VOT 0 ms).
- Next they were either presented with a sound from the same category (e.g., /ba/ with VOT 20 ms).
- Or with a sound from a different category (e.g., /pa/ with VOT 40 ms).
- The infant's sucking rate only changed when the sound category changed!

Categorical perception in infancy

- What does this mean?
- Infants of 1 and 4 months old behave like adults in how they perceive these sounds.
- Assuming they have not yet already learned these categories (in 1 month?) it seems like these categories might be innate!
- In other words, there are innate constraints that lead us to hear the distinction between /ba/ and /pa/, but not between /ba/ VOT 0 ms, and /ba/ VOT 20 ms.

The role of language experience

- If these phonemic categories are innate, then infants must be able to perceive many of them, even ones that are not part of their language.
- Young children hear the contrast, older children do not.



The role of language experience

- **When do infants lose the ability to perceive contrasts that are not present in their language?**
- **Research suggests this decline begins as early as 1 month (Werker & Tees, 1984).**
- **Werker & Pegg (1992) argued that there is a perceptual reorganization instead of loss of abilities.**

Speech segmentation

- As mentioned before statistical cues are important
- Saffran, Aslin, & Newport (1996) presented infants with continuous streams of sounds like “bidakupadotigolabubidaku”
- Some syllable pairs more common (e.g., bida) than others (e.g., kapu).
- After being exposed to the continuous sound stream, they tested the infants to listen to the common and new strings.
- They preferred to listen to the new strings, suggesting they had retained the probabilities between the syllables. This information can be used to segment speech into words.

Speech segmentation

- **Such speech segmentation mechanisms are not innate**
 - **Chinchillas also do categorical perception (Kuhl, 1981)**
 - **Cotton-top tamarins (Hauser, Newport, & Aslin, 2001)**

Babbling

- **What is babbling?**
- **Pinker (1997): “The infant is like a person who has been given a complicated piece of audio equipment bristling with unlabeled knobs and switches but missing the instruction manual”.**
- **Fiddling with the controls to see what happens, writing their own instruction manual.**

Transition to speech

- **By end of first year, children start to produce first words.**
- **This depends on at least three factors**
 - 1. Greater motor control of speech apparatus**
 - 2. Cognitive maturation – knowing how communication works**
 - 3. Becoming aware that things have names!**

Transition to speech

- Things have names, sometimes they invent their own names
- Example is kid who called icecream “ABCDE”, because parents used to spell out I-C-E-C-R-E-A-M to make sure he didn’t understand.
- Suggests language learning is creative, and not only relies on input from parents

Phonological processes in early words

- Children's version of words often differ from correct adult's version
- Looking at errors could lead to how phonological processes work
- Four types of errors:
 1. Tore for store
 2. Paf for pacifier
 3. nance for dance
 4. titty for kitty

Phonological processes in early words

- **Why do children make these errors?**
- **They might hear them incorrectly? Unlikely, when you tell them the incorrect word they get upset.**
- **Cannot produce omitted sound? Unlikely, many studies show errors not made in imitation (Dale, 1976)**
- **Information overload? Possible, since child needs to pay attention to many factors. In this case, child would produce “simpler” forms, which seems true. Also explains good imitation performance, which is easier.**

Summary

- **Acquisition of sounds of language starts early**
- **Sensitive to prosody**
- **Using statistical learning mechanisms to segment speech**

Lexical / semantic development

- First word appears around 12 months, and by 18 months reliably produce names for things.
- This means they are beginning to form a lexicon.
- Estimates are that by age 6, children know about 14,000 words (Carey, 1978).
- Assuming they start learning at 18 months, this means they must learn 8 words / day.
- What do we mean when we say children “know” these words?

Lexical development of early words

- **Early words are related to here and now.**
- **Toys they play with, clothes, food.**
- **Not only nouns, but also action words (up, go), modifiers (dirty, pretty), personal and social words (please, want), and function words (what, for).**
- **Words for objects that the child cannot manipulate (tree, diaper) are absent.**

Overextensions and underextensions

- Part of word learning is the meaning of words. Some insight into how this works comes from children's semantic errors.
- Overextension = too many items in a category (e.g., all four legged animals are dogs)
- Underextension = too specific (e.g., shoe means daddy's shoe, not mommy's shoe)
- These observations can be useful in figuring out the cognitive mechanisms of conceptual development.

The role of adult speech

- Parent and child engage in the so-called Original Word Game (Brown, 1958).
- Child says “whats that?”, parents replies with name, child repeats, parent corrects, etc.
- Sounds simple, but it is not.

The role of adult speech

- Consider the situation of seeing a rabbit running by, and the parent saying to the child “rabbit!”.
- How does the child know that this name refers to the basic level, and is not a category name?
- Why does it not refer to a part of the rabbit?
- Why does it not refer to the action?
- How do children solve this Gavagai problem (Quine, 1960)?

Role of adult speech

- Turns out, parental speech is very systematic
- Parents tend to choose basic level names when they refer to objects (Rosch et al., 1976; look there! Its an animal!)
- Tend to refer to whole objects, not parts (Ninio, 1980)
- Adults play original word game with certain preferences that help child learn in the correct way.

Cognitive constraints

- Quine's Gavagai problem might also be solved by constraints already present in the child.
- Whole-object and taxonomic biases could be innate and not imposed by the parents (Markman, 1989).
- Mutual exclusivity bias = if an object already has a name, reject a new name for that object.
- Wachtel (1988), present 3 yr olds with pairs objects, one member of the pair they knew (apple, banana) the other they did not (lemon wedge). They were asked to show me the X, where X was nonsense syllable. They were more likely to pick the novel object.
- Subsequent studies show that children will think a new name for an already existing object (claw for hammer) means a part of the object.

Cognitive constraints

- **Summary**
- **The internal and external constraints allow for a rapid learning of words during pre-school period.**
- **That children make few errors in this process is a testament for the important role that these constraints play in learning.**

Summary

- **Early word learning is complex**
 - Involves learning word and its meaning

- **There are constraints**
 - Basic level
 - Mutual exclusivity

- **Are these innate or learned?**

Syntax

Holophrases

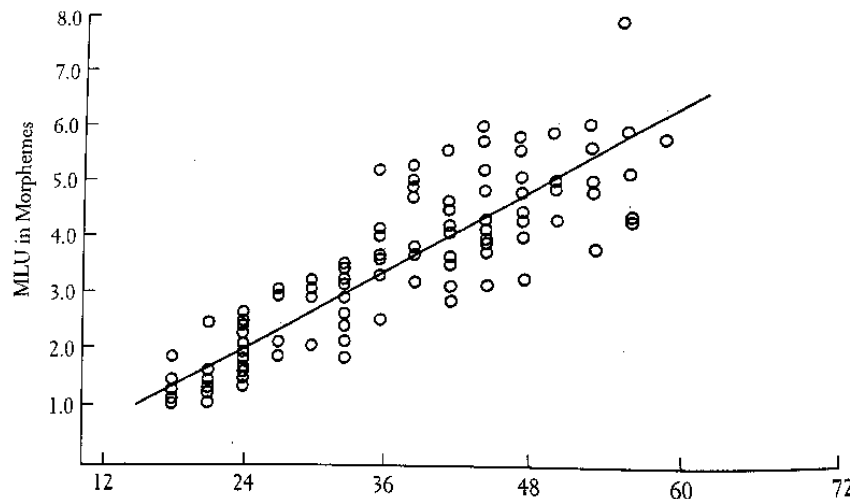
- **Preschool children often communicate larger chunks of meaning with a single word**
- **“Daddy”, which can mean, “come here”, “look who just came in”, etc.**
- **This suggests that syntax plays very little role at this stage**

Early grammar

- **Word combinations start around 2 years of age (24 months).**
- **In the next year they must master the syntax of their language**
- **Every grammar is different, and requires focus on different aspects (English word order, Turkish verb conjugations)**
- **Researchers think that early grammar acquisition is basically universal, and called it Basic Child Grammar (Slobin, 1985).**

Measures of syntactic growth

- How to measure syntactic development?
- Mean Length of Utterances in morphemes (MLU; Brown, 1973)
- Take 100 spontaneous utterances of child and count morphemes:



Measures of syntactic growth

- **MLUs are used to define stages of syntactic development**
- **Eg: Stage II (MLU 2.25) corresponds to modulate meaning of utterances through grammatical morphemes (plural).**
- **At larger MLUs the measure loses its value as an index of language development**

Emergence of grammatical categories

- Consider these two-word utterances: “allgone baby”, “more crayon”, “mamma no”, etc.
- Is there syntax involved here? Or are children simply imitating parents speech?
- Its not just imitation because
 1. Systematically leaving out function words, perhaps more efficient?
 2. No putting words together randomly, but respecting word order constraints “more crayon” not “crayon more”.
- Thus its unlikely that children are just imitating.

Interpretations of early multi-word utterances

- If not imitation, then on the basis of what kind of information does the child produce these utterances?
- Consider “baby cry”
 1. Syntactic (subject, verb)
 2. Positional (first position, second position)
 3. Semantic (agent, action)

Interpretations of early multi-word utterances

- **Syntactic information?** This is unlikely, requires that child already grasps that “subject” can refer to agents and objects. Unlikely.
- **Positional?** Child learns that word baby is initial position, and cry in second position and put the two together. However, this would lead to many incorrect utterances.
- **Semantics?** Its likely that children understand these utterances in terms of agents and actions.
- It seems therefore most likely that semantic information is used to construct these early utterances.

Acquiring grammatical categories

- **Syntax cannot work on the basis of semantic information:**
- **All objects are nouns, but not every noun is an object (e.g., the explosion).**
- **So the child needs to acquire more general grammatical categories that have a function in syntax (e.g., nouns, verbs, etc).**
- **This process is known as semantic bootstrapping (Pinker, 1987).**

Semantic Bootstrapping

- Consider the utterance “the cat chased the rat” .
- Children might first represent this utterance in terms of semantic information such as agents and actions
- Later they need to infer on the basis of distributional information of words in sentences that other words in the initial position are also nouns (e.g., the explosion).
- This will then lead to a fully functioning grammar

Comprehension and production

- Most of the research discussed so far has focused on production, what about comprehension?
- Parents will often say that children at this age understand more than what they are able to produce. Is there any evidence for this claim?
- Golinkoff et al. (1987) placed young infants in front of two video monitors with sesame street characters. In one big bird was brushing cookie monsters hair, in another cookie monster was brushing big bird's hair. When they heard the sentence "big bird is brushing cookie monster's hair", they looked at the corresponding monitor more likely than chance.
- Thus, infant comprehension at this stage of development seems to be more advanced than production.

Individual differences

- Not all children acquire language in the same way – there are huge individual differences.
- Some children seem to focus on referential terms: They first learn names for objects, actions (“car”, “ball”, etc).
- Other children focus on expressive terms: They first learn names for social interactions (“stop it”, “I want it”).
- What causes these differences?
- Some research suggests it has to do with the amount and type of parental speech that the child receives (Goldfield, 1987)

Summary

- **Children early language acquisition is based on learning pre-linguistic communicative skills**
- **They first acquire the sound system of their language, and this becomes a front-end to learn the other aspects of language**
- **One word speech signals the beginning of the lexicon and to use single words to communicate chunks of meaning**
- **First word combinations are not simply imitations of parent's speech, but are based on semantic information**
- **Syntactic categories are learned on the basis of semantic bootstrapping**