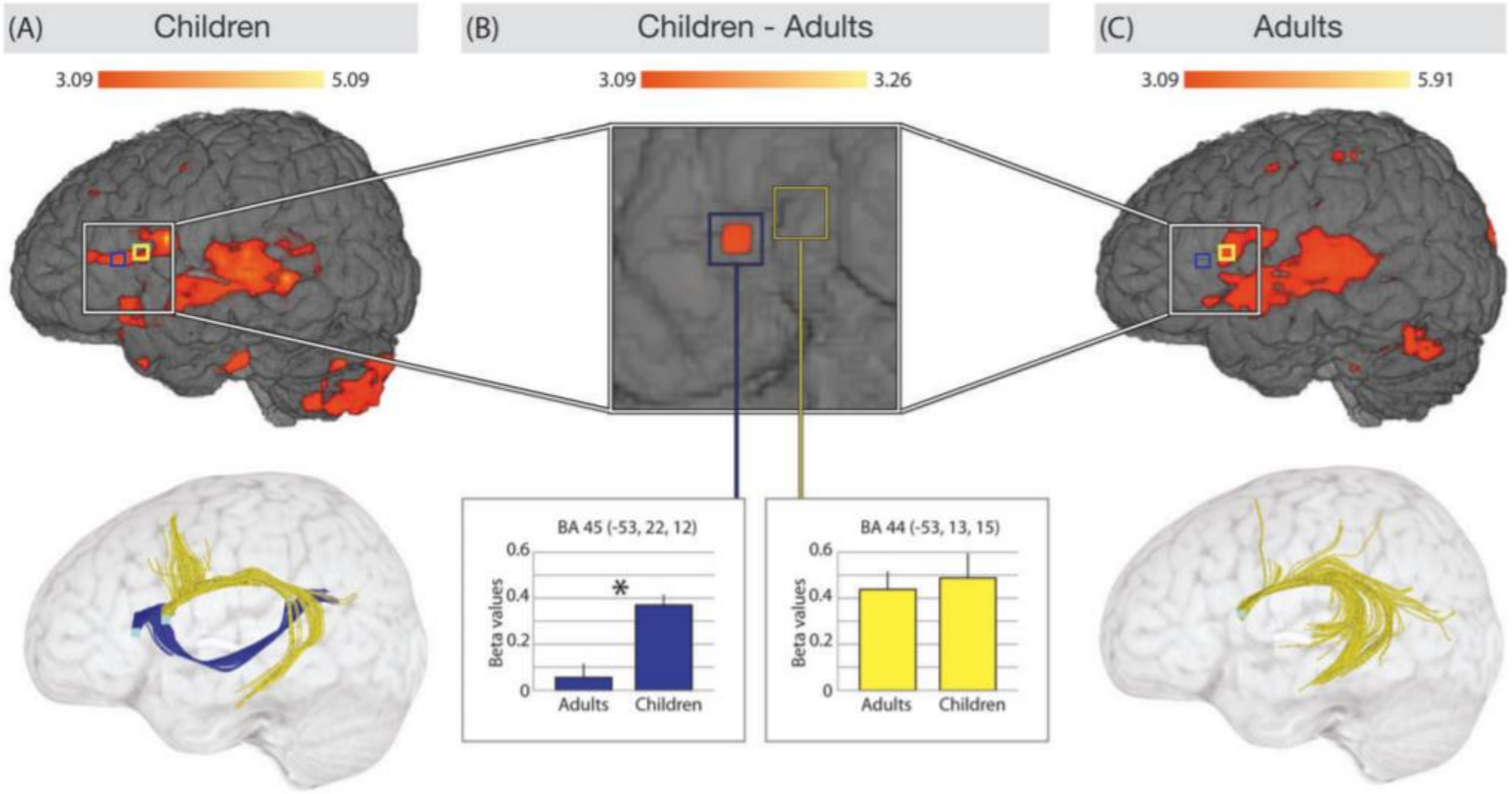
First Language Acquisition - Grammar

Ben Weissman

COGS 4780

Acquisition of grammar

- Children start out producing 1 word at a time (12 months) and move to 2-word sequences (18 months)
- By 2 years they produce **telegraphic speech**
  - Content words
  - Correct word order
  - No function words
  - No inflection
- By 6 years they know most parts of their language's syntax


(A) Children
3.09
5.09
(B) Children - Adults
3.09
3.26
(C) Adults
3.09
5.91
BA 45 (-53, 22, 12)
Beta values
0.6
0.4
0.2
0
*
Adults
Children
BA 44 (-53, 13, 15)
Beta values
0.6
0.4
0.2
0
Adults
Children

Acquisition of grammar

- A simple yet effective way to track syntactic development is **MLU**…. Mean Length of Utterance (Brown 1973)
  - How many morphemes in an utterance

Age (months)	MLU	Morphemes	Example
15-30	1.75	content words	“Bird fly”
28-30	2.25	*-ing*, *in*, *on*, plural	“I falling”
36-42	2.75	possessive	“Mommy’s hat”
40-46	3.5	articles, past tense, 3S present	“This is the dog”
42-52	4.0	auxiliary *be*, contractions	“He’s swimming”

Acquisition of grammar

- Some elements of grammar are **compositional** – fixed rules of form that dictate fixed rules of meaning
- Adjective + noun combinations
  - Wet sock, big hat, purple chair, broken finger

- Noun + noun combinations are non-compositional
  - Houseboat, housewife, house arrest

- Same question as before – are structures learned by learning rules or something else?
  - The non-compositional ones aren’t rule-derived
  - But what about the compositional ones?

Acquisition of grammar

- Learning of syntax is aided by… **semantic bootstrapping**
  - Learning the meanings and references of words helps to form grammatical categories
  - Learning types of semantic concepts aids learning of syntactic concepts
    - Nouns tend to refer to objects, verbs to actions, etc.
  - This can be either a full theory (Pinker) or just a partial principle

- Based on an assumption that grammatical concepts align with semantic concepts
- One explanation: syntactic categories are innate
- Another: this information is learned through **distributional evidence**
  - observations about tendencies → generalizations about categories

Distributional evidence

- Can distributional evidence actually work?

Distributional evidence

- Can distributional evidence actually work?
- Is distributional evidence reliable? (Pinker 1987)
  - John ate fish
  - John can fish
  - John ate rabbits
  - *John can rabbits

  - *fish* can fall into two different syntactic categories – how would a child recognize that from the two examples above?

Distributional evidence

- Can distributional evidence actually work?
- Is distributional evidence reliable? (Pinker 1987)
  - John ate fish
  - Eat the fish
  - The fish smells bad
  - Whales like fish
  - Some of the fish smells bad
  - Quick, catch the fish
  - Never eat fish with a spoon
- Which types of words can appear at the beginning of a sentence?

Distributional evidence

- Can distributional evidence actually work?
- Looking at relative orders may be useful – **lexical co-occurrence**
  - Bigrams (2) and trigrams (3)
    - the _____
    - should _____
    - very _____

    - the _____ is
    - should _____ the
    - very _____ house

Distributional evidence

- Can distributional evidence actually work?
- Looking at relative orders may be useful – **lexical co-occurrence**
  - Mintz (2003) corpus analysis of parent-child recordings
  - 45 most frequent trigram *frames* (first and third word the same)
  - How often does the middle word of the frame belong to one category?
    - (over 90%)
  - Lexical co-occurrences do provide enough distributional evidence to infer information about grammatical categories
  - …if children know what to look for

Distributional evidence

- Can distributional evidence actually work?
- Looking at relative orders may be useful – **lexical co-occurrence**
  - Children do seem capable of learning from these sorts of patterns
  - Head-turn paradigm used to test this (Mintz 2006)
    - Can you *deeg* the room?
    - You can *deeg*.
    - I see the *bist* in the room.
    - That's your *bist*.
  - When 12 month olds encounter a word that violates its grammatical pattern from the testing phase → significantly longer looking times

Distributional evidence

- Can distributional evidence actually work?
- Gets more complex when we consider different languages, too
  - Word order frames won’t be useful in a language with variable word order
  - In a language like that, morphological frames may instead be necessary

- Middle ground: maybe it’s a mix of distributional evidence and abstract notions
  - And those abstract notions could be innage (like UG) or not (like the paper)

Generalizations

- Examples like the overregularization (holded, eated) from last time may provide evidence for abstract rule-based knowledge
- Similar examples in syntax:
  - “Don’t giggle me”
  - “She falled me”
  - Extending a pattern of transitive verbs to intransitive verbs

Generalizations

- “I said her no.”
- “Don’t say me that.”
- “I don’t want any more grapes. They just cough me.”
- “I want to comfortable you.”
- “Did I afraid you?”

Generalizations

- Overgeneralizations are well-studied and easy to study
- Children also may do *undergeneralizations*
  - Why would this be difficult to study?

Generalizations

- Overgeneralizations are well-studied and easy to study
- Children also may do *undergeneralizations*
  - Why would this be difficult to study?
- Let's say we want to investigate a child's use of the adjective *nice*
  - They should be able to add this adjective onto any reasonable noun
  - If they only use *nice* along with a small subset of their nouns, that may be interpreted as evidence of undergeneralization (MacWhinney 1975)
- Different verbs might be inserted into different frames
    - *break* always produced with subject and object; *cut* always produced with only object (Tomasello 1992)

Generalizations

- In fact, it seems like children are willing/able to extend nouns into different syntactic environments but not as willing/able to do the same for verbs
- There are so many different verb subtypes and patterns of behavior
  - Children are probably warranted in not wanting to generalize across different verbs
    - She poked the food with the fork
    - She touched the cat with the stick
    - She hit the piñata with the stick
    - She spanked the child with her hand
    - She swatted the fly with a flyswatter

Generalizations

- In fact, it seems like children are willing/able to extend nouns into different syntactic environments but not as willing/able to do the same for verbs
- There are so many different verb subtypes and patterns of behavior
  - Children are probably warranted in not wanting to generalize across different verbs
    - She poked the food with the fork
    - She touched the cat with the stick
    - She hit the piñata with the stick
    - She spanked the child with her hand
    - She swatted the fly with a flyswatter
    - She poked at the food
    - She touched at the cat
    - She hit at the piñata
    - She spanked at the child
    - She swatted at the fly

Generalizations

- In fact, it seems like children are willing/able to extend nouns into different syntactic environments but not as willing/able to do the same for verbs
- There are so many different verb subtypes and patterns of behavior
  - Children are probably warranted in not wanting to generalize across different verbs
    - She poked the food with the fork
    - She touched the cat with the stick
    - She hit the piñata with the stick
    - She spanked the child with her hand
    - She swatted the fly with a flyswatter
    - She poked at the food
    - *She touched at the cat
    - She hit at the piñata
    - *She spanked at the child
    - She swatted at the fly

Generalizations

- In fact, it seems like children are willing/able to extend nouns into different syntactic environments but not as willing/able to do the same for verbs
- There are so many different verb subtypes and patterns of behavior
  - Children are probably warranted in not wanting to generalize across different verbs
    - She poked the food with the fork
    - She touched the cat with the stick
    - She hit the piñata with the stick
    - She spanked the child with her hand
    - She swatted the fly with a flyswatter
    - The fork poked the food
    - The stick touched the cat
    - The stick hit the piñata
    - The hand spanked the child
    - The flyswatter swatted the fly

Generalizations

- In fact, it seems like children are willing/able to extend nouns into different syntactic environments but not as willing/able to do the same for verbs
- There are so many different verb subtypes and patterns of behavior
  - Children are probably warranted in not wanting to generalize across different verbs
    - She poked the food with the fork
    - She touched the cat with the stick
    - She hit the piñata with the stick
    - She spanked the child with her hand
    - She swatted the fly with a flyswatter
    - ?The fork poked the food
    - The stick touched the cat
    - The stick hit the piñata
    - *The hand spanked the child
    - *The flyswatter swatted the fly

Generalizations

- Wonnacott (2011): artificial language learning task
  - Children hear data in one structure: Verb – Noun – Particle

  - *moop giraffe dow*
  - *moop giraffe tay*
  - *moop cat dow*
  - *moop cat tay*
  - *moop mouse dow*
  - *moop mouse tay*
  - *moop pig dow*
  - *moop pig tay*

Generalizations

- Wonnacott (2011): artificial language learning task
  - Children hear data in one structure: Verb – Noun – Particle

  - *moop giraffe dow*
  - *moop giraffe tay*
  - *moop cat dow*
  - *moop cat tay*
  - *moop mouse dow*
  - *moop mouse tay*
  - *moop pig dow*
  - *moop pig tay*

  - *moop giraffe dow*
  - *moop cat dow*
  - *moop mouse dow*
  - *moop pig tay*
  - *moop cat dow*
  - *moop pig tay*
  - *moop mouse dow*
  - *moop giraffe dow*

Generalizations

- Wonnacott (2011): artificial language learning task
  - Children hear data in one structure: Verb – Noun – Particle

  - Children were able to learn the pattern in either case
  - But what happens when they hear a sentence with a new noun?
  - *moop dog dow*

  - The first group was willing to generalize, so *moop dog dow* and *moop dog tay* are both ok
  - The second group was not, so if they heard *moop dog dow* they will only use *moop dog dow*

Generalizations

- Some prefer to focus on undergeneralizations over overgeneralizations – maybe children are actually much more cautious than we realized
  - Instead of learning abstract rules, perhaps children learn a bunch of little constructions
  - “usage-based” account

Acquisition of grammar

- Rule-based accounts are built on phrase structure rules, like those you see in Intro to Linguistics
  - S → NP VP
  - NP → DET N
  - PP → P NP

- Constructionist/constructivist accounts reject the idea of rules, reject the idea of separating lexical information from syntactic information
  - Syntactic knowledge exists in the form of **constructions**
    - Templates that specify the structure and meaning of a phrase
    - Can range from narrow to broad