Psych 156A/ Ling 150: Acquisition of Language II

Lecture 13

Poverty of the stimulus I

Announcements

Review questions available for poverty of the stimulus

Be working on HW3 (due: 5/26/16)

About language

One way to think about how to classify the knowledge that you have when you know a language:

You know what items (sounds, words, sentences, questions, etc.) are part of the language. You can tell whether or not a given item is grammatical in the language.

Hoggle is definitely an ornery dwarf. [grammatical]
* Hoggle an dwarf definitely ornery is. [ungrammatical]

About language

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Hoggle is definitely an ornery dwarf. [part of English]
* Hoggle an dwarf definitely ornery is. [not part of English]

About language

One way to think about how to classify the knowledge that you have when you know a language:

You know what items (sounds, words, sentences, questions, etc.) are part of the language. You can tell whether or not a given item is grammatical in the language.

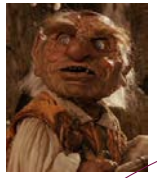
The reason you can do this is because you know the rules & patterns that generate the items that are part of the language.
(mental grammar)

About children learning language

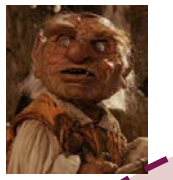
Adult knowledge = rules & patterns that generate the items that are part of the language (mental grammar).

The child's job: figure out the rules that generate the items that belong in the language and that don't generate items that don't belong in the language.

For example, the child wants rules to generate
"Hoggle is definitely an ornery dwarf" but not
* "Hoggle an dwarf definitely ornery is".







…and exclude this set of items

Not in English

Hoggle a dwarf ornery is

Bite adventurers fairies

In English

Hoggle is an ornery dwarf

Fairies bite adventurers

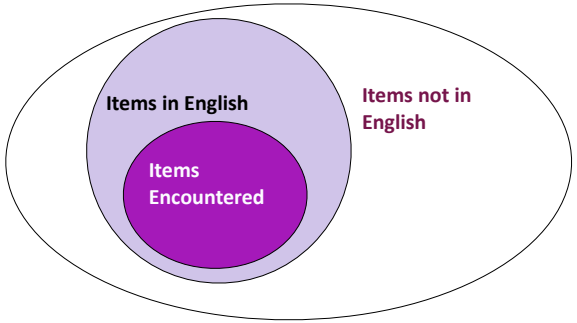
Can the girl who can summon the Goblin King solve the Labyrinth?

Can the girl who summon the Goblin King can solve the Labyrinth?

So what's the problem?

It's not clear that children encounter all the items that are part of the language (they have finite time to learn).

If they only encounter a subset of the language's items, how do they know everything that belongs in the language?

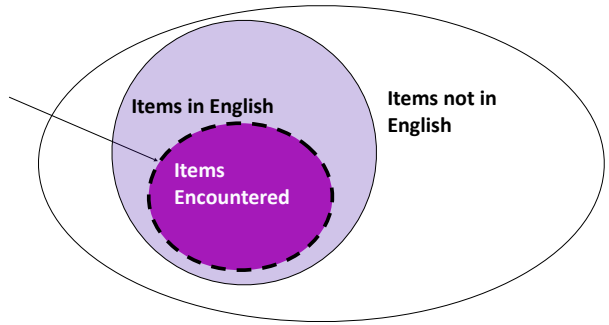


So what's the problem?

One solution: children generalize

But how do they generalize?

To here (only what they've heard)?



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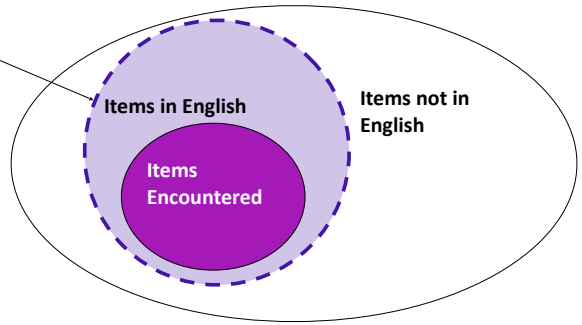

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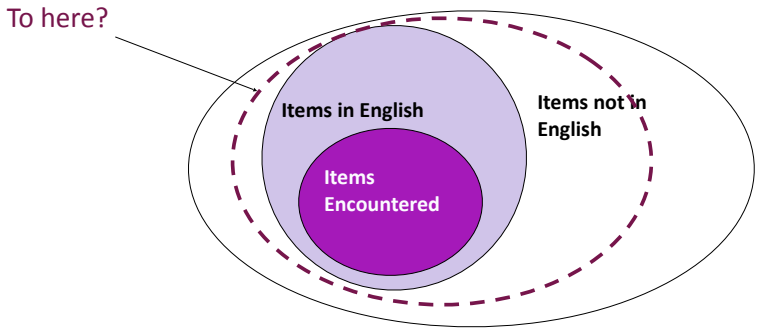

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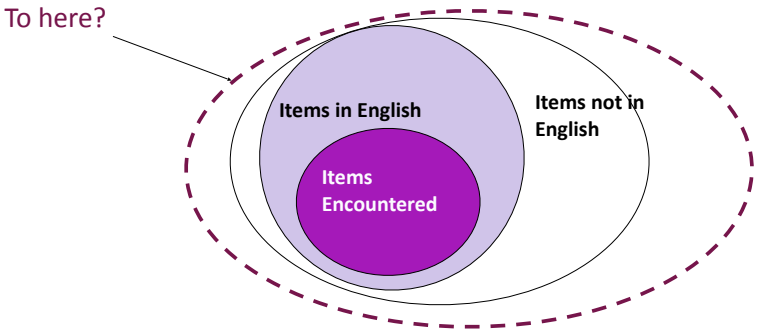
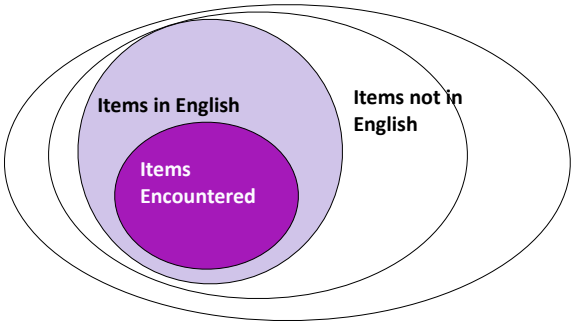


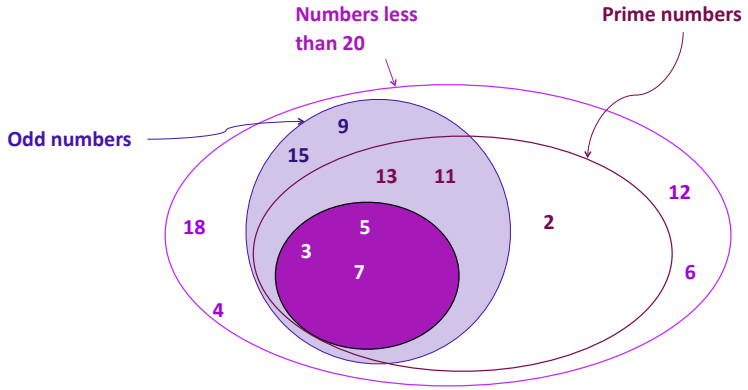
So what's the problem?

The problem is that children must make the right generalization from data that are compatible with multiple generalizations. In this sense, the data (stimulus) encountered are impoverished. They do not single out the correct generalization by themselves.



A numerical analogy

Suppose you encounter the numbers 3, 5, and 7.
What set are these numbers drawn from? That is, what is the right "number rule" for this language that will allow you to predict what numbers will appear in the future?



Impoverished data in word learning

“birdie” =



data encountered

Impoverished data in word learning

“birdie” =



hypothesis 1

data encountered


Blue things!

Impoverished data in word learning

“birdie” =



hypothesis 1

data encountered

hypothesis 2


Things on branches!

Impoverished data in word learning

“birdie” =



correct hypothesis

hypothesis 1

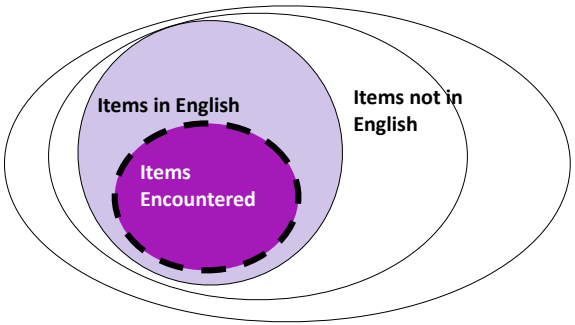
data encountered

hypothesis 2


[BIRD]

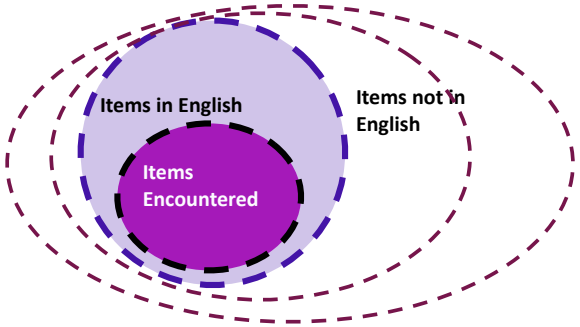
Poverty of the Stimulus: Logic

Children encounter data that are compatible with many hypotheses about the correct rules and patterns of the language.



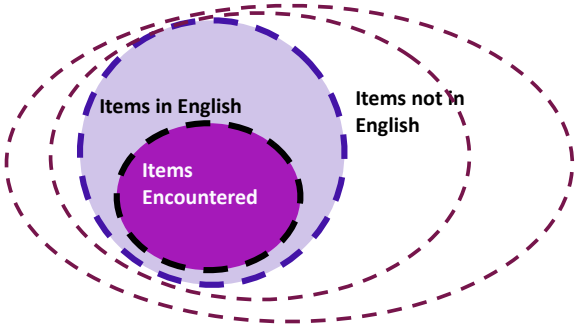
Poverty of the Stimulus: Logic

Specifically, the data encountered are compatible with both the correct hypothesis and other incorrect hypotheses about the rules and patterns of the language.



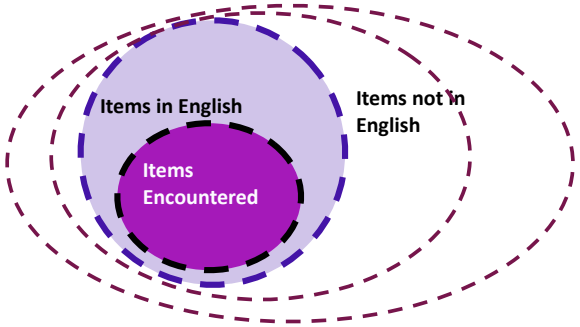
Poverty of the Stimulus: Logic

A rational learner would consider all compatible hypotheses, and perhaps choose the wrong hypothesis in the end, or at least make errors during acquisition.



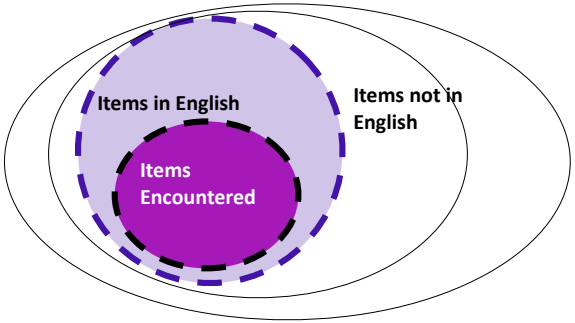
Poverty of the Stimulus: Logic

Expectation for rational learners: errors in performance. Children will behave as if they think ungrammatical items are part of the language at some point in their development.



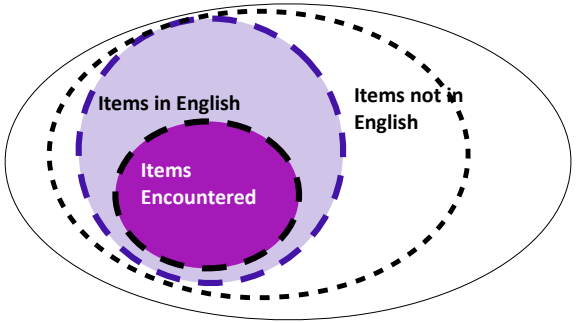
Argument about prior knowledge

But what if children never behave as if they consider the incorrect hypotheses? That is, they never produce errors compatible with the incorrect hypotheses. They only seem to produce items that are compatible with the correct hypothesis.



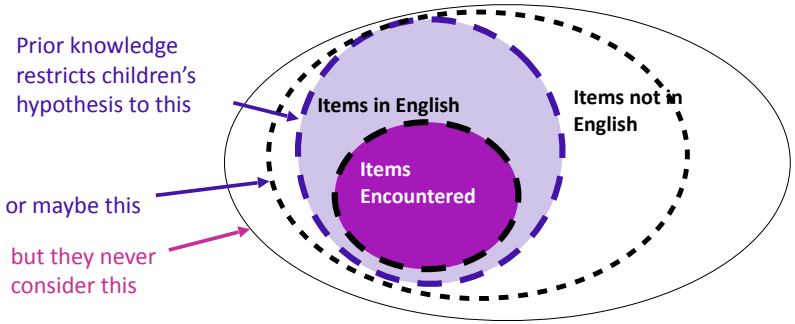
Argument about prior knowledge

A more relaxed version of this:
But what if children never behave as if they consider **some of** the incorrect hypotheses? That is, they never produce errors compatible with **those** incorrect hypotheses. They only seem to produce items that are compatible with the correct hypothesis or other incorrect hypotheses.



Argument about prior knowledge

Conclusion: children have some prior knowledge that causes them never to consider (some of) the incorrect hypotheses. Instead, they only consider some of the possible hypotheses for what the rules and patterns of the language might be.



Specific example: Yes/No question formation

Jareth can alter time.

Can Jareth alter time?

To turn the sentence into a yes/no question, move the auxiliary verb ("can") to the front. Other examples of auxiliary verbs: *could, should, might, would, will, did, do, may*

The child's task: figure out a rule that will form yes/no questions from their corresponding sentences.

Specific example: Yes/No question formation

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Can Jareth alter time?

Rule?

Specific example: Yes/No question formation

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Rule: Move first auxiliary?

Specific example: Yes/No question formation

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Rule: Move first auxiliary?

Anyone who can wish away their brother would be tempted to do it.
Would anyone who can wish away their brother be tempted to do it?

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Someone who can solve the labyrinth can show someone else who can't how.
Can someone who can solve the labyrinth show someone else who can't how?

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Rule???

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Need a rule that is compatible with *all* of these, since they're all grammatical English questions.

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Idea: Try looking at the sentence structure, not just the linear order of the words in the sentences.

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embedded clauses = additional descriptive sentences that are not part of the main clause

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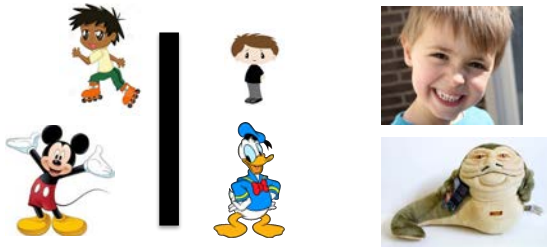
Can someone show someone else how?

Rule that works for all of these examples (and all English examples): Move the auxiliary verb in the main clause to make a yes/no question.

This is a rule dependent on the structure of the sentences, since it refers to "main clause".

Children's knowledge

Crain & Nakayama 1987: Get children (three- to five-year-olds) to produce complex yes/no questions that require them to demonstrate how they deal with multiple auxiliaries.



"Ask Jabba if *the boy who can see Mickey Mouse is happy*."
"Ask Jabba if *the boy who is happy can see Mickey Mouse.*"

Children's knowledge

Crain & Nakayama 1987: Get children (three- to five-year-olds) to produce complex yes/no questions that require them to demonstrate how they deal with multiple auxiliaries.

Common errors that occurred:

(Restarts)
"Is the boy who can see Mickey Mouse, is he happy?"
"Can the boy who is happy, can he see Mickey Mouse?

(Initial *is* prefix)
"Is the boy who can see Mickey Mouse is happy?"
"Is the boy who is happy can see Mickey Mouse?"

"Ask Jabba if *the boy who can see Mickey Mouse is happy*."
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Crain & Nakayama 1987: Get children (three- to five-year-olds) to produce complex yes/no questions that require them to demonstrate how they deal with multiple auxiliaries.

The error that didn't occur:

(Structure-independent auxiliary movement)
[=Move the first auxiliary]
"Can the boy who __ see Mickey Mouse is happy?"
"Is the boy who __ happy can see Mickey Mouse?

"Ask Jabba if *the boy who can see Mickey Mouse is happy*."
"Ask Jabba if *the boy who is happy can see Mickey Mouse.*"

Children's knowledge

Crain & Nakayama 1987: Get children (three- to five-year-olds) to produce complex yes/no questions that require them to demonstrate how they deal with multiple auxiliaries.

Conclusion: As young as three years old, children have some very specific constraints on the kind of hypotheses they'll consider for complex yes/no questions.

Children's knowledge

Learning problem: Children don't encounter all the examples we saw. They encounter a subset of the possible yes/no questions in English.

Most of the data they encounter (particularly before the age of 3) consists of simple yes/no questions.

Jareth can alter time.
Can Jareth alter time?

Learning difficulties: Yes/No questions

The problem is that these simple yes/no questions are compatible with a lot of different rules.

Jareth can alter time.
Can Jareth alter time?

Rule: Move first auxiliary?

Rule: Move last auxiliary?

Rule: Move main clause auxiliary?

Rule: Move auxiliary in even-numbered position in sentence?

Rule: Move auxiliary closest to a noun?

Learning difficulties: Yes/No questions

Rational learner prediction: if children considered all these hypotheses, they should make mistakes on more complex yes/no questions. Let's look at two hypotheses in detail.

Rule: Move first auxiliary?

Rule: Move main clause auxiliary?

Learning difficulties: Yes/No questions

The girl who can solve the labyrinth is happy.

Predictions of questions generated

Rule: Move first auxiliary?

* Can the girl who solve the labyrinth is happy?

Learning difficulties: Yes/No questions

The girl who can solve the labyrinth is happy.

Predictions of questions generated

Rule: Move first auxiliary?

* Can the girl who solve the labyrinth is happy?

Rule: Move main clause auxiliary?

Correct rule = grammatical question

Is the girl who can solve the labyrinth happy?

Learning difficulties: Yes/No questions

Remember: Crain & Nakayama (1987) showed that children as young as 3 years old don't make these mistakes.

Predictions of questions generated

Rule: Move first auxiliary?

* Can the girl who solve the labyrinth is happy?

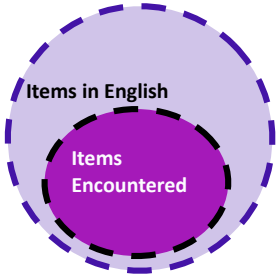
"Can the boy who __ see Mickey Mouse is happy?"
"Is the boy who __ happy can see Mickey Mouse?

Rule: Move main clause auxiliary?

Is the girl who can solve the labyrinth happy?

Learning difficulties: Yes/No questions

But the simple questions they see are compatible with both of these hypotheses (along with many others). How do children choose the right rule from all the possible rules that are compatible? That is, how do they generalize the right way from the subset of the data they encounter?



Rule: Move main clause auxiliary?

Is the girl who can solve the labyrinth happy?

Learning difficulties: Yes/No questions

Linguistic nativist position: Children have an innate bias to look for rules that make use of sentence structure. Specifically, they only consider rules that are structure-dependent.

~~Rule: Move first auxiliary?~~

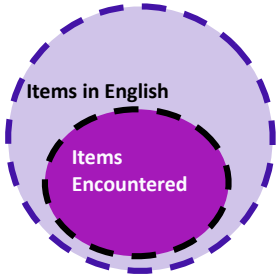
~~Rule: Move last auxiliary?~~

~~Rule: Move auxiliary in even-numbered position in sentence?~~

~~Rule: Move auxiliary closest to a noun?~~

Rule: Move main clause auxiliary?

Is the girl who can solve the labyrinth happy?

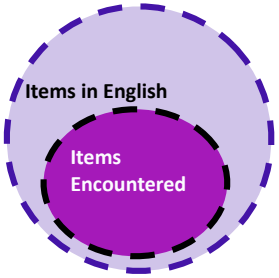


Learning difficulties: Yes/No questions

It is this structure-dependent learning bias that allows children to generalize the correct way from "impoverished" data.

Nativists say: Children constrain their generalizations in a specific way, based on their innate knowledge. (But it may be domain-specific knowledge about language or domain-general knowledge.)

Linguistic nativists say: Children constrain their generalizations in a specific way, based on their innate knowledge of language.



Another example of children's constrained generalization

Crain & McKee (1985): pronoun interpretation

While he danced around the throne room, Jareth smiled.
(Adults: he = Jareth)
(Children: he = Jareth)

Another example of children's constrained generalization

Crain & McKee (1985): pronoun interpretation

While he danced around the throne room, Jareth smiled.
(he = Jareth)

Jareth smiled while he danced around the throne room.

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Possible generalization for the language: Can put pronoun before name or name before pronoun

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(he = Jareth)

He smiled while Jareth danced around the throne room.
(Adults: he ≠ Jareth)

Another example of children's constrained generalization

Crain & McKee (1985): pronoun interpretation

While Jareth danced around the throne room, he smiled.
(he = Jareth)

He smiled while Jareth danced around the throne room.
(Adults: he ≠ Jareth)
(Children: he ≠ Jareth)

Possible generalization fails: Order of pronoun and name matters. Children seem to know this without being taught it. Why?

Another example of children's constrained generalization

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While Jareth danced around the throne room, he smiled.
(he = Jareth)

He smiled while Jareth danced around the throne room.
(Adults: he ≠ Jareth)
(Children: he ≠ Jareth)

One answer: Prior knowledge about interpreting pronouns in sentences. This constraint is structure-dependent, it turns out.

Another example of children's constrained generalization

Crain & McKee (1985): Summary

While he danced around the throne room, Jareth smiled.
(he = Jareth)

Jareth smiled while he danced around the throne room.
(he = Jareth)

While Jareth danced around the throne room, he smiled.
(he = Jareth)

He smiled while Jareth danced around the throne room.
(he ≠ Jareth)

Another example of children's constrained generalization

The point: Children generalize only in a very specific way. In particular, they don't just generalize everything that they can. Their generalizations appear to be constrained.

Nativist idea for how their generalizations/hypotheses are constrained: innate knowledge.

Linguistic nativist idea for how their generalizations/hypotheses are constrained: innate knowledge about language.

Poverty of the stimulus leads to prior knowledge about language: Summary of Logic

1) Suppose there are some data.

2) Suppose there are some incorrect hypothesis compatible with the data.

3) Suppose children behave as if they never entertain (some) incorrect hypotheses.

Conclusion: Children possess prior (innate) knowledge ruling out those incorrect hypotheses from consideration.

Questions?

You should be able to do up through question 11 on the poverty of the stimulus review questions and up through question 6 on HW3.