
- Chomsky & Universal Grammar (UG) → **Structure-dependent** operation hypothesis: based on the abstract structural organizations of word sequences ("an innate schematism applied by the mind to the data of experience” – Chomsky)
  - VS. **Structure-independent** operation hypothesis: applies to consequences of words themselves, e.g. linear order (concepts like *next* and *closest*)

1. **Previous research on structure-dependence.**
  - Experimenter 1 speaks → Experimenter 2 repeats speech → 7- and 8-year-olds learn how this is done by mimicking, then take the place of (“Echoing”) Experimenter 2 → Investigators noted number of trials it took to for children to give consistently correct responses.
  - 2 Conditions:
    1. Major phrasal *constituents* repeated (i.e. subject NPs and predicate phrases)
       - >50% of children could repeat these constituents >4 times consecutively
    2. Four-unit sequences (*words or syllables*) repeated
       - No child could accurately repeat these sequences >4 times consecutively
  - Conclusion:
    - structure-independent sequences pose a problem for children in this metalinguistic task
    - perhaps they perform better when they can rely on their implicit knowledge of constituent structure

**Backwards Prenominalization Hypothesis**
- Fact: it is possible to perform structure-independent operations on constituents in an assigned structure
- Claim: young children rule out coreference between a pronoun and a noun phrase just in case the pronoun appears first in the sentence
  - dependent on *linear structure* of constituents, not structural relationships → therefore **structure independent**
- Tavakolian (1978) – study of grammatical knowledge of 3- to 5-year-olds
  - children asked to enact (using props) sentences like:
    1. *For him to kiss the lion would make the duck happy.*
    2. *That he kissed the lion made the duck happy.*
  - as referent to the pronoun, children often selected an animal among the props, but not mentioned in the sentence
because meanings of sentences like (1) and (2) are ambiguous, this response doesn’t necessarily prove children have a grammatical prohibition against **backwards anaphora** (anaphora = when one expression refers to another, preceding expression)

- Crain & McKee (1985) – tested availability of backwards anaphora for preschool-age children (2-5 years)
  - children judged the “truth value” of sentences like (3) and (4) against situations the experimenter would act out
    1. When he took the chickens, the lion was in the box.
    2. He took the chickens when the lion was in the box.

  - **Results**:
    - for sentence (3), whether the experimenter acted out the lion taking the chickens *or* someone else taking the chickens (**extrasential interpretation of the pronoun**), most children equally said this was a true representation of the original sentence
      - evidence for children’s acceptance of **backwards prenominalization**
    - for sentence (4), most children *only* accepted one interpretation (rejected lion as taker of the chickens)
      - evidence that children only prohibit backwards anaphora when structural conditions demand it (**don’t restrict merely by linear order**)

- Thus, past research supports the idea that **children use structure-dependent principles to make their grammatical hypotheses**
- this paper investigates “Movement Transformation,” namely: Subject/Auxiliary inversion in sentences with relative clauses

2. **Two hypotheses about yes/no questions.**

- How do children form yes/no Qs?
  1. a. The man is tall. → *Is the man tall?*
  2. b. The book is on the table. → *Is the book on the table?*
  3. c. I can go. → *Can I go?*

- from these examples, we can formulate a **preliminary hypothesis**:
  1. In yes/no Qs, the leftmost verbal element of a declarative (is, can, etc.) has been moved to the front of the sentence.   

- BUT:
  1. this ignores higher-order structural units, relying only on linear order (a structure-independent hypothesis)
  2. doesn’t work for sentences like:
     1. The man who is tall is in the other room.
        which becomes:
     2. *Is the man who ____ tall is in the other room?*
     3. Is the man who is tall ____ in the other room?
o this hypothesis fails because it does not take into account the idea that verbal elements inside a relative clause remain unaffected by yes/no Q formation

\[ \text{to work in all cases, the correct hypothesis must therefore recognize the internal structure of sentences (must realize & distinguish between concepts like NOUN PHRASE vs. VERB PHRASE and MAIN CLAUSE vs. SUBORDINATE CLAUSE)} \]

• New hypothesis:

II. In yes/no Qs, the auxiliary verb in the main clause of a declarative is inverted with the subject noun phrase.

o this takes into account abstract structure

o able to correctly form question (3) from complex declarative (1)

• Hypothesis I works for simpler declaratives (like a, b, and c). Since children probably hear more simple forms than complex ones, they find little linguistic demand for the more complex reasoning of Hypothesis II.

o Do some children assume Hypothesis I?

Learnability Problem: since children receive little/no negative evidence, how do they learn they’ve made an error, and how to fix it?

o they’re known to produce lexico-syntactic misgeneralizations (e.g. Who deaded my kitty?)—do they product similar, purely syntactic misgeneralizations (e.g. Subj/Aux inversion)?

o What about positive evidence?

• Even if the child creates Hypothesis II to account for positive evidence like (3), he can simply add it to his existing grammar (no need to abandon old rule) \(\Rightarrow\) could still produce ungrammatical forms, as well as grammatical ones!

  ▪ this is called the unlearning problem

• Chomsky to the rescue: UG circumvents the unlearning problem entirely.

  o According to the theory of UG, children don’t ever consider structure-independent rules (like Hypothesis I), even when relevant evidence supports such rules. Therefore, children will never produce things like (7).

3. Experiment I: Eliciting complex yes/no questions.

• 3-5 year-olds tested (period when children overgeneralize)

• Elicited yes/no Qs in order to determine whether children use Hypothesis I or II

o Qs elicited from complex sentences (ones which included a relative clause in the subject noun phrase, like (1))

o Experimenter asks child to direct corresponding yes/no Qs to a doll (Jabba) re. a set of pictures, for example:

  Experimenter: Ask Jabba if the boy who is watching Mickey Mouse is happy.
Results: Children did make ungrammatical formations like Types I and II, but no child produced Type III responses.

- Type I. *Is the boy who is being kissed by his mother is happy?
- Type II. *Is the boy that is watching Mickey Mouse, is he happy?
- Type III. *Is the boy who’s watching Mickey Mouse is happy?

None of them made the mistake of moving the verbal element of a relative clause → nothing to imply the adherence to Hypothesis I

But: the presence of Type I errors threaten the idea that children form rules by adhering to structure-dependence

- Is the child “copying” the extra *is* from the relative clause (an error due to structure-independence)?
- Or has the child simply placed the extra *is* in front of the statement, and then simply repeated the declarative (may not threaten idea of structure-dependence, but is just the wrong theory for English)

Are the errors children made due to production, and not competence?

- Evidence points to processing problem (not structural)
- Thus, children’s misgeneralizations are not failures of their grammars, but of their ability to process such complex phrases (adults have this problem, too!)


- Basic Operations Hypothesis: A model of performance. Some researchers think movement transportation like Subject/Auxiliary Inversion is done in two steps, namely:
  - A copy of the constituent (e.g. *is*) is placed into a new location, then
  - The source constituent is then deleted
  → this hypothesis allows for elementary operations to be acquired separately (i.e. child can have acquired one of these movement rules but not the other)
  - Many types of errors children make can be attributed to the deletion of a constituent without its replacement
    Did you came home?
    The barber cut off his hair off.

- In Experiment 1, are errors due to copying the *is* from the main clause (a structure-independent operation) or from the relative clause (structure-dependent)?
  - The fact that both clauses in these sentences contain the same Auxiliary (*is*) makes it impossible to test out this question!
  → To test, experiment must use sentences with 2 different Auxiliaries, e.g.
    c. The boy who was holding the plate is crying.
    d. *Was the boy who was holding the plate is crying?*
  - There were no responses like d (which specifically implicates structure-independent processing)

5. Experiment 2.
to discover source of prefix errors in Experiment 1

3 possible procedures: to form a yes/no Q from an assertion, start with:
S1) a copy of the leftmost auxiliary verb
S2) the copula *is*, followed by a replica of Experimenter’s assertion
S3) a copy of the auxiliary verb in the main clause of Experimenter’s assertion

S1: structure-independent
S2: unclear whether structure-dependent or -independent
S3: children forget the second part of process, deletion
since S2 and S3 don’t mess with the relative clause at all, they pose little threat to the hypothesis that children invariably use structure-dependent operations

children tested with sentences that had a different Aux. in the main clause than the subordinate clause (to avoid Experiment 1’s problem)
procedures nearly identical to Experiment 1, but with more description of the pictures
IM sentences contain *is* in the relative clause & a modal in the main clause, e.g.:
a. *The boy who is happy can see Mickey Mouse.*
MI sentences contain a modal in the relative clause & *is* in the main clause, e.g.:
b. *The boy who can see Mickey Mouse is happy.*

possible ungrammatical results from sentence a:
a1. *Is the boy who is happy can see Mickey Mouse?*
   \[\text{cause: S1 or copying of *is* without deletion}\]
a2. *Can the boy who is happy can see Mickey Mouse?*
   \[\text{cause: S3}\]

more possible ungrammatical responses:
*Is the boy who can see Mickey Mouse is happy?*
\[\text{cause: S2 or S3}\]
*Can the boy who see Mickey Mouse is happy?*
\[\text{cause: S1}\]

Results & Discussion
more ungrammatical responses in Experiment 2 (79%) vs. Experiment 1 (65%); why?
o verbal encoding of info that was presented graphically in E1 \[\text{processing capabilities exceeded}\] in E2? (forgot facts \[\text{couldn’t form Qs properly}\]
o *modals more difficult* to manipulate than *is* for some children?
majority of Type I errors among IM sentences imply S1 or S2
no Type I errors among MI sentences imply S1
likely conclusion: prefix errors \textit{not due to structure-independent operation} (S1);
   instead due to either S2 or S3 (which don’t affect Aux. in the relative clause)
\[\text{UG prevails!}\]
to reiterate: \textbf{UG claims structure-dependence as an inherent property of children’s grammar. They use it even if a simpler operation would serve their needs.}
implies innateness—i.e. children’s hypotheses undetermined by input (which solves the poverty of stimulus problem)


- Stemmer (1981) argues against innateness, saying children acquire the following semantic generalization:
  - “Questions are formed by locating the is (or others like it: may, will, etc.) which follows the first compound which refers to a particular object, before this compound.”
    - this works for sentences like The man who is tall is in the room. but does not correctly explain question forms like Is running dangerous?
      - realizing this, the child must abandon the above hypothesis and create Hypothesis II (see section 2)
  - this fosters syntactic undergeneration (which is preferable over overgeneration for learnability, because it invites positive evidence for target grammar)
  - but if syntax & semantics work together in this way, how do they separate later in development…?

7. Experiment 3.

- to evaluate Stemmer’s claim that acquisition of yes/no Qs is based on semantics (i.e. the first stage of yes/no Q development is semantically constrained)
  - his claim works for referring to concrete objects, not for actions or abstract objects
  - it and there = semantically empty (non-referential) → don’t apply to Stemmer’s claim:
    - e.g. There is a fly in my soup.

So, the 2 Opposing Arguments are:

- Stemmer: first, semantic generalization → then, replaced by structural generalization
- Developmental autonomy of syntax: semantic features of subject NPs = irrelevant (all NPs treated alike from the start)

- ages 2;9 to 4;8 (younger than in earlier experiments, to test earlier stages of development)
- same procedures as Experiment 2
- pretest sentences given (e.g. He can see the smurfs. and The mouse should be smoking.)
- 2 types of test sentences:
  1. action or abstraction
    - Running is fun.
    - Love is good or bad.
  2. expletives as subject NPs, w/ corresponding semantic control sentence that corresponded in meaning, but instead had referential NPs as subjects
    - It is raining in this picture. Rain is falling in this picture.
    - There is a snake in this picture. A frog is in this picture.
Results and Discussion

- children made more errors with pretest sentences than test sentences!
- much fewer Type 1 errors (younger group of children, yet more successful)
  - relative clause constructions in earlier experiments must have been more difficult → supports idea that errors in earlier experiments were made because of processing complexity of subject relatives

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<th>PRETEST SENTENCES</th>
<th>TOTAL</th>
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<th>INCORRECT</th>
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<tbody>
<tr>
<td><em>is</em></td>
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<td>11</td>
<td>3</td>
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<tr>
<td><em>can</em></td>
<td>19</td>
<td>18</td>
<td>1</td>
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<tr>
<td><em>should</em></td>
<td>26</td>
<td>17</td>
<td>9</td>
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<tr>
<th>TEST SENTENCES</th>
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<tbody>
<tr>
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<td>Expletive NP’s</td>
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<tr>
<td>Controls</td>
<td>41</td>
<td>38</td>
<td>3</td>
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Table 7. Frequency of correct and incorrect responses by sentence type.

- these results clearly undermine Stemmer’s claim

- errors due to misuse of _should_ in pretest sentences
  - its semantic properties (in relation to verbs like _have_) may inhibit the correct syntactic generalization that _should_ is an Aux.
  - or: _should_ might be assigned to Aux. category after _is_ and _can_ because it appears less often

Summary

- children remained unaffected by semantic features of NPs
- their grammars have _syntactically_ integrated: expletives, abstract/action NPs, and referential NPs → syntactic autonomy
  - Stemmer disproved (for this age range)
- no evidence for discontinuous development (as suggested by _semantic bootstrapping_)
- there was evidence for stepwise acquisition of Aux. verbs in yes/no Q formation → problem for Null Subject parameter

**Null Subject parameter**: partly explains why clusters of syntactic properties vary systematically across languages
  - e.g. presence/absence of null element in subject position of tensed clauses, as in Spanish, Italian, or Latin
    - _Te amo._ I love you.
    - _Veni, vidi, vici._ I came, I saw, I conquered.

**Parameter-setting models**: there’s a set of universal syntactic principles of unmarked value that the child can abandon in response to simple positive evidence, in favor of some new specific value from a finite set
  - this process builds on itself (one parameter makes way for a host of new parameters)
• Hyams (1986) says null subjects are the unmarked value; languages like English must be restructured to ensure use of overt subjects
  o this occurs among children in reaction to expletives, then they acquire modals, then subject/Aux. inversion
    ➔ Experiment 3’s findings reject this idea (all children had problems w/ at least one modal, though all produced expletives)

Conclusion
• Experiment 3: children’s hypotheses re. yes/no Q formation don’t rely on semantics
  o syntax = autonomous from semantics
• Experiments 1 & 2: children’s syntactic hypotheses are “tightly constrained”
  o they don’t pay attention to linear (serial) order in creating a rule for subject/Aux inversion ➔ supported by UG
• support for Chomsky: only structure-dependent rules are formulated during acquisition!