The Strong Minimalist Thesis (SMT): *what it means for theories of human language and computation*

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Abbreviations/Glossary

Slides!

Synsalon, Dept. of Linguistics. 4-5pm. Sep 24th 2025

https://arizona.zoom.us/j/84176427932

Topics

Not today:

- **Generative Linguistics and Generative AI**
  - (Separate) Linguistics Colloquium
  - Friday Oct 10th 3pm
  - Communications Bldg. 311, https://arizona.zoom.us/j/83224247918
- **FormSet**
  - 2025 paper with M. Oishi
- **SMT Parser**
  - a computational model of parsing
  - joint project with *U. of Puerto Rico at Mayaguez* (NSF)

Topics

- For SLAT students: *Pro Seminar talk* (Oct 31st)

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- **Generative Linguistics and Generative AI**

Linguistics Colloquium
Friday Oct 10th 3pm

Subject Verb Agreement and Attention

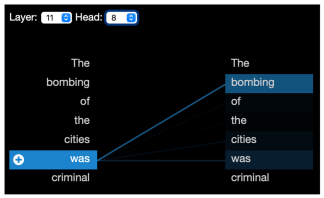
Example (Chomsky 2021):

- The *bombing* of the *cities was* criminal

Adapted:

- The *indiscriminate bombing*$_3$ of the *cities was*$_7$ criminal
- The *indiscriminate bombing*$_3$ of the *ancient and modern cities*$_9$ *was* criminal
- * The *indiscriminate bombing*$_3$ of the *ancient and modern cities*$_9$ *were* criminal
- The *indiscriminate bombing*$_3$ of the *cities that we couldn't possibly have predicted was*$_{13}$ criminal

- GPT-2 small (12 levels; 12 heads)



Adverb-Verb Construal and Attention

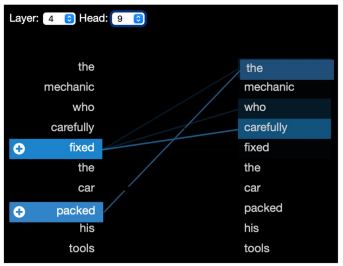
- The mechanic who *carefully* ***fixed*** the car *packed* his tools
- The mechanic who ***fixed*** the car *carefully* ***packed*** his tools
- *Carefully*, the mechanic who *fixed* the car ***packed*** his tools

adapted from (Chomsky 2021)

5.3.2 Dependency Relations

Figure 8 shows the dependency alignment scores (Eq. 4) broken out by layer. Attention aligns with dependency relations most strongly in the middle layers, consistent with recent syntactic probing analyses (Liu et al., 2019; Tenney et al., 2019).

Figure 8: Proportion of attention that is aligned with dependency relations, aggregated by layer. The orange line shows the baseline proportion of token pairs that share a dependency relationship, independent of attention.



Topics

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- Generative Linguistics and Generat

- **FormSet** *link on* `sandiway.arizona.edu`
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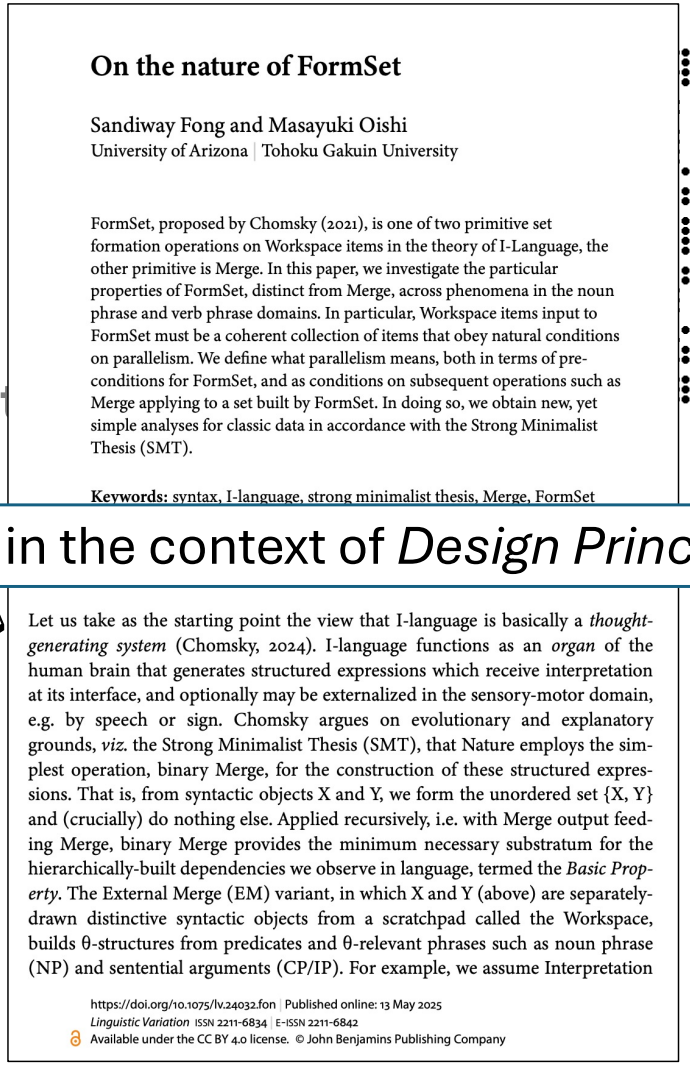

On the nature of FormSet

Sandiway Fong and Masayuki Oishi
University of Arizona | Tohoku Gakuin University

FormSet, proposed by Chomsky (2021), is one of two primitive set formation operations on Workspace items in the theory of I-Language, the other primitive is Merge. In this paper, we investigate the particular properties of FormSet, distinct from Merge, across phenomena in the noun phrase and verb phrase domains. In particular, Workspace items input to FormSet must be a coherent collection of items that obey natural conditions on parallelism. We define what parallelism means, both in terms of pre-conditions for FormSet, and as conditions on subsequent operations such as Merge applying to a set built by FormSet. In doing so, we obtain new, yet simple analyses for classic data in accordance with the Strong Minimalist Thesis (SMT).

Keywords: syntax, I-language, strong minimalist thesis, Merge, FormSet

will mention it in the context of *Design Principles*

Let us take as the starting point the view that I-language is basically a *thought-generating system* (Chomsky, 2024). I-language functions as an *organ* of the human brain that generates structured expressions which receive interpretation at its interface, and optionally may be externalized in the sensory-motor domain, e.g. by speech or sign. Chomsky argues on evolutionary and explanatory grounds, *viz.* the Strong Minimalist Thesis (SMT), that Nature employs the simplest operation, binary Merge, for the construction of these structured expressions. That is, from syntactic objects X and Y, we form the unordered set {X, Y} and (crucially) do nothing else. Applied recursively, i.e. with Merge output feeding Merge, binary Merge provides the minimum necessary substratum for the hierarchically-built dependencies we observe in language, termed the *Basic Property*. The External Merge (EM) variant, in which X and Y (above) are separately-drawn distinctive syntactic objects from a scratchpad called the Workspace, builds θ-structures from predicates and θ-relevant phrases such as noun phrase (NP) and sentential arguments (CP/IP). For example, we assume Interpretation

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Topics

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- **FormSet**
  - 2025 paper with
- **SMT Parser**
  - a computational

GK paper: Chomsky (2021)

With this much background, consider one of the more complex sequences, pairing unaccusative and transitive, keeping to essentials:

(39) John arrived and met Bill.

The first step is to form the two independent objects $\{_1\ v, \{arrive, John_1\}\}$ and $\{_2\ John_2, \{v^*, \{meet, Bill\}\}\}$ of (40a) (*John arrived* and *John met Bill*) in the normal way, satisfying Θ-Theory. The next step is to construct the *set* (40b):

(40) a. $\{_1\ v, \{arrive,\ John_1\}\}, \{_2\ John_2, \{v^*, \{meet, Bill\}\}\}$
b. $\{\{_1\ v, \{arrive,\ John_1\}\}, \{_2\ John_2, \{v^*, \{meet, Bill\}\}\}\}$

Application of Merge, introducing & and INFL, yields (41):

(41) $INFL, \{\&, \{\{_1\ v, \{arrive,\ John_1\}\}, \{_2\ John_2, \{v^*, \{meet, Bill\}\}\}\}\}$

Since we so far have only sets, extraction is possible, so either of the occurrences of *John* can be raised to SPEC–INFL, yielding (42), which is converted to (43) by merging C and then applying FSQ:[51]

(42) $John_3, \{INFL, \{\&, \{\{_1\ v, \{arrive,\ John_1\}\}, \{_2\ John_2, \{v^*, \{meet, Bill\}\}\}\}\}\}$
(43) $C, \{John_3, \{INFL, <\&, \{_1\ v, \{arrive,\ John_1\}\}, \{_2\ John_2, \{v^*, \{meet, Bill\}\}\}>\}\}$

Topics

Not today:

- Generative I
- FormSet
  - 2025 paper v
- SMT Parser
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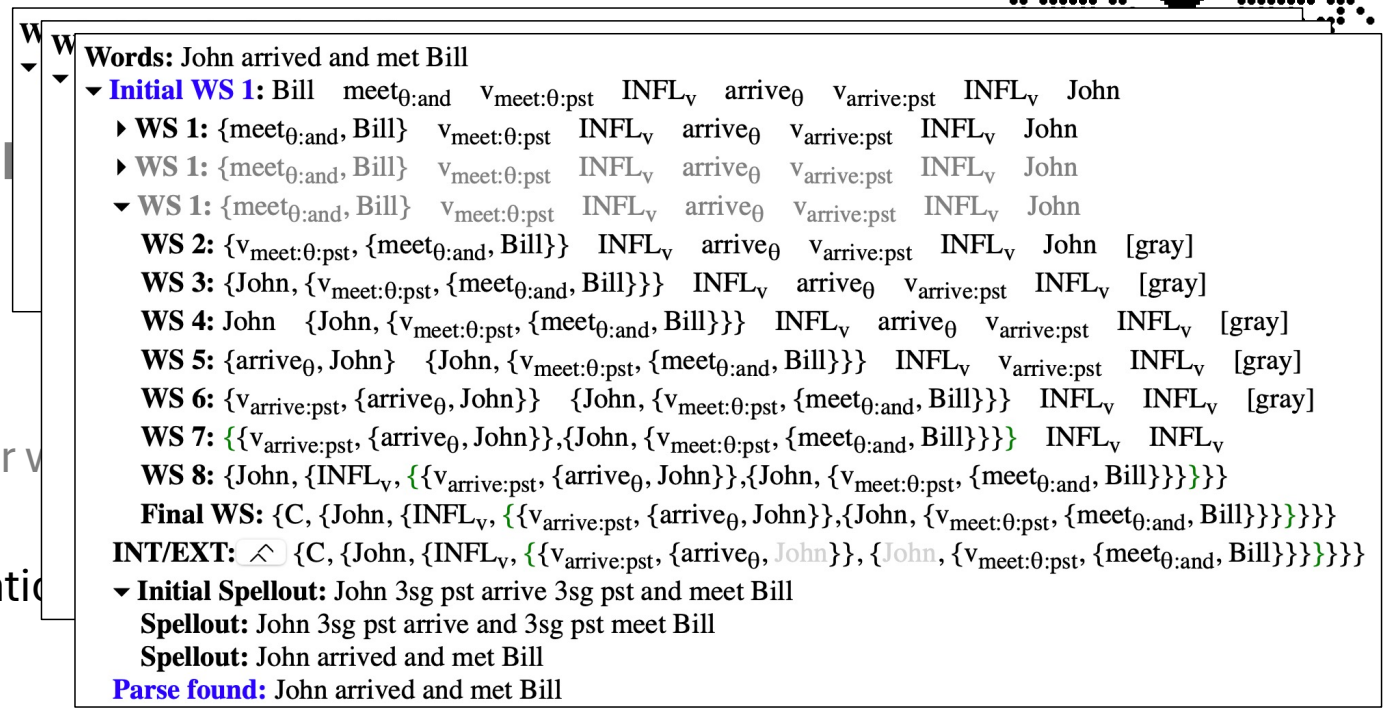

Words: John arrived and met Bill

Initial WS 1: Bill $meet_{\theta:and}$ $v_{meet:\theta:pst}$ $INFL_v$ $arrive_\theta$ $v_{arrive:pst}$ $INFL_v$ John

WS 1: {$meet_{\theta:and}$, Bill} $v_{meet:\theta:pst}$ $INFL_v$ $arrive_\theta$ $v_{arrive:pst}$ $INFL_v$ John

WS 1: {$meet_{\theta:and}$, Bill} $v_{meet:\theta:pst}$ $INFL_v$ $arrive_\theta$ $v_{arrive:pst}$ $INFL_v$ John

WS 1: {$meet_{\theta:and}$, Bill} $v_{meet:\theta:pst}$ $INFL_v$ $arrive_\theta$ $v_{arrive:pst}$ $INFL_v$ John

WS 2: {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}} $INFL_v$ $arrive_\theta$ $v_{arrive:pst}$ $INFL_v$ John [gray]

WS 3: {John, {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}}} $INFL_v$ $arrive_\theta$ $v_{arrive:pst}$ $INFL_v$ [gray]

WS 4: John {John, {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}}} $INFL_v$ $arrive_\theta$ $v_{arrive:pst}$ $INFL_v$ [gray]

WS 5: {$arrive_\theta$, John} {John, {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}}} $INFL_v$ $v_{arrive:pst}$ $INFL_v$ [gray]

WS 6: {$v_{arrive:pst}$, {$arrive_\theta$, John}} {John, {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}}} $INFL_v$ $INFL_v$ [gray]

WS 7: {{$v_{arrive:pst}$, {$arrive_\theta$, John}},{John, {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}}}} $INFL_v$ $INFL_v$

WS 8: {John, {$INFL_v$, {{$v_{arrive:pst}$, {$arrive_\theta$, John}},{John, {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}}}}}}

Final WS: {C, {John, {$INFL_v$, {{$v_{arrive:pst}$, {$arrive_\theta$, John}},{John, {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}}}}}}}

INT/EXT: {C, {John, {$INFL_v$, {{$v_{arrive:pst}$, {$arrive_\theta$, John}}, {John, {$v_{meet:\theta:pst}$, {$meet_{\theta:and}$, Bill}}}}}}}

Initial Spellout: John 3sg pst arrive 3sg pst and meet Bill

Spellout: John 3sg pst arrive and 3sg pst meet Bill

Spellout: John arrived and met Bill

Parse found: John arrived and met Bill

Topics

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- **Generative Ling**

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  - 2025 paper with
- **SMT Parser**
  - a computationa

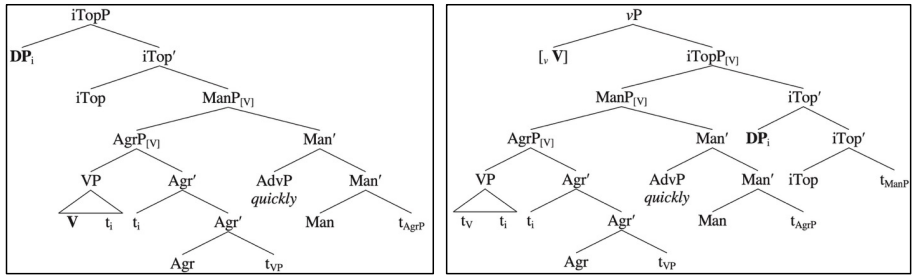
banned!

parsing algorithms:

- Cocke–Younger–Kasami (CKY) algorithm, Sakai (1961)
- LR(*k*) parsing, (D)PDA discovery, Knuth (1965)
- Earley algorithm, Earley (1968)

Key Research Questions:

- How to *parse efficiently* if we only have **Merge**?
- How does **Externalization (EXT)** work?
  - *how do we learn and encode word order variation?*
  - *Merge does not encode linear order, cf. trees*



*Trees: **OS** in 6 moves. Pearson (2000). Really want this?*

Topics

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- **SMT Parser**
  - a computational

Key Research Questions:

- How do we *parse* if we only have **Merge**?
- How does **Externalization** work?
  - *word order variation*
- **M-gaps**: *unpronounced θ-items* (*perception problem*)
- A/A-bar segregation: **IM** *and the* **Box**

Examples: `sandiway.arizona.edu/smtparser`

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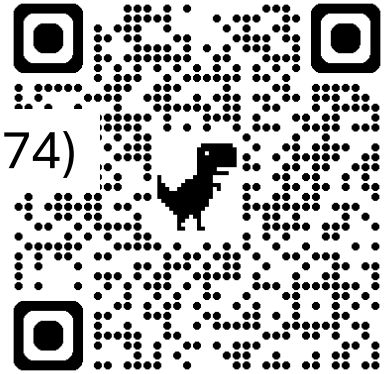
- *Alex Tubens* (*UA linguistics grad. student*)
- Spanish (NSF collaboration with *Hilton Alers-Valentín*, University of Puerto Rico at Mayaguez)

Today's Topics

***Biolinguistics** perspective* (1974)



- **Motivation for the SMT**
  - (recent) human evolution
  - slow brain (*a bottleneck*), but excellent sensors
- **Organ: Language Faculty (FL)** ☜ **Theory: Universal Grammar (UG)**
  - Design: *must be* (*very*) *simple* (*Miracle Creed*)
  - Third Factor: *must be efficient* (1st factor: *genetic*; 2nd: *experience*)
  - Workspace (WS): *(only) scratchpad*
  - WS Merge
  - Markovian Assumption: *no access to computational history*
  - Difference between a 3rd Factor Design Principle and a Constraint
  - Minimal Search (MS)
  - Duality of Semantics: *Internal/External Merge division of labor*
  - Copy/Repetition Problem
  - …

Recent Human Evolution

- Explosion of symbolic works in the fossil record
  - *coincides with the appearance of modern humans* (200-300 tya)
  - … until the emergence of behaviorally modern *H. sapiens*: **in general, technological innovations have been sporadic and rare**. The most-striking evidence for a distinct cognitive contrast between modern humans and all their predecessors, however, comes from Europe. *H. sapiens* came late to this continent and brought a new kind of stone tool based on striking long thin "blades" from a carefully prepared long core. **In short order these Europeans, the so-called Cro-Magnons, left a dazzling variety of symbolic works of prehistoric art**. (Tattersall in *Encyclopaedia Britannica*)

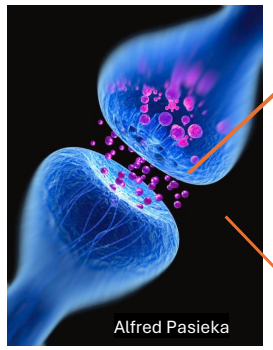
    Last Updated: Aug. 29, 2025
  - *we can fashion tools that amplify these inherent abilities that we have to spectacular magnitudes, e.g. wrt. locomotion, computation, medicine*

Slow Brain Bottleneck

- 3rd Factor (*computational efficiency*)
- Sensor/brain mismatch
  - slow brain limits what sensory inputs can be analyzed
  - mid-20th C: chemical neural communication, not electrical
    - *The War of Soups and Sparks* (Valenstein, 2005)
- Example: can we "see" a single photon?
  - *Adaptation: **neural filters** only allow a signal to pass to the brain to trigger a conscious response when at least 5-9 arrive within < 100 ms.* (Gibbs 1996)
  - **Yes** (Tinsley *et al*. 2016) vs. **No** ~5-7 (Hecht, Schlaer & Pirenne 1942)
  - *Single photon priming effect* (peak ~3.5 secs)

neurotransmitters

predates evolution of neurons



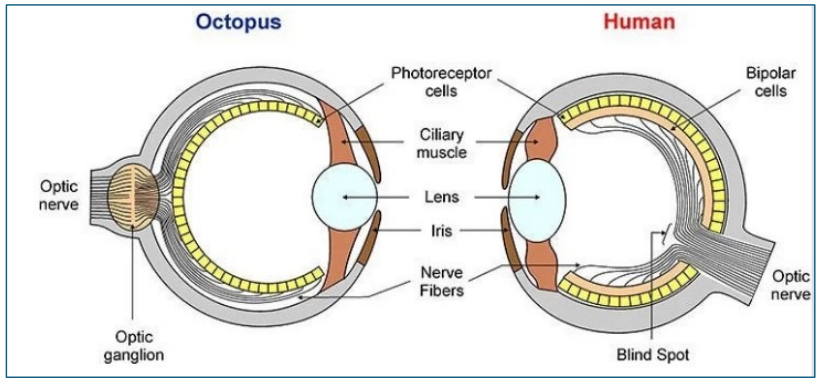
20-40nm synaptic cleft between two neurons

Recent Human Evolution

- (Berwick & Chomsky 2016)
  - *Vocal learning and production aspect of* [***EXT***] *is not human-specific* (ancient)
- (Chomsky 2021)
  - Language/thought, **I-Language**, an authentic species property (recent)
  - *Our closest relatives, otherwise intelligent apes, cannot begin to grasp the most elementary rudiments of language even with intensive training. They have about the same auditory system as humans, but acquire nothing from the sounds that lead a human infant, almost reflexively, to develop complex systems for constructing and expressing thought.*
- Basic structure of I-Language should be simple (**Merge**):
  - *the result of some […] small rewiring of the brain […] and has not changed […] since.*
- Modern human ~20K protein coding genes (*1.5% human genome*)
  - Neanderthal/Modern human Y-chromosome divergence ~588 tya (Mendez *et al*. 2016)
  - 14,042 regions of archaic DNA (Neanderthal/Denisovans) (Weiss et al. 2021)
  - *407 […] drove differential expression between the modern and archaic alleles*

Motivation for the SMT

- *Nature adapts/optimizes what it has to work with …*
- Disruptive event: *new entity/functionality* (**I-Language**)
- Reconstruction: *put together a simplest system new/old*



- Example of convergent evolution

- 750-570 mya: **LCA**
- 530 mya: high-res camera eyes (*re-invented many times*) (Land & Fernald 1992) (Land & Nilsson 2012)
- 500 mya: first nervous system
- 100 mya: we lost tetrachromatic vision (*cone cells*)
- 3-4 mya: first human-like brain
- 1-0.2 mya: modern brain
- octopus: "colorblind" (only 1 type of photoreceptor), but employ color (*camouflage*)

SMT

- Structures of **I-Language** are generated by the *simplest operations*
  - simplicity of mechanism is needed (*evolutionary plausibility*)
  - computational efficiency is needed (*slow brain*)
  - simplicity is possible? (*Miracle Creed*)
- Not part of core I-Language:
  - language variation/parameterization, e.g. *word order*
  - acquisition: e.g. *words, variation in word order, surface subject*
- I-Language/E-Language divide:
  - could have a **well-formed thought** but not (directly) externalizable
- **Strong**: *all linguistic phenomena can be accounted for*

Miracle Creed

LLMs: *GPT-4 1,760 billion parameters*

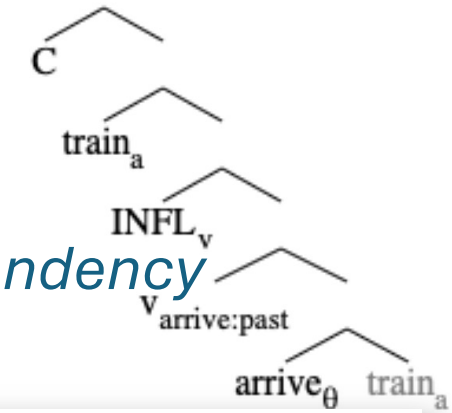
APRIL 1, 1950 | 20 MIN READ

On the Generalized Theory of Gravitation

how pure a "positivist" he may fancy himself. The metaphysicist believes that the logically simple is also the real. The tamed metaphysicist believes that not all that is logically simple is embodied in experienced reality, but that the totality of all sensory experience can be "comprehended" on the basis of a conceptual system built on premises of great simplicity. The skeptic will say that this is a "miracle creed." Admittedly so, but it is a miracle creed which has been borne out to an amazing extent by the development of science.

A. Einstein in *Scientific American* Vol. 182 No. 4 (1950)

(Simplest) Merge



- **Basic Property** of I-Language: *structural dependency*
  - *not linear order!* (surprising: *even simpler*)
- **SMT**:
  - what is the simplest mechanism that results in structure?
- (Mathematical) **Merge**:
  - two items X and Y (*binary*)
  - create {X, Y} (set: *no order*)
  - **recurse**: *Merge can feed Merge* (**WS**)
  - no embellishments!

INT/EXT: ⩤ {C, {train$_a$, {INFL$_v$, {v$_{arrive:past}$, {arrive$_\theta$, train:a$_a$}}}}}

(Marcoli et al. 2025)

banned!

non-recursive precursors?
- Core-Merge (Fujita 2014)
- Conjoin (Progovac 2015)

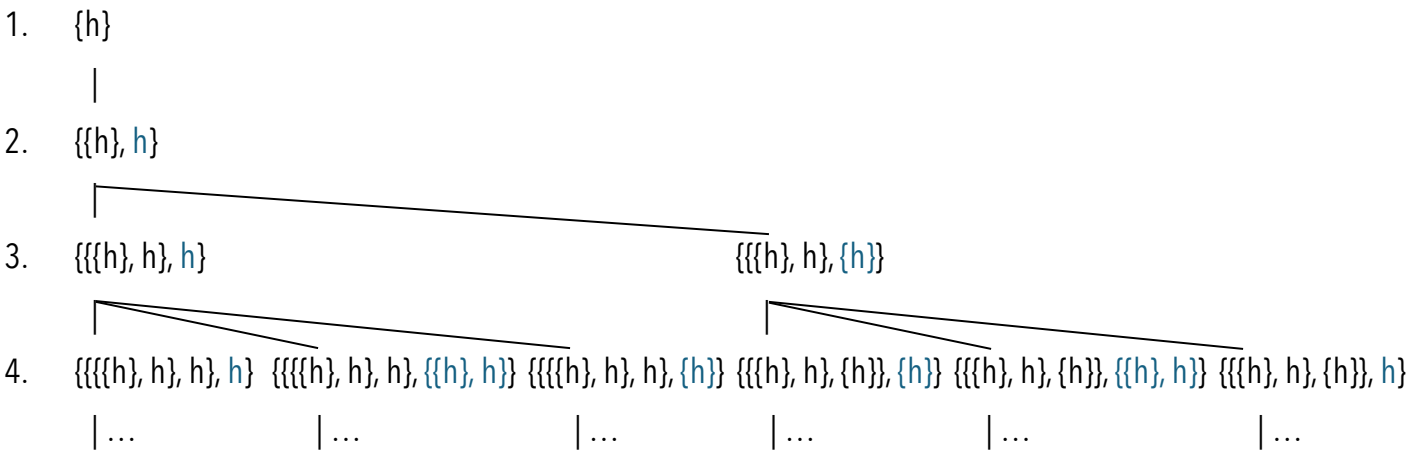
(Simplest) Merge

- Nature makes **Merge** available for cognition
- Natural Numbers ($\mathbb{N}$)
  - lexicon (**LEX**): h (*lexical item*: **LI**, a head h)
  - Workspace (**WS**): {h} (*suppose WS items: sets*)
  - **Merge**: {h} h
    - select WS item *X* and *Y*, a (sub-)**term of** *X*
    - create {X, Y} {{h}, h}
  - WS': {{h}, h} (*WS': state of WS after 1 Merge*)
  - WS'': {{{h}, h}, h} (h *a term of* {{h}, h} in WS')
    or {{{h}, h}, {h}} ({h} *a term of* {{h}, h} in WS')
    or {{{h_1}, h_2}, h_1} (h *a term of* {{h}, h} in WS')

Internal Merge (IM)
"*simplest case*"

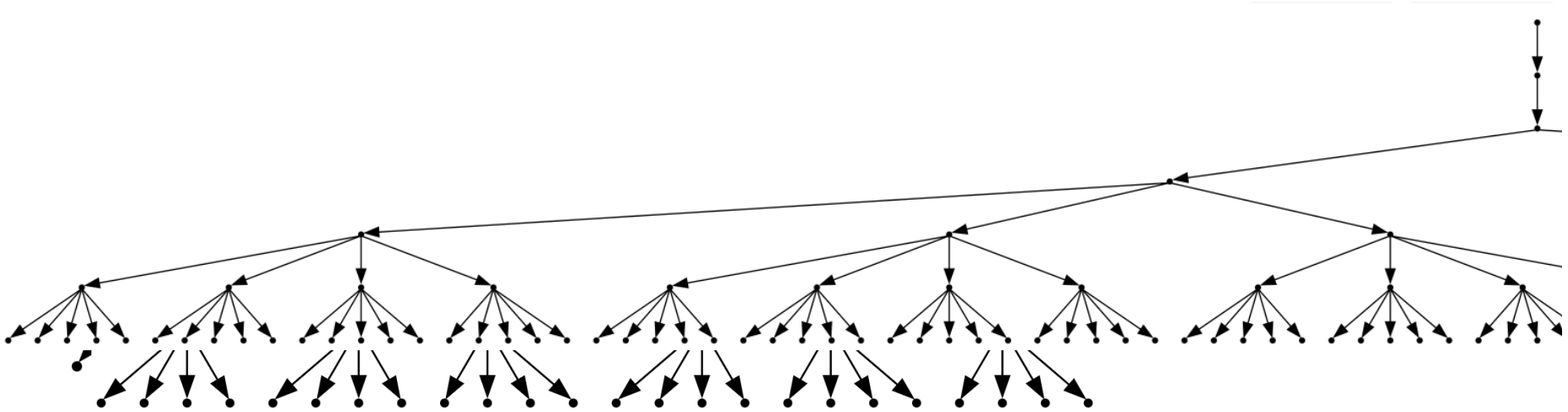
Workspace (WS)

- **IM WS** computation (*ignoring duplicates*):



Workspace (WS)

- **IM WS** computation space (*zoomed out*)



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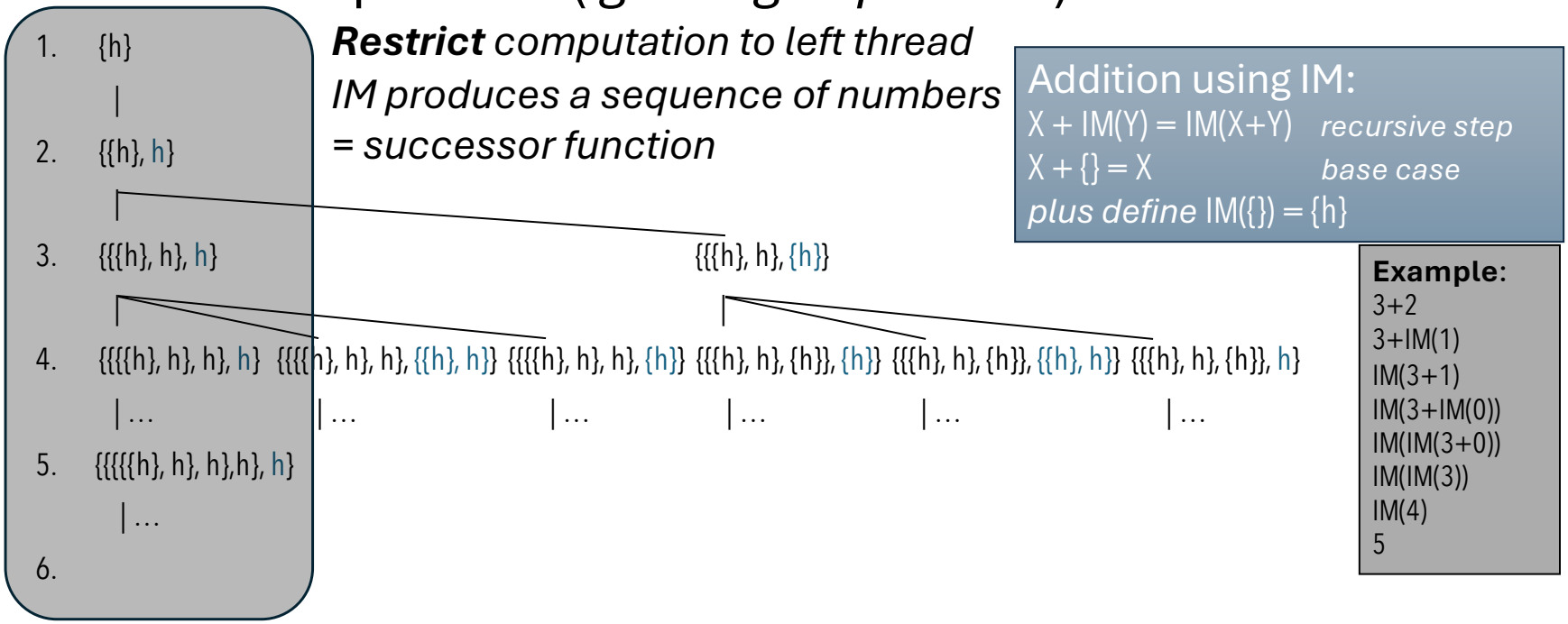
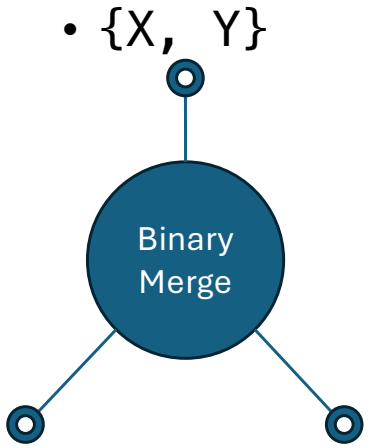


Workspace (WS)

- **EM** is more complex than **IM** (Chomsky)
- *but required by* **FL** *for thought construction*

- For I-Language
  - **LEX** contains (> 1) heads
  - **IM** is basic, *term-of* is the simplest relation
- Need also some θ-configurations:
  - {v, {R, IA_θ}} *unaccusative*
  - {EA_θ, {v, {R, IA_θ}} *transitive*
  - {EA_θ, {v, R}} *unergative*
  - assume v & R are heads (**LEX**)
  - EA & IA could be complex objects
  - *External Merge* (**EM**), brings *sister-of* relation

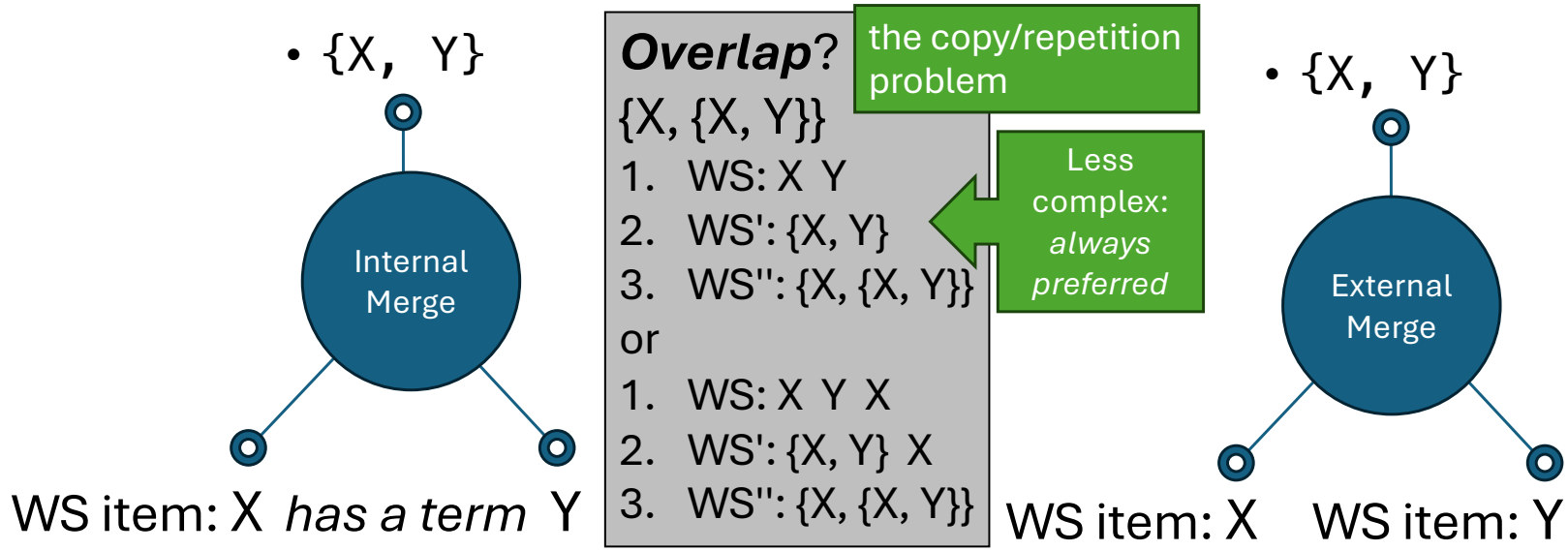
known to **INT**



Note: *assume* X *&* Y *are distinct, i.e. can't draw the same item twice*

Duality of Semantics

Earlier theory: $\{X_i, \{t_i, Y\}\}$ vs. $\{X, \{X, Y\}\}$

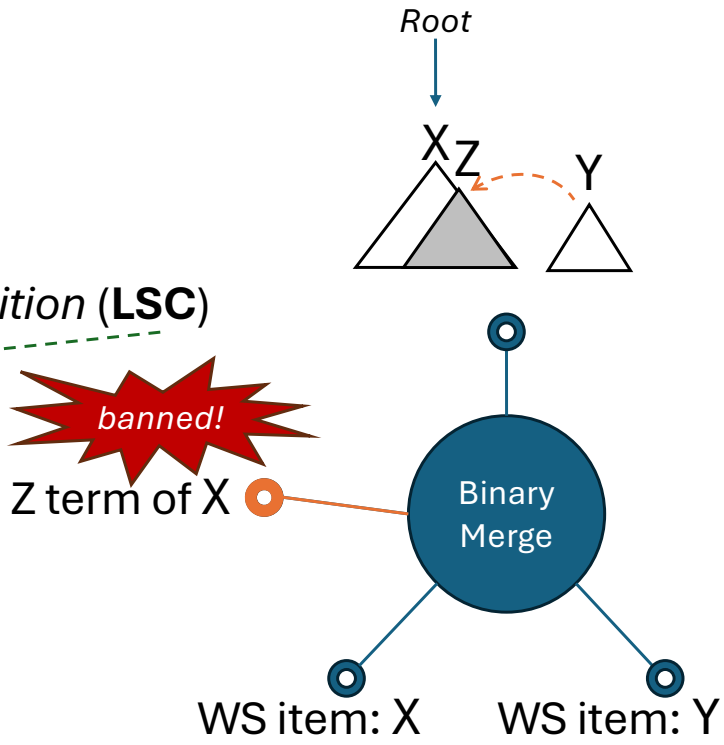


- IM for discourse/information functions
- EM for θ-configurations

Consequences

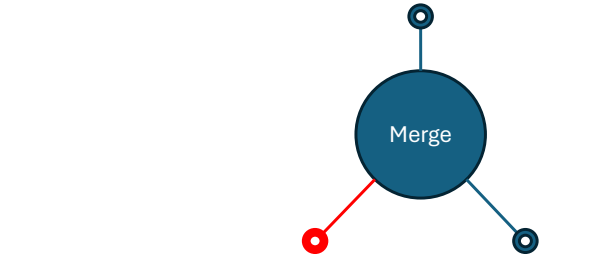
- **Merge** customized for I-Language use
  - **Duality**: *Language* (*Faculty*)*-Specific Condition* (**LSC**)
  - Minimal Search (**LSC**)
- **Design Principles**:
  - *Extension Condition* (*root-only*)
    - *no tuck-in / splicing / no verbal head movement*
  - *Non-Tampering Condition* (**NTC**)
    - *deletion / turning something into a trace*
  - *Inclusiveness* (*no invention during derivation*)
    - *coindexation / γ-mark / assign a feature*
- No circumvention of these principles
  - e.g. *pre-indexed* heads X_i X_i into the WS
- **Merge** builds θ-configurations (*propositional domain*)
  - then transitions to the *clausal domain* via $INFL_\phi$
  - then adds heads like C/C_Q, Topic, Focus *etc*. (*probe with language-particular spellout **EXT***)

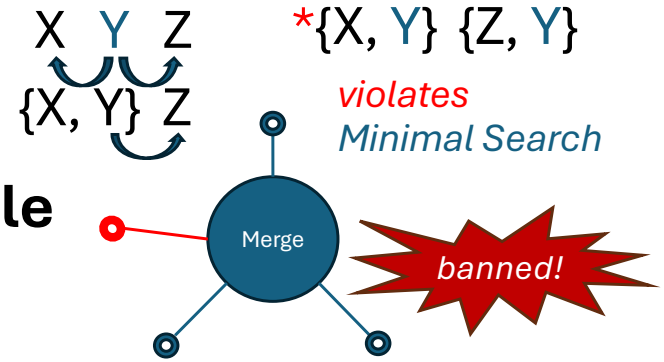
baked/designed-in



Consequences 2

- Just plain Merge:
  - *no feature movement / inheritance*
  - *no extra memory devices/scratchpads*
  - *no WS history: Markovian assumption*
- More complex forms of Merge:
  - *useful perhaps, but also out!*
  - parallel Merge, sideways Merge
- *Minimal Yield* (**MY**) is a **design principle**
  - *not a **filter** on Merge output*





Minimal Search (MS)

Chomsky (2021) (3) d. carefully, the mechanic who fixed the car packed his tools

- Examples of structural relations (*all must obey MS*):
  - an adverb must **find** a verb to modify
    - *but cannot use the simplest computation: pick linearly closest verb*
  - INFL$_{\phi}$ must **find** θ-relevant item (*with ϕ for* **EXT**) (*Agree*)
    - θ-relevant item: *EA for transitives, IA for unaccusatives*
- Merge must also obey MS
- Formulate the **find** operation:
  - **IM** brings the *term-of* relation
  - **EM** brings the *sister-of* relation
  - **c-command** = *sister-of* + *term-of* (**Phase**-local; related: **WS** partitioning)
  - No embellishments!

Minimal Search (MS) 2

- **Search**: *look for something, e.g. an identical inscription*
  - in **structure**: *for free* ***c-command*** (basic: *sister-of* + *term-of*)
  - in **WS**: *for free member-of* (*but not inside*)
- **MS**:
  - *1st thing you find, you have to* ***stop*** (**3rd Factor**)
  - *How to know we pick A or B?* **Answer**: *you never get to see B*
- **Minimal Yield (MY):**
  - *Merge should not explode the WS search space* (**Design Principle**)
- **Contrast with sorting** (*finding optimal*):
  - sort requires comparisons
  - compare candidates
  - must find/generate (multiple) candidates (**3rd Factor**)
  - *no optimality-theoretic accounts?*

On Minimal Search (MS)

- Chomsky (p.c.):
  - *Right now I don't see any reason why any operation should be exempt from MS. If so, MS can include structural identity checking -- which is its basic intuitive content.*

FormSet

(Chomsky 2021:31)

- *unbounded unstructured sequences* (**UUS**)

John, Bill, my friends, the actor who won the Oscar, … ran, danced, took a vacation (*respectively*)

- FormSet ({…}):

8) (a) S_1 = {John, Bill, my friends, the actor who won the Oscar}
   (b) S_2 = {ran, danced, took a vacation}

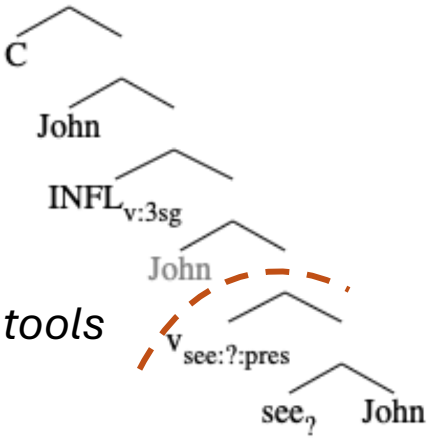
- *Other examples:*
  - John lived on a farm *and* with his family
  - John arrived *and* met Bill (*derivation on earlier slide*)
  - when *and* where did you see her? (Williams 1978)
  - which book did John buy *and* read?
  - the student who lives here who studies English whom I know
  - the politician is greedy *and* a charlatan (adjectival)
  - the long, dark *and* narrow hallway

SMT and FormSet

- *suppose FormSet is generally available to cognition*
  - *grouping given similarity* (*part of the toolkit*)
- **Simplest** conditions: (Design Principles)
  - members must be a *coherent* of set of syntactic objects
    - *but be easily computable, e.g.* ***±substantive, ±predicative***
  - members must obey some *parallelism* requirement for **INT**
  - members must *integrate identically* with Merge syntax (ATB effects)
- **Note**:
  - n = 2: {X, Y} *not same as binary Merge* {X, Y} *due to different conditions*
  - *n = 1? not available for* ***I-Language****, cf. arithmetic (Merge)*

Workspace (WS) 2

Economy of **EXT**:
in English, pronounce only the highest copy



- **WS** *Partitions* and **Phases**:
  - **John likes* means the EA is in a higher Phase than the IA
  - *the nice mechanic who fixed the car carefully packed his tools*
  - WS_1: C_{rel} v fix $_{PAST}$ car who carefully ➲ $C_{rel}P$
  - WS_2: C v pack $_{PAST}$ tools he mechanic nice
  - or
  - WS_1: C_{rel} v fix $_{PAST}$ car who ➲ $C_{rel}P$
  - WS_2: C v pack $_{PAST}$ tools he mechanic nice carefully
- Note {XP, YP} *generally* requires WS partitioning:
  - (**EA**) *the nice mechanic* (who …) = XP
  - EM inserts EA into matrix θ-config. {EA, {v_{PAST}, {pack, {he, tools}}}}

YP

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- **Theory**
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    - The Miracle Creed and SMT. In Greco, M. & Mocci, D. (Eds.), *A Cartesian dream: A geometrical account of syntax: In honor of Andrea Moro*. Rivista di Grammatica Generativa/Research in Generative Grammar. (*2024*)
  - Chomsky D:

Appendices

Sections:

- **Abbreviations/Glossary**
- Biology
- Combinatorics and Computation
- Structural Ambiguity
- Thought and Externalization
- Thought vs. Communication
- Syntax
- Mathematical Set Theory

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ABBREVIATIONS/GLOSSARY

1. {} Empty set
2. {…} Non-empty set made by Merge
3. {…} set made by FormSet
4. **<** Precedes (in time)
5. **1st Factor** genetic, see Third Factor
6. **2nd Factor** experience, see Third Factor
7. **3rd Factor** see Third Factor
8. **Agree** Agreement (a relation)
9. **Box** see MC
10. **c-command** a relation built on sister-of and term-of (set)
11. **CKY** Cocke-Younger-Kasami
12. **copy** non-independent occurrence of phrase/head, see repetition
13. **DPDA** Deterministic PushDown Automata
14. **E-Language** Externalized language
15. **EA** External Argument
16. **EM** External Merge
17. **EXT** Externalization
18. **FL** Language Faculty (organ: biology)
19. **GK** (Chomsky 2021) in *Gengo Kenkyu* (LSJ journal)
20. **GPT** Generalized Pre-trained Transformer
21. **head** smallest unit (atom) in I-Language computation
22. **I-Language** contrast with E-Language
23. **IA** Internal Argument
24. **IM** Internal Merge
25. **INFL** Inflection (a head)
26. **LEX** Lexicon (heads & idiom chunks)
27. **OS** Object Shift
28. **INT** Interpretation
29. **LCA** Last Common Ancestor
30. **LI** Lexical Item from LEX
31. **LLM** Large Language Model
32. **LR** Left-to-Right
33. **LSC** Language-Specific Condition
34. **M-gap** Markovian gap see GK
35. **MC** *The Miracle Creed and SMT* (Chomsky 2024)
36. **ms**. millisecond
37. **MS** Minimal Search
38. **MY** Minimal Yield
39. **mya** Million Years Ago
40. ℕ Natural numbers 0,1,2…
41. **nm** nanometer
42. **NTC** Non-Tampering Condition
43. **PAST** Past tense
44. **PDA** PushDown Automata
45. **ϕ** phi-features, e.g. Person, Number, (grammatical) Gender
46. **phrase** structure formed by Merge, cf. head
47. **occurrence** in structure, a phrase or head may occur 1,2,3… times, see also copy and repetition
48. **sister** sister-of (a relation: set)
49. **SMT** Strong Minimalist Thesis
50. **structure** (I-Language) structure formed by Merge
51. **R** Root (a head)
52. **Root** highest node (tree)
53. **repetition** independent occurrence (of phrase/head)
54. **term** term-of (a relation: set)
55. **θ** Theta (as in Theta Theory)
56. **Third Factor** see *Three Factors in Language Design* (Chomsky 2005)
57. **tya** Thousand Years Ago
58. **UG** Universal Grammar (a theory)
59. **UUS** Unbounded Unstructured Sequences
60. **v** "little v" (a head)
61. **WS** Workspace