

What movement and adjunction really mean

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Research Goal:

Identify the basic syntactic and semantic operations employed by the language faculty, and in particular which ones are used *only* by the language faculty.

Hypothesis:

There are only a small number of basic operations specific to the language faculty.

Why a small number of operations?

- ▶ Evidence of a small “genetic gap” between humans and other animals
 - ▶ Tension with the more familiar acquisition boundary conditions
 - ▶ Heterogeneous, modular nature of GB theory is problematic
- ▶ It would bring connections with neuroscience closer
 - ▶ Identifying brain areas associated with “syntax”, “semantics”, etc. provides “interesting correlative datapoints” but “little of explanatory depth”
 - ▶ Identifying brain areas associated with *components* of syntax/semantics seems a long way off if these are government, binding, A-movement, etc.
- ▶ Ockham’s Razor; most falsifiable hypothesis

Outline

Adjunction as unlabelled structure

Problems to be solved

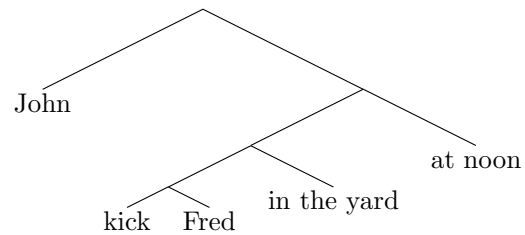
A revised version

Movement, copying and adjunction

A challenge for bare phrase structure

(1) John kicked Fred in the yard at noon.

(2)



- (3)
- It was *kick Fred* that John did in the yard at noon.
 - It was *kick Fred in the yard* that John did at noon.
 - It was *kick Fred at noon* that John did in the yard.
 - It was *kick Fred in the yard at noon* that John did.
 - It was *kick Fred at noon in the yard* that John did.
 - * It was *kick* that John did Fred in the yard at noon.

A challenge for bare phrase structure

Substitution of 'did so' presents the same problem:

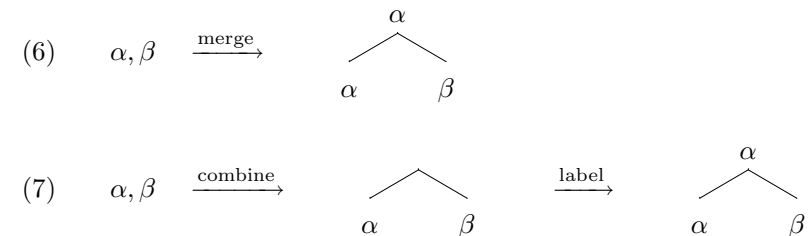
- (4)
- John *kicked Fred* in the yard at noon, and Bill did so in the house at one o'clock.
 - John *kicked Fred in the yard* at noon, and Bill did so at one o'clock.
 - John *kicked Fred* in the yard *at noon*, and Bill did so in the house.
 - John *kicked Fred in the yard at noon*, and Bill did so too.
 - * John *kicked Fred* in the yard at noon, and Bill did so Peter in the house as one o'clock.

A challenge for bare phrase structure

Substitution of 'one' presents the same problem:

- (5)
- John found the yellow *bottle of water* with the cork, but not the blue one with the cap.
 - John found the *yellow bottle of water* with the cork, but not the one with the cap.
 - John found the yellow *bottle of water with the cork*, but not the blue one.
 - John found the *yellow bottle of water with the cork*, but not the glass.
 - * John found the yellow *bottle* of water with the cork, but not the blue one of wine with the cap.

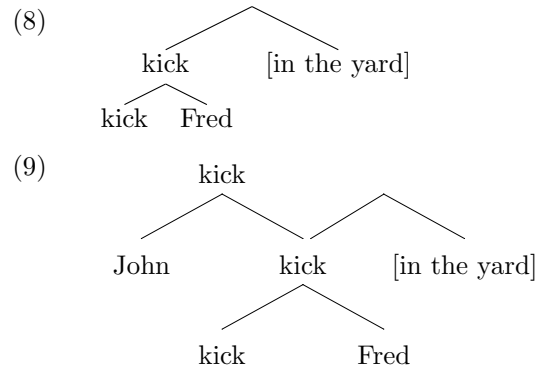
Optional Labelling



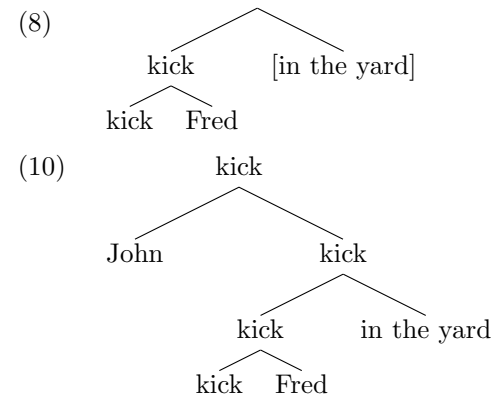
We stipulate (for now) that

- ▶ the result of combining with an argument *must* be labelled
- ▶ the result of combining with an adjunct *may* (optionally) be labelled

Optional Labelling



Optional Labelling

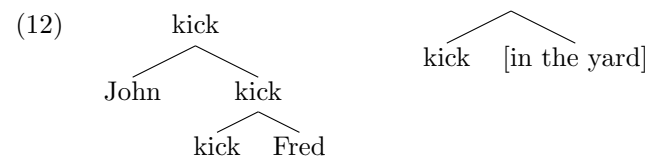


But why?

We have independent reasons to think that the logical form of 'John kicked Fred in the yard at noon' is something like:

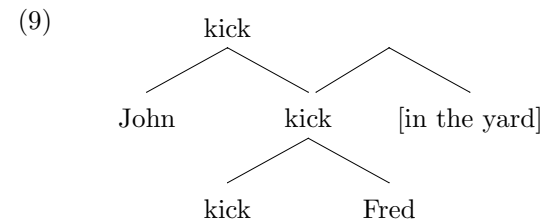
$$(11) \quad \exists e[\text{Kicking}(e) \wedge \text{Agent}(e, j) \wedge \text{Theme}(e, f) \wedge \text{InTheYard}(e) \wedge \text{AtNoon}(e)]$$

- ▶ adjuncts modify the event variable *directly*
- ▶ arguments modify the event variable *indirectly*, and each in a slightly different way



Problem 1

How do we interpret non-tree structures?

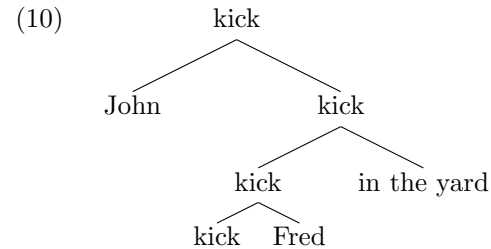


- ▶ Usually semantic composition works up towards one single root, and then we stop

Problem 2

How do we interpret adjuncts when labelling *does* happen?

- ▶ We need the label here in order to be able to front ‘kick Fred in the yard’



- ▶ We don't want ‘in the yard’ to be the external argument

Problems to be solved

1. How do we interpret non-tree structures?
2. How do we interpret adjuncts when labelling *does* happen?

The “combine” operation

(13) John ran quickly [on Monday] [from here] [to there] [because of the parrot].

- ▶ We need to allow for an unbounded number of adjuncts all “equally close” to the verb
- ▶ Let's represent the result of $\text{combine}(\alpha, \beta)$ as $\{\alpha, \beta\}$

(14) $\{\{\text{ran, quickly}\}, \{\text{ran, [on Monday]}\}, \{\text{ran, [from here]}\}, \{\text{ran, [to there]}\}, \{\text{ran, [because of the parrot]}\}\}$

The “label” operation

(13) John ran quickly [on Monday] [from here] [to there] [because of the parrot].

- ▶ We need to establish a relation between ‘ran’ and ‘John’
- ▶ Let's represent the result of applying the label α to $\{\alpha, \beta\}$ as $\langle \alpha, \beta \rangle$

(15) $\{\{\text{ran, John}\}, \{\text{ran, quickly}\}, \{\text{ran, [on Monday]}\}, \{\text{ran, [from here]}\}, \{\text{ran, [to there]}\}, \{\text{ran, [because of the parrot]}\}\}$

(16) $\{\langle \text{ran, John} \rangle, \{\text{ran, quickly}\}, \{\text{ran, [on Monday]}\}, \{\text{ran, [from here]}\}, \{\text{ran, [to there]}\}, \{\text{ran, [because of the parrot]}\}\}$

This completes the derivation of (13)

The “label” operation

(17) John kicked Fred in the yard.

This won't do:

(18) { ⟨kick, John⟩, ⟨kick, Fred⟩, {kick, [in the yard]} }

So we allow combine to apply to “labelled” objects (ie. ordered pairs)

(19) a. { ⟨kick, Fred⟩, {kick, [in the yard]} }
b. { {John, ⟨kick, Fred⟩}, {kick, [in the yard]} }
c. { ⟨⟨kick, Fred⟩, John⟩, {kick, [in the yard]} }

This completes the derivation of (17)

Objects to be interpreted

We now need to provide a mapping from the structures to the relevant interpretations for each of the following:

(20) a. John ran quickly on Monday from here to there because of the parrot.
b. { {ran, quickly}, {ran, [on Monday]}, {ran, [from here]}, {ran, [to there]}, {ran, [because of the parrot]}, ⟨ran, John⟩ }

(21) a. John kicked Fred in the yard.
b. { ⟨⟨kick, Fred⟩, John⟩, {kick, [in the yard]} }

Conjunctivist semantics

- ▶ Every expression signifies a one-place predicate

$$(22) \quad \llbracket \text{John} \rrbracket = \lambda x. \text{John}(x)$$

$$(23) \quad \llbracket \text{kick} \rrbracket = \lambda e. \text{Kicking}(e)$$

- ▶ Complex expressions signify the *conjunction* of their parts

$$(24) \quad \llbracket \text{kick in the yard} \rrbracket = \lambda e. \llbracket \text{kick} \rrbracket(e) \wedge \llbracket \text{in the yard} \rrbracket(e) \\ = \lambda e. \text{Kicking}(e) \wedge \text{InTheYard}(e)$$

- ▶ Arguments require some special treatment:

$$(25) \quad \llbracket \text{kick Fred} \rrbracket \neq \lambda e. \text{Kicking}(e) \wedge \text{Fred}(e)$$

Conjunctivist semantics

- ▶ ‘Fred’ signifies a predicate of individuals:

$$(26) \quad \llbracket \text{Fred} \rrbracket = \lambda x. \text{Fred}(x)$$

- ▶ ‘Fred’ *interpreted as an internal argument* signifies a predicate of events:

$$(27) \quad \llbracket \text{Fred}_{\text{INT}} \rrbracket = \lambda e. \exists x [\llbracket \text{Fred} \rrbracket(x) \wedge \text{Internal}(e, x)] \\ = \lambda e. \exists x [\text{Fred}(x) \wedge \text{Internal}(e, x)]$$

- ▶ This can be conjoined with the verb’s predicate of events:

$$(28) \quad \llbracket \text{kick Fred} \rrbracket = \llbracket \text{kick Fred}_{\text{INT}} \rrbracket \\ = \lambda e. \llbracket \text{kick} \rrbracket(e) \wedge \llbracket \text{Fred}_{\text{INT}} \rrbracket(e) \\ = \lambda e. \text{Kicking}(e) \wedge \exists x [\text{Fred}(x) \wedge \text{Internal}(e, x)]$$

How we can use all that

$$(29) \quad \llbracket \{\alpha, \beta\} \rrbracket = \lambda e. \llbracket \alpha \rrbracket(e) \wedge \llbracket \beta \rrbracket(e)$$

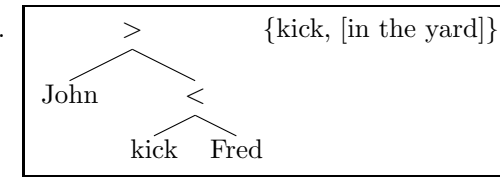
$$(30) \quad \llbracket \langle \alpha, \beta \rangle \rrbracket = \begin{cases} \lambda e. \llbracket \alpha \rrbracket(e) \wedge \exists x \llbracket \beta \rrbracket(x) \wedge \mathbf{Internal}(e, x) \\ \lambda e. \llbracket \alpha \rrbracket(e) \wedge \exists x \llbracket \beta \rrbracket(x) \wedge \mathbf{External}(e, x) \end{cases}$$

Linearisation facts to account for

- (3)
- a. It was *kick Fred* that John did in the yard at noon.
 - b. It was *kick Fred in the yard* that John did at noon.
 - c. It was *kick Fred at noon* that John did in the yard.
 - d. It was *kick Fred in the yard at noon* that John did.
 - e. It was *kick Fred at noon in the yard* that John did.
 - f. * It was *kick* that John did Fred in the yard at noon.

How we can use all that

- (21)
- a. John kicked Fred in the yard.
 - b. { ⟨⟨kick, Fred⟩, John⟩, {kick, [in the yard]} }
 - c.



$$(31) \quad \lambda e. \llbracket \langle \text{kick}, \text{Fred} \rangle \rrbracket(e) \wedge \exists x [\mathbf{John}(x) \wedge \mathbf{External}(e, x)] \\ = \lambda e. \mathbf{Kicking}(e) \wedge \\ \exists y [\mathbf{Fred}(y) \wedge \mathbf{Internal}(e, y)] \wedge \exists x [\mathbf{John}(x) \wedge \mathbf{External}(e, x)]$$

$$(32) \quad \lambda e. (\mathbf{Kicking}(e) \wedge \mathbf{InTheYard}(e)) \wedge \\ \exists y [\mathbf{Fred}(y) \wedge \mathbf{Internal}(e, y)] \wedge \exists x [\mathbf{John}(x) \wedge \mathbf{External}(e, x)]$$

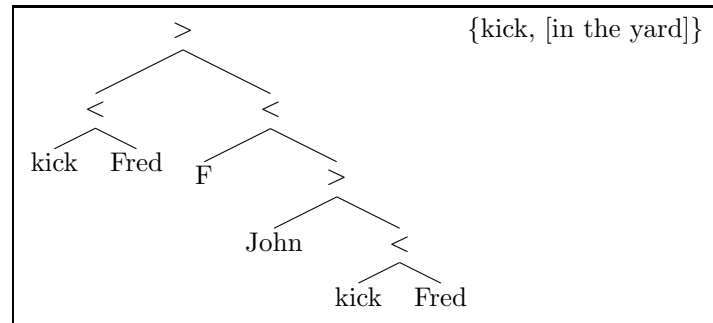
Transformed “focus” structures

- (21)
- a. John kicked Fred in the yard.
 - b. { ⟨⟨kick, Fred⟩, John⟩, {kick, [in the yard]} }
- (33) { ⟨F, ⟨⟨kick, Fred⟩, John⟩⟩, {kick, [in the yard]} }

To establish the required relation between F and ‘kick’, we combine ⟨kick, Fred⟩ with F:

$$(34) \quad \{ \langle \langle F, \langle \langle \text{kick}, \text{Fred} \rangle, \text{John} \rangle \rangle, \langle \text{kick}, \text{Fred} \rangle \rangle, \{ \text{kick}, [\text{in the yard}] \} \}$$

Transformed “focus” structures

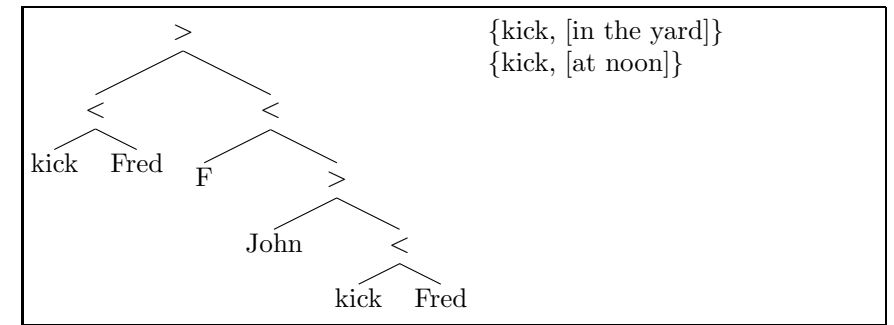


(35) Kick Fred, John did.

(36) a. Kick Fred in the yard, John did.

b. Kick Fred, John did in the yard.

Transformed “focus” structures



- Choosing one of the places where ‘kick’ appears for each of the adjuncts independently gives us the right range of choices for (3).

Problems solved

1. How do we interpret non-tree structures?
 - Treat the “main tree” conventionally, to “anchor” the interpretation
 - Integrate adjuncts by choosing a (leaf) position in the tree with which they are associated
2. How do we interpret adjuncts when labelling *does* happen?
 - Never label the result of combining with an adjunct

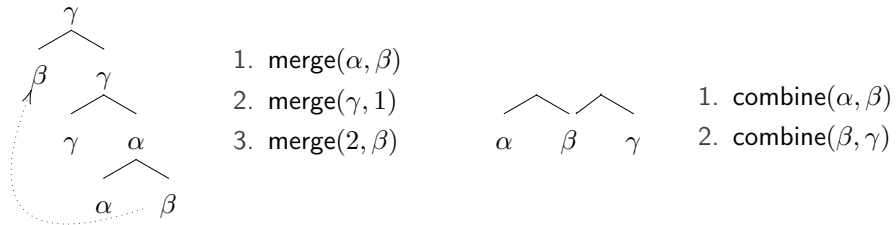
Movement, copying and adjunction

- (37) a. { ⟨⟨kick, Fred⟩, John⟩, {kick, [in the yard]} }
- b. { ⟨⟨F, ⟨⟨kick, Fred⟩, John⟩⟩, ⟨kick, Fred⟩⟩, {kick, [in the yard]} }

Why should a “copy” be required in (37b), if not in (37a)?

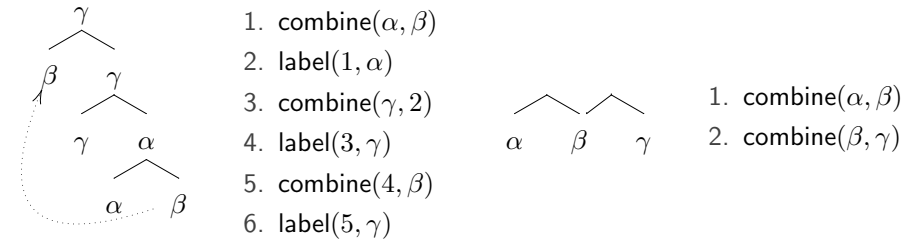
- If ‘kick’ can relate to arguments and to adjuncts without being copied, why should a copy be required to establish the relation with F?
- If it can’t, why isn’t a copy required to establish relations with both ‘Fred’ and ‘John’?

Movement, copying and adjunction



- ▶ “movement” means being merged with something of which you are a part
- ▶ “adjunction” means being combined with two otherwise unrelated things

Movement, copying and adjunction

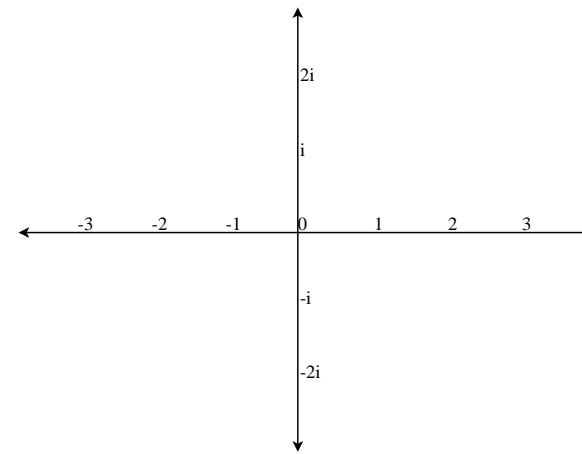


- ▶ “movement” means being combined with something of which you are a part
- ▶ “adjunction” means being combined with two otherwise unrelated things
- ▶ “projection” means being used to label something of which you are an immediate part

How do we interpret these operations?

- ▶ How do combine and label connect to the big picture?
- ▶ Operations as statements about *representations* (not processes)
- ▶ Think “function” in the static, declarative, mathematical sense

Characterising the space of representations



$$f(x, y) = x + iy$$

