The logical form of lexical semantics

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Section 1

Recap

Last time

- Manner/Result
- Argument and event structure
- Some lambdas

Today

- Another empirical domain
- Slightly different analysis
- More syntax. Lambdas **and** root types

Section 2

Setting the stage: Mayan

Verbs in Chuj

- Four traditional kinds of roots in Chuj (Mayan, Guatemala).
- Coon (2019) reconceptualizes them as having different types:

Root class		Formal type		
Nominal	$\sqrt{\text{NOM}}$	$< e, t >$	*at'is*	'sneeze'
Transitive	$\sqrt{\text{TV}}$	$< e, < s, t >>$	*chonh*	'sell'
Intransitive (unaccusative)	$\sqrt{\text{ITV}}$	$< e, < s, t >>$	*way*	'sleep'
Positional	$\sqrt{\text{POS}}$	$< e, < s, d >>$	*chot*	'crouched'

You can make an intransitive verb (for example) out of each of these, but they'd require different morphology.

Mayan verbs often have "status suffixes," which we'll ignore and just gloss SFX.

Deriving intransitive verbs in Chuj

Intransitive root (no further derivation):

(1) Ix-onh-way-i
PFV-ABS1P-sleep-SFX
'We slept.'

Transitive roots:

(2) Tas ix-e-chonh-o'?
what PFV-A2P-sell-SFX
'What did you.PL sell?'

(3) Ix-in-xik-**w**-i k'atzitz
PFV-B1S-chop-DAG-SFX wood
'I wood-chopped.'

Positional roots:

(4) Chot-an em nok'
crouched-STAT DIR.down CLF
k'ok'on
frog
'The frog is crouched down.'

(5) Ix-onh-k'ox-n-**aj**-i
PFV-ERG1P-seated-STAT-DIV-SFX
'We sat down.'

Nominal roots:

(6) Ix-w-ab' jun at'is
PFV-ERG1S-hear one sneeze
'I heard a sneeze.'

(7) Ix-at'is-**w**-i ix unin
PFV-sneeze-DAG-SFX CLF child
'The girl sneezed.'

Root classes in Mayan

A few notes:

- The Chuj root determines whether it can compose (directly) with an internal argument.
- The bulk of Coon (2019) is mostly an analysis of the Chuj suffix *-w* ("incorporation antipassive") and the related "absolutive antipassive."
- If you're interested in positionals and adjectives, check out Henderson (2019) on adjectives in Kaqchikel:
  - Adjectives are degree relations, $< d, < e, t >>$: *säq* 'white,' *kow* 'hard,' *nïm* 'big.'
  - Positionals roots are measure functions, $< e, d >$: *jot* 'elevated,' *ch'eq* 'wet,' *set* 'circular,' *tun* 'adjacent,' *tik'* 'facing a reference point.'
  - The two classes take different morphology and are compatible with different contexts.

Section 3

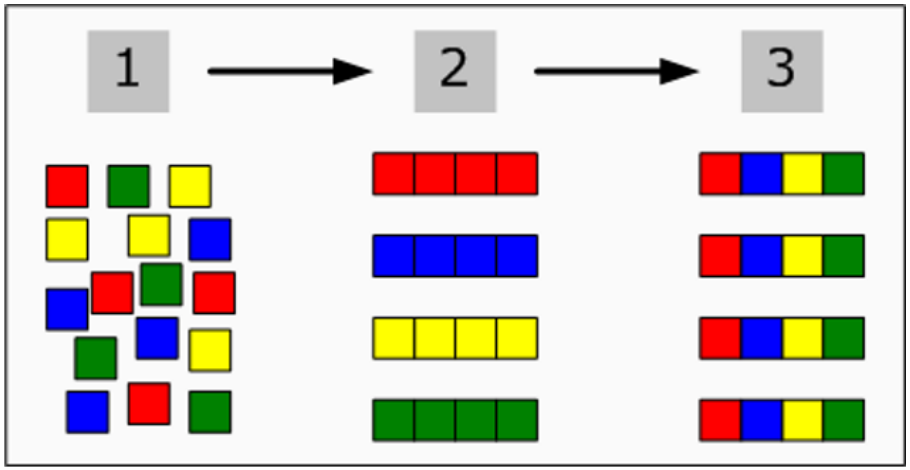
The Levinson classes

The Levinson classes

- We'll do a collaborative jigsaw puzzle! (Levinson 2007, 2010, 2014)
- But first: what formal tools have we discussed so far?

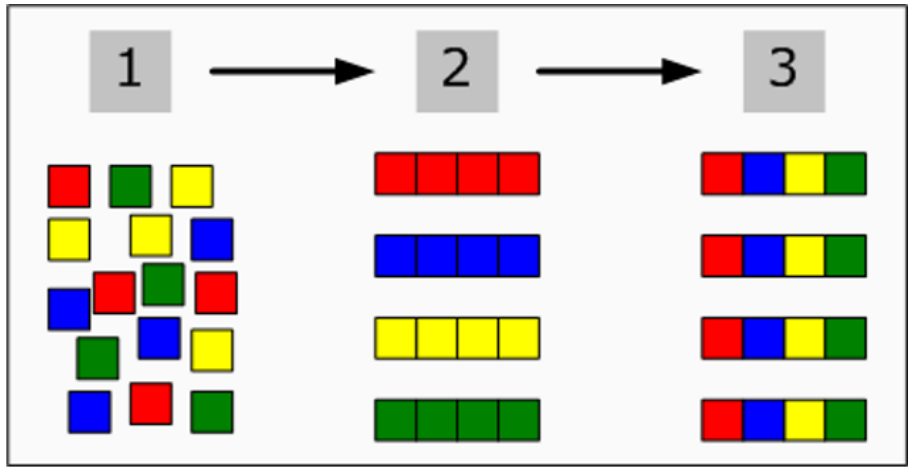
How the jigsaw puzzle works

1. What we want to find out.
   - We have three verb classes: A, B and C.
   - We have three diagnostics: 1, 2 and 3.
2. First you'll form **expert groups** devoted to each verb class.
   - Discuss the generalizations.
   - Outline an analysis.
3. Then we'll reshuffle you to form **puzzle groups**.
4. The puzzle groups will discuss the different verb classes.
   - Representatives of each expert group will brief the rest of the puzzle group.
   - The puzzle group as a whole discusses.



Expert groups (step 1)

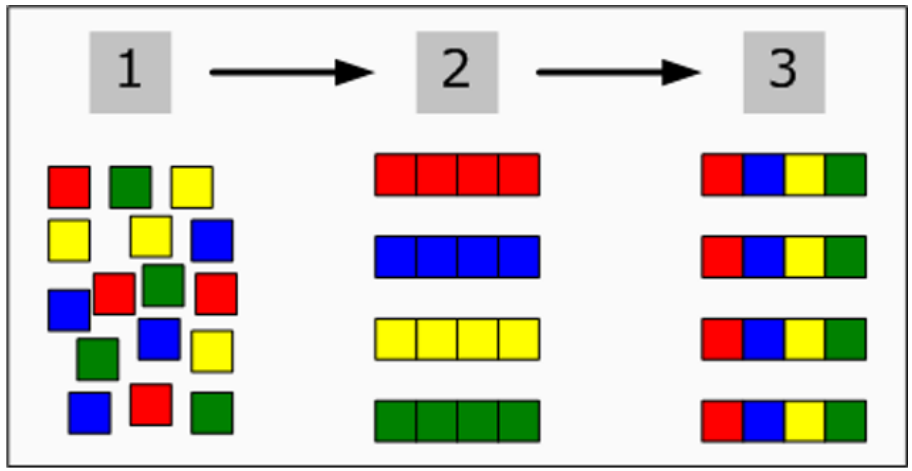
- We need a couple of expert groups for each verb class.
- Each expert group will get a handout with data.
- Try to characterize your verb class informally. Name it!
- Try to characterize the diagnostics and name them.
- You might want to come up with additional examples, if you have native speakers in your group.
- What could an analysis look like? What are the syntactic/semantic assumptions?



- Some diagnostics might not make sense unless you compare with other verbs (either now or in the next stage).
- Each member should be ready to explain their verb class to the puzzle groups in the next stage!
- You could try to think up other verbs that do or don't belong in this class.

Puzzle groups (step 2)

- Reshuffle so that each group has a couple of representatives from each verb class.
- Experts take turns explaining their verb class to the rest of the puzzle group.
  - Start with the data and generalizations.
  - Then give an overview of your proposed analysis.



- Discuss as a group:
  - How do these verb classes differ?
  - What syntactic assumptions do we need to make?
  - What semantic assumptions do we need to make?
  - Do these look similar for the different classes? Can they? Should they?

Some verb classes

- **Explicit creation verbs** (A):
  - The verb denotes the kind of element created.
  - *bake, build, cook.*
- **Change-of-state verbs** (B):
  - The verb denotes the new state of an element.
  - *break, clear, open.*
- **Root creation verbs** (C):
  - The verb denotes the element created.
  - *braid, pile, stack.*

Root creation verbs

- *Braid, pile, stack*: A direct object names the material of the created element, signified by the root.

(8) Sam cooked a **dish**. EXP

a. $\Rightarrow$ A dish was created.

b. $\overset{?}{\Rightarrow}$ A cooked thing was created.

c. $\not\Rightarrow$ A cook was created.

(9) Mary **piled** the cushions. RTC

a. $\not\Rightarrow$ Cushions were created.

b. $\overset{?}{\Rightarrow}$ A piled thing was created.

c. $\Rightarrow$ A pile was created.

Basic transitives and intransitives

The first set of examples is as follows:

(10) Explicit creation roots derive transitive and unergative verbs:

a. John baked a cake.

b. John baked.

(11) Change-of-state roots derive transitive (and unaccusative) verbs:

a. John opened the door.

b. #(The door opened.)

(12) Root creation verbs derive transitive (and some unaccusative) verbs:

a. John piled the cushions.

b. ?(The cushions piled in the corner.)

Diagnostic 1: Obligatory object

Explicit creation is fine without an object; COS and root creation require one.

(13) John baked (all day yesterday).

(14) a. #John was opening all day.

b. *John was clearing all day.

c. #John was cooling all day.

(15) #The kids piled (all day).

Diagnostic 2: Double object construction

- In general, the distribution of double objects in English is restricted regardless of verb class.
- Acceptable only with an interpretation that involves a **transfer of possession** from the theme to the recipient.
- No general "benefactive" reading. (Pylkkänen 2008; Levinson 2010, 2014)

(16) COS verbs in double object vPs:

a. John opened his mom a beer. $\Rightarrow$ *change of possession*

b. *John opened his mom the door. $\not\Rightarrow$ *change of possession*

c. ?John broke his brother a stick.

Example (c) improves if John's brother is building a little structure out of sticks, and John is helping by breaking sticks and giving them to him.

Diagnostic 2: Double object construction

(17) Ray baked their mom a cake.

(18) Ray opened their mom a beer.

(19) a. *Ray piled their mom some cushions.

b. *?Ray stacked their uncle some wood.

c. ??Ray braided the captain some rope.

Diagnostic 3: Pseudo-resultatives (Levinson 2010)

- Regular resultatives: indicate the resultant state of the direct object.
- Pseudo-resultatives: indicate the resultant state the material the object is made of. Only possible with root creation verbs.

Two kinds of resultatives

(20) Typical resultatives

a. Mary hammered [the metal$_i$] flat$_i$. ⇒ The metal became flat.

b. Mary cooked [the meat$_i$] black$_i$. ⇒ The meat became black.

c. The kids lifted [the pillow$_i$] high$_i$. ⇒ The pillow became high.

(21) Pseudo-resultative modification

a. Lisa braided [her hair] tight. ⇏ The hair became tight.
⇒ 'Lisa formed a tight braid out of her hair.'

b. The kids piled [the cushions] high. ⇏ The cushions became high. ⇒ 'The kids formed a high pile out of the pillows.'

c. Mary ground [the coffee beans] fine. ⇏ The coffee beans became fine. ⇒ 'Mary formed a fine grind out of the coffee beans.'

Diagnostic 3: Pseudo-resultatives (Levinson 2010)

Explicit creation:

(22) True resultatives ok:

a. John baked the cake$_i$ crispy$_i$.

b. John baked the cake$_i$ black$_i$.

(23) Pseudo-resultatives bad:

a. #John baked$_i$ the cake tasty$_i$.

b. #John baked$_i$ the ingredients tasty$_i$.

Diagnostic 3: Pseudo-resultatives (Levinson 2010)

COS:

(24) True resultatives ok:

a. John cleared the table$_i$ clean$_i$.

b. John broke the door$_i$ to pieces$_i$.

(25) Pseudo-resultatives bad:

a. #John opened$_i$ the door tiny$_i$.

b. #John broke$_i$ the mirror jagged$_i$.

Diagnostic 3: Pseudo-resultatives (Levinson 2010)

Root creation:

(26) True resultatives bad:

a. *The kids piled the cushions$_i$ small/squished$_i$.

b. *Lisa braided her hair$_i$ clean$_i$.

(27) Pseudo-resultatives ok:

a. The kids piled$_i$ the cushions high$_i$.

b. Lisa braided$_i$ her hair tight$_i$.

To be explained

Verb (from root)	No object	Pseudo-resultative	Double object
Explicit creation	✓(possible)	✗	✓
Change of state	✗	✗	✓
Root creation	✗	✓	✗

Section 4

Analysis

The Levinson system

- Developed in a series of works by Lisa Levinson (Levinson 2007, 2010, 2014).
- For an attempted reanalysis, see Irwin and Kastner (2020).

Semantics

Architecture

Two types of eventualities:

- s_e: dynamic events
- s_s: stative events

We'll just have s for all events in these slides.

Semantics

Types need to match during composition (no shifting / QR / etc).

Type mismatch $\Rightarrow$ Unacceptability.

Root types

An ontology of formally-typed roots:

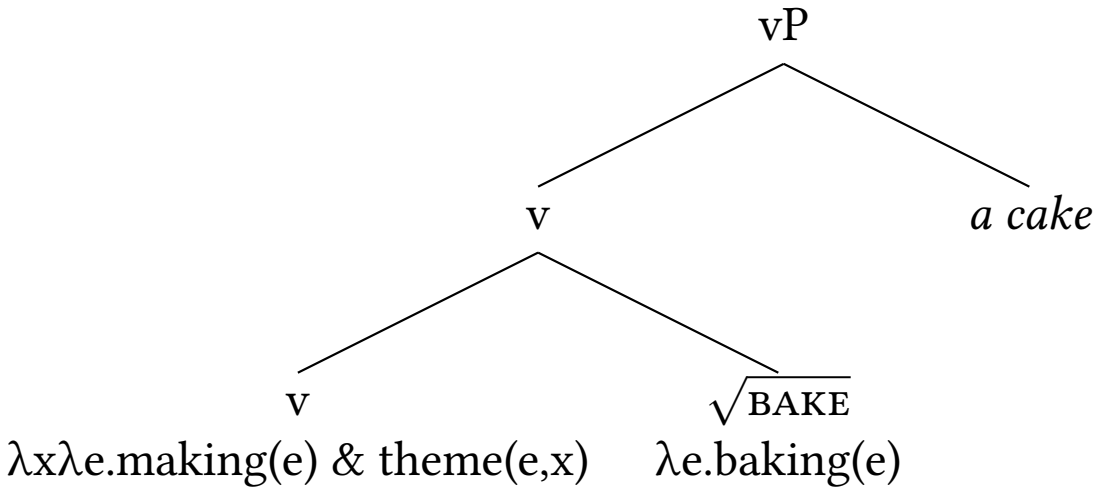
- Explicit creation *bake*: $< s, t > -$ λe.baking(e)
- Change-of-state *open*: $< e, < s, t >> -$ λxλs.open(s) & theme(x,s)
- Root creation *pile*: $< e, t > -$ λx.pile(x)

Analysis: Explicit creation, optional theme

(28) $[\![\sqrt{\text{BAKE}}]\!]$ = λe.baking(e)

Assumption: since verbs can be transitive or intransitive, we need two kinds of verbal heads, a transitive one and an intransitive one.

(29)



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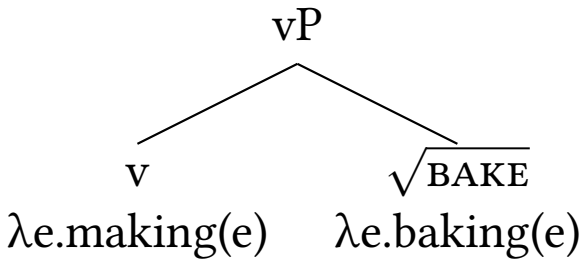
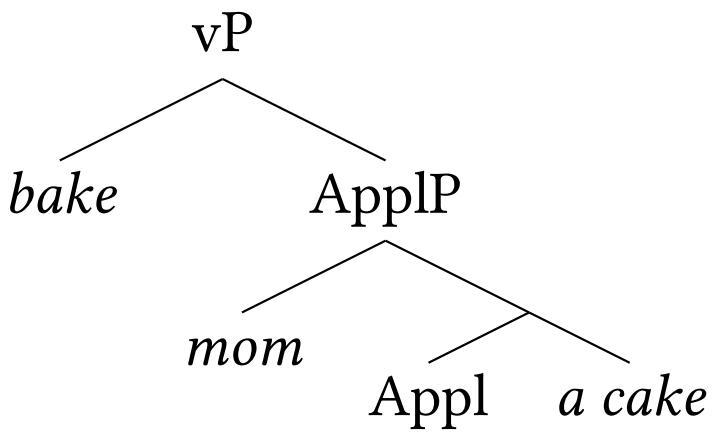


Analysis: Explicit creation, double objects

The head Appl introduces benefactives:

(31)



(32) $[\![\text{ApplP}]\!] = \lambda f \lambda e.f(e, \text{a cake}) \,\&\, \text{theme}(e, \text{a cake}) \,\&\, \text{to-the-possession}(\text{a cake}, \text{her mom})$

(33) $[\![\text{v} + \sqrt{\text{BAKE}}]\!] = \lambda x \lambda e.\text{making}(e) \,\&\, \text{baking}(e) \,\&\, \text{theme}(e,x)$

(34) $[\![\text{vP}]\!] = \lambda e.\text{making}(e) \,\&\, \text{baking}(e) \,\&\, \text{theme}(e, \text{a cake}) \,\&\, \text{theme}(e, \text{a cake}) \,\&\, \text{to-the-possession}(\text{a cake}, \text{her mom})$

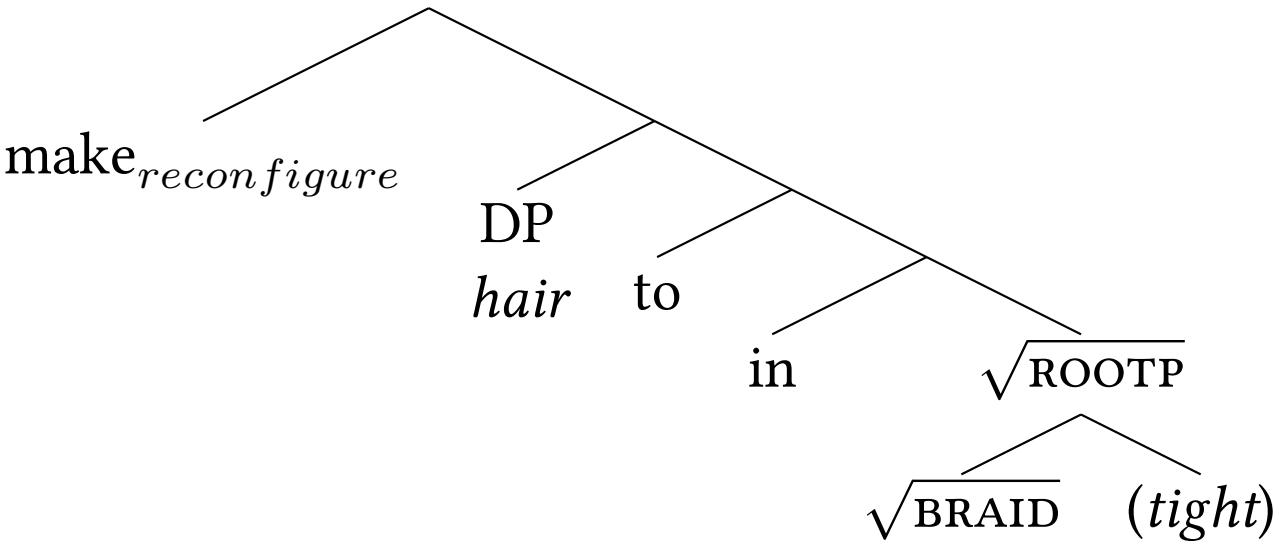
Analysis: Root creation

Switching over to root creation, start with this:

(35) She *made* her hair *in-to* a braid.

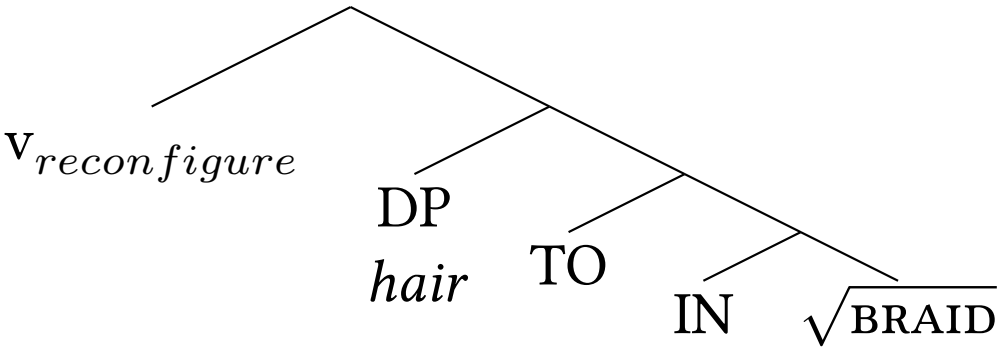
(36) $[\![\sqrt{\text{BRAID}}]\!] = \lambda x.\text{braid}(x)$

(37)



Analysis: Root creation, obligatory theme

(38) *She braided her hair*:



(39) ⟦TO⟧ is vacuous (λf.f).

(40) ⟦IN⟧ = $\lambda f_{<e,t>}$**λy**λsΞx[f(x) & being-in(s,x) & **theme(s,y)**]

(41) ⟦vP⟧ = λe.Ξs.Ξx.braid(x) & being-in(s)(x) & **theme(s,her hair)** & reconfiguration(e) & CAUSE(s)(e)

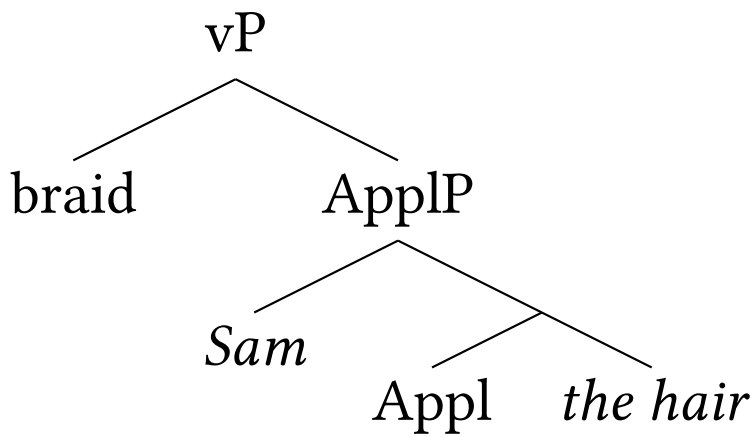
A set of reconfiguration events which cause a state in which 'her hair' is in a braid.

Analysis: Root creation, double objects

(42) $[\![\text{Appl}]\!] = \lambda x \lambda y \lambda f \lambda e[f(e,x) \,\&\, \text{theme}(e,x) \,\&\, \text{to-the-possession}(x,y)]$

If this were an applicative structure, then:

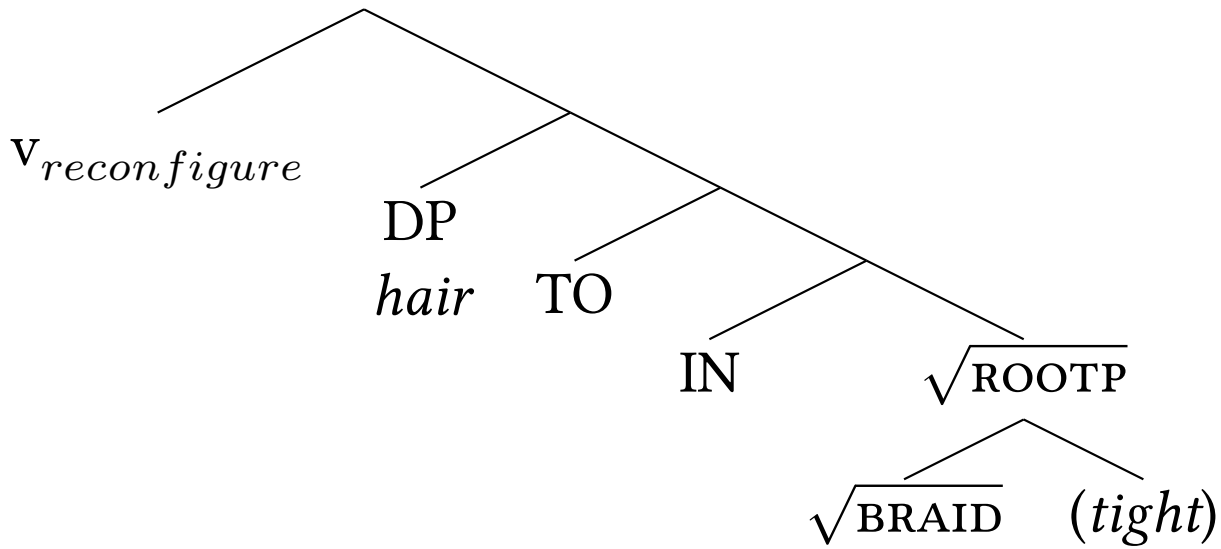
(43)



But what's being created now (the theme)? And what's being transferred?

Analysis: Root creation, psuedo-resultatives

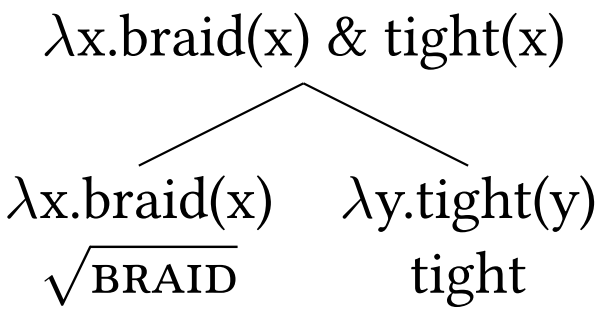
(44) *She braided her hair **tight**:*



Analysis: Root creation, psuedo-resultatives

Since the $\sqrt{\text{BRAID}}$ is essentially a $[_{DP}$ *braid*] or *braid*(x):

(45)

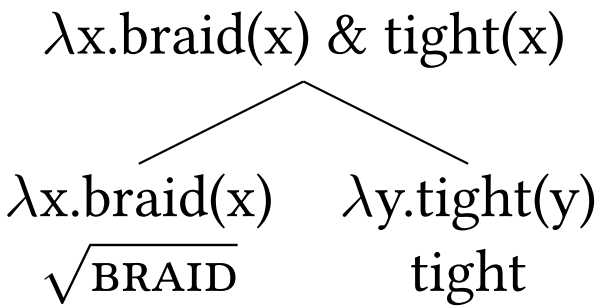


So the braid (or whatever is denoted by the root) is tight.

Analysis: Explicit creation, pseudo-resultatives

Now back to explicit creation (*bake*).

(46)

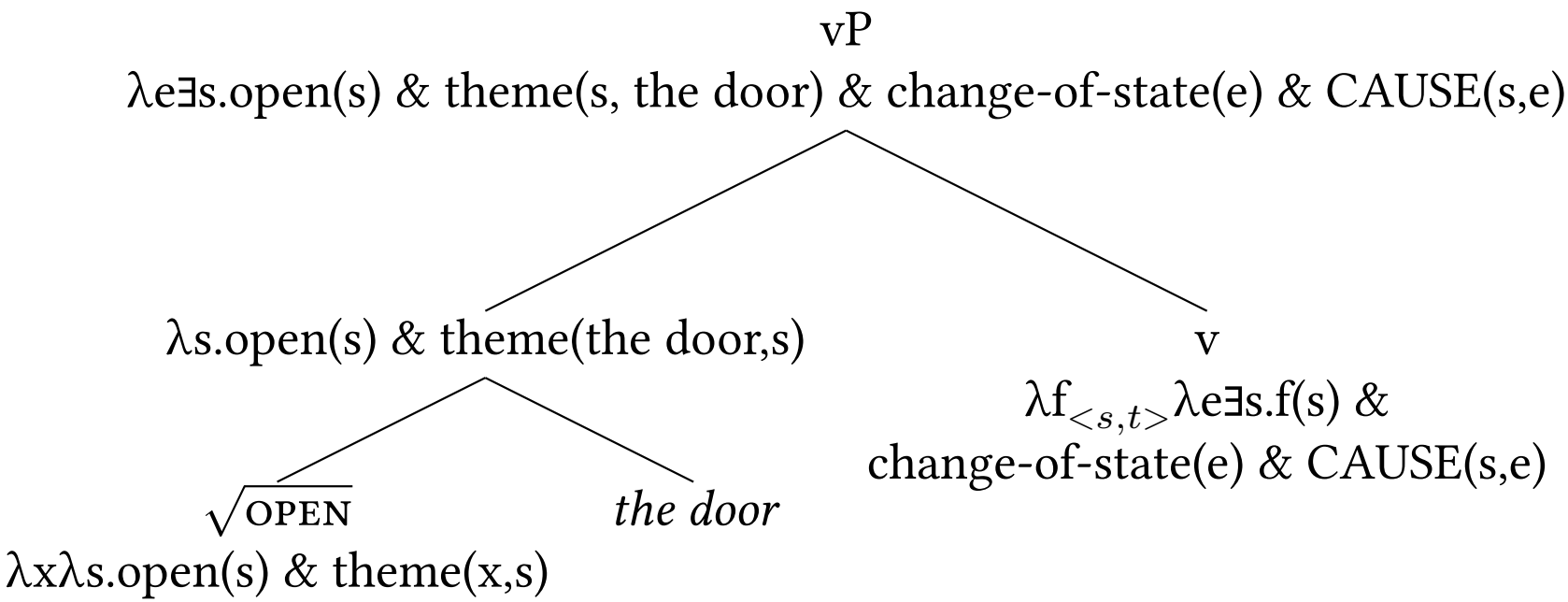


- An explicit root is not of type $< e, t >$.
- So you can't get a pseudo-resultative composition.
- Resultative composition arises another way. The literature is vast - see Williams (2015).

Analysis: COS, obligatory theme

(47) $[\![\sqrt{\text{OPEN}}]\!]$ = λxλs.open(s) & theme(x,s)

(48)



Analysis: COS, double objects

(49) $[\![\text{ApplP}]\!] = \lambda f_{<e,<s,t>>} \lambda e.f(e, \text{a beer}) \,\&\, \text{theme}(e, \text{a beer}) \,\&\, \text{to-the-possession}(\text{a beer}, \text{her mom})$

(50) $[\![\text{open}]\!] = \lambda y \lambda s.\text{open}(s) \,\&\, \text{theme}(s,e)$

The two nodes are of the same type and can compose.

Analysis: COS, pseudo-resultatives

1. First step: check that the assumptions so far indeed ban pseudo-resultatives with COS roots.
2. Second step: check that you get regular resultatives.
3. Third step: does the account predict the following?

(51) a. Finn closed the door **partway**.

b. Tyler **half** filled the glass.

See Levinson (2010) to check your answers!

Summary

Root types and some architectural assumptions:

	Explicit Creation $< s, t >$	Root Creation $< e, t >$	Change of State $< e, < s, t >>$
modifier	*build* root is modifier of v		
argument		*pile* root is arg of head IN	
function			*break* root takes DP arg

Section 5

Evaluating the proposal

Critique

- Levinson's work is still the state of the art on these root/verb classes.
  - We tried to streamline it in Irwin and Kastner (2020) and failed.
- There are a bunch of assumptions that one needs to put in place.
  - All of which can be critiqued, as always.
  - Though they're admirably explicit, so that's important.
- A crucial part of Levinson's analysis is the novel proposal for root creation verbs.
- But is the verb *braid* really underlyingly *MAKE TO IN braid*?
- Two ways of evaluating this:
  - Thinking of the verbs in terms of entailments.
  - Revisiting Fodor (1970).

Entailments

- Remember some of our tests for Manner/Result.
- They give different entailments for *pile* and *make in-to a pile*.

(52) Mary lost her Tetris game on purpose.

a. She made the Tetris pieces into a pile/stack by not pushing the arrow buttons at all.

b. ??She piled/stacked the Tetris pieces by not pushing the arrow buttons at all.

(53) The hairdresser was too lazy to do Mary's hair properly, so he just sat there and hoped the strong wind would form her hair. Amazingly, that's exactly what happened.

a. He made her hair into a braid by not touching it at all.

b. ?He braided her hair by not touching it at all.

Three reasons

Fodor (1970) argues against deriving *kill* from *cause to die* (or [CAUSE *die*]).

Fodor, reason 1

Direct causation:

(54) a. Mary caused John to die and it surprised me that he did so.

b. *Mary killed John and it surprised me that he did so.

Inapplicable to ours:

(55) a. *Mary made the cushions into a pile/stack (neatly) and it surprised me that they did so.

b. *Mary piled/stacked the cushions (neatly) and it surprised me that they did so.

Three reasons

Fodor, reason 2

Conflicting temporal adverbs:

(56) a. Mary caused the glass to melt on Sunday by heating it on Saturday.

b. *Mary melted the glass on Sunday by heating it on Saturday.

This test can be applied to our verbs if some context is added:

(57) Mary wanted to see how long a game of Tetris lasts if she doesn't touch any of the keys. She started a new game just before midnight and found out that the game takes about two minutes.

a. She made the pieces into a pile/stack at 00:01 by launching {them / the game} at 23:59.

b. *She piled/stacked the pieces at 00:01 by launching {them / the game} at 23:59.

Three reasons

Fodor, reason 2

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Three reasons

Fodor, reason 3

Agent-oriented adverbials such as instrumentals:

(58) a. John caused Bill to die by swallowing his tongue.

b. *John killed Bill by swallowing his tongue.

Here neither use sounds particularly natural but we do find a contrast:

(59) Mary now wanted to test how quickly a game of Tetris can end, so she kept hitting the space bar in order to get the pieces to drop.

a. ?Mary made the pieces into a pile/stack by falling down {quickly / faster than usual}.

b. *Mary piled/stacked the pieces by falling down {quickly / faster than usual}.

Three reasons

Fodor, reason 3

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Discussion

Summary

- For root creation verbs, a lot of work is spent trying to get things which aren't identical to be derived identically.
- If this motivation is removed, what motivation remains for silent structure like TO-IN and a different v head?
  - Levinson (2010): overt cross-linguistic patterns of pseudo-resultatives.
- Root creation verbs (*braid, pile*) in Chuj are not "transitive roots" but derived transitives from NOM and POS.

Discussion

Coercion

- The clash between root type and structure is analyzed as a **type mismatch**.
- Possibility that **type-shifting (coercion)** could apply.
- Would perhaps need sufficient contextual support:
  1. *The ropes braided in the wind.*
  2. *John stacked me the wood so I wouldn't have to.*
- Like other types of coercion, it is predicted to have processing costs. (Pylkkänen and McElree 2006, 2007)
- Prediction: inverse correlation between amount of shifting (operationalized in types) and acceptability.
- Formal way of thinking about argument structure constraints in terms of coercion.

Discussion

Polysemy

- Levinson posits root polysemy between types:
  - $\sqrt{\text{SLICE}}$
  - $\sqrt{\text{GRIND}}$
  - $\sqrt{\text{CHOP}}$
  - $\sqrt{\text{BRAID}}$
- All polysemous between explicit creation and root creation.
- So should pass the diagnostics for both.
- Better than the other root creation verbs but still not as good as the explicit creation ones?

Can talk about polysemy in more explicit terms (Levinson 2014, 229):

1. Conceptual polysemy (*book*∼*book*, perhaps the domain of the Encyclopedia).
2. Type coercion, of the *John stacked me the wood* sort.
3. The formal type polysemy of roots.

Section 6

Summary

Summary

- Empirical summary
- Syntactic or semantics effects?
- Formal tools:
  - Lambdas (and semantic primitives)
  - Root types

Section 7

Further reading

Further reading

- The collection in Alexiadou, Borer, and Schäfer (2014) has lots of interesting work on the root-syntax interface, though not every chapter is as explicit as Levinson's.
- If you don't want to read the whole book just yet, see the review in Kastner (2016).

Section 8

References

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