

Roots don't select, categorial heads do: lexical-selection of PPs may vary by category

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Abstract

The vast majority of roots in English show uniform selectional properties across their various instantiations in verbs, nouns, or adjectives: *rely*_V *on*, *reliance*_N *on*, *reliant*_A *on*. This paper reports a new discovery: there are hundreds of roots that display nonuniform selectional behavior. Their selectional class depends on whether the root is realized as a verb, a noun, or an adjective: *pride*_V *oneself on*, *pride*_N *in*, *proud*_A *of*. I argue that this is best modeled if the categorizing node itself determines selection.

Keywords: selection, lexical selection, roots, categorization¹

1 How selection works

Linguistics is an empirical science, and therefore descriptive adequacy is its bedrock, as it is of any empirical science. The moment we abandon it, or suggest that we can move beyond it and no longer concern ourselves with it, we are engaged in a different project: we are no longer doing linguistics, though we may be doing some kind philosophy, or even theology, fields whose methods, aims, and tools are quite distinct from those of an empirical science such as linguistics. This much is uncontroversial, or should be, among serious students of the topic.

Selection is the most basic syntactic relation. Capturing the dependencies between morphemes, words, and phrases is the basic task of any syntactic theory, and the ones that go under the rubric of selection are the most basic of these. Differences among these units are the basis for learners (and linguists) to posit features, in particular selectional features, such as those in (1). This list may contain categorial features like *C*, and subcategorial features like [+wh], as well as

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roots like $\sqrt{\text{RELI}}$ and words like *on*. There is no reason to assume that the features, any more than the roots themselves, are universal; they can be induced by the differing behavior of the elements that they combine with. A system containing such features permits both c(ategory)- and l(exical)-selection (the former controversially—see Pesetsky 1991; see also Adger 2003, Collins and Stabler 2016 for related definitions, and Merchant 2014 for the full system).

- (1) The set F of selectional features = $\{ N, V, P, A, C, \textit{on}, \textit{in}, +\textit{wh}, -Q, +\textit{pl}, \sqrt{\text{RELI}}, \dots \}$

The most basic operation in a grammar, therefore, is the mechanism that regulates selection. In a Minimalist grammar, this mechanism is the operation Merge, defined in (2). Merge must do several things. It must be sensitive to (even driven by) selectional features, which themselves are a list (not an unordered set); these selectional features must match the categorial (sub)features of an object that is being Merged with. The object with the selectional features is called the ‘head’.² Second, Merge must produce a complex syntactic object consisting of three things: the original object α minus its selectional list (that is, the selectional feature has been eliminated on the head, sometimes called ‘checked’); the Merged second object β ; and feature structure consisting of the subset of the features of α that are relevant to further syntactic computations, namely α ’s categorial features (that is, the category of the projection is the same as the category of the head, returned by the function $\textit{cat}(x)$), and whatever selectional features remain on α ’s list after β has been Merged (which may participate in further selection).³

- (2) Merge(α, β)

For any syntactic objects α, β , where α bears a nonempty selectional list $\ell = \langle \bullet F_1, \dots, \bullet F_n \rangle$ of selectional features⁴, and β bears a categorial feature F' that matches $\bullet F_1$, call α the head and

- a. let $\alpha = \{ \gamma, \{ \alpha - \ell, \beta \} \}$ call γ the projection of α , and

²This use of ‘head’ should not be confused with the phrase-geometric use of ‘head’: non-minimal, branching projections with selectional features can still be ‘heads’ for the purposes of Merge.

³For present purposes, I have suppressed any features that drive movement or agreement; see Müller 2011 and Georgi 2017 for discussion of these, and Merchant 2014 for a précis of a more complete system.

⁴For marking selectional features, I use the \bullet from Müller 2011, though I use the convention of Stabler 2014 in making this only a prefix.

- b. if $n > 1$, let $\ell = \langle \bullet F_2, \dots, \bullet F_n \rangle$, else let $\ell = \emptyset$, and
- c. let $\gamma = \begin{bmatrix} \text{CAT} & [\text{cat}(\alpha)] \\ \text{SEL} & [\ell] \end{bmatrix}$

This definition may look baroque, but it is no more so than is necessary. It is worthwhile in this context to recall the words attributed to the Franciscan friar William of Ockham, that *entia non sunt multiplicanda praeter necessitatem*. It is the last two words of this phrase that give it meaning: *praeter necessitatem*, ‘beyond necessity’, where descriptive adequacy is the necessity. The definition of Merge in (2) is clearly superior to certain recent formulations which remain, even after years of discussion, still intolerably vague and unable to capture the simplest facts of selection. About these definitions, we can at best charitably say, echoing the Renaissance motto, *se non è vero, è ben trovato*.

A compelling argument that roots are acategorical comes from selection: idiosyncratic selectional properties (dubbed ‘l-selection’ for ‘lexical selection’ by Pesetsky, since the selected head is realized as a particular lexical item) are stable across different realizations of a root:

- (3) a. They rely on oil.
 b. Their reliance on oil is well-known.
 c. They are reliant on oil.
- (4) a. The compound reacted to light.
 b. The compound’s reaction to light was expected.
 c. The compound was reactive to light.

As Harley 2014:22–23 fn 22 puts it, “the fact that selectional restrictions remain in force across the nominal/verbal divide (*study chemistry/student of chemistry*) suggests that whatever low category is sister to the internal argument is not specific to the nominal extended projection. The acategorical root meets this description perfectly.”

These facts indeed receive a satisfying explanation on a theory like Harley’s and its forerunners (see also van Craenenbroeck 2014 for discussion and references): the root itself selects for its complement (a selectional feature σ , and the root variously surfaces as a noun, verb, or adjective depending on what additional structure is added to the root:

V	N	A	P
look, name			after
laugh	laughter		at
apologize	apology	apologetic	for
blame	blame		for
		game	for
hope	hope	hopeful	for
believe	belief	(cf. <i>credulous of</i>)	in
trust	trust	trusting	in
look	look		into
rely	reliance	reliant	on
object	objection		to
react	reaction	reactive	to
	right		to
	sensitivity	sensitive	to
		tantamount	to
	consciousness	conscious	of
dispose	disposal		of
tire		tired	of
comply	compliance	compliant	with

In the words of Pesetsky 1991:10: “These facts are arbitrary.” The preposition in question, unlike in particle-verb combinations, contributes little or even nothing to the meaning. Its absence in compounds is unremarkable, and we can safely assign these prepositions, in their l-selected uses, an identity function meaning.

- (9) a. a time-sensitive (*to) matter; the matter’s time-sensitivity (*to)
b. a drug-dependent (*on) recovery; his drug-dependence (*on)
- (10) $[[of/in/on/at/...]] = \lambda x_\tau[x_\tau]$, where τ is any type

An even larger class is represented by triples like *envy_V*, *envy_N*, *envious*; *appreciate*, *appreciation*, *appreciative*; and *fear_V*, *fear_N*, *fearful*, where the noun and adjective both take an *of*-PP. The analytical options for such a productive pattern are wider, and hence less interesting as a way of distinguishing among theories of selection.

- (11) a. Abby fears dark spaces.
b. Abby’s fear **of** dark spaces is well known.
c. Abby is fearful **of** dark spaces.

2 Category-dependent I(exical)-selection

The empirical contribution of the present paper is the discovery of a class of items that do not follow the regular pattern exemplified above. A search of dictionaries for words that take I-selected PPs, and an expansion of those words (typically verbs) to other, related words, checked by four native speakers of English, has produced a database of 134 roots whose selectional properties vary across their appearance in nouns, verbs, and adjectives.

Representative examples in sentences are given in (12)-(27), and a table listing additional tuples is in (28). For the most part, only the preposition given is possible in the complement of the word.

- (12) a. She prides herself **on/*in/*of** her thoroughness.
b. Her pride **in/*on/*of** her thoroughness is understandable.
c. She is proud **of/*on/*in** her thoroughness.
- (13) a. I oppose (***to**) lower capital gains taxes.
b. My opposition **to** lower capital gains taxes is well known.
c. I am very opposed **to** lower capital gains taxes.
- (14) a. I desire (***for**) chocolate.
b. My desire **for** chocolate knows no bounds.
c. I am desirous **of** chocolate.
- (15) a. Buckley attacked (***on**) liberalism.
b. Buckley's attack **on** liberalism was scathing.
- (16) a. Sam needs to account **for/*of/*()** his behavior.
b. Sam's account **of** his behavior was penitent.
- (17) a. Her country abounds **in/*of** mineral wealth.
b. Her country enjoys an abundance **of/*in** mineral wealth.
c. Her country is abundant **in/?with/*of** mineral wealth.
- (18) a. I rarely concern myself **about/*for/with** his progress.
b. My rare concern **about/for/with** his progress is understandable.
c. I am quite unconcerned **about/*for/?with** his progress.
- (19) a. i. She attempted the hardest problem.
ii. She attempted to climb the Sears Tower.
iii. She attempted taking seven courses in one quarter.

- (20) a. i. Her attempt **of** the hardest problem was inspiring.
 ii. Her attempt to climb the Sears Tower was illegal.
 iii. Her attempt ***(at)** taking seven courses was insane.
 iv. ***Her attempt of** taking seven courses was insane.
- (21) a. Ralph answered **(*to)** the question.
 b. Ralph's answer **to** the question was the best one.
- (22) a. The music disrupted her concentration.
 b. The music's disruption **of** her concentration was complete.
 c. The music is disruptive **to** her concentration.
- (23) a. Bernie supports **(*for)** tax increases on the wealthy.
 b. Bernie's support **of/for** tax increases on the wealthy is unwavering.
 c. Bernie is supportive **of/*for** tax increases on the wealthy.
- (24) a. Abby is the equivalent **of** three teachers.
 b. Abby is equivalent **to** three teachers.
- (25) a. Sara helped me.
 b. Sara's help **to** me was invaluable. Sara was a great help **to** me.
 c. Sara was very helpful **to** me.
- (26) a. The gang menaced the neighborhood.
 b. The gang's menace **to/*of** the neighborhood was clear.
 c. The gang was (very/un-) menacing **to/*of** the neighborhood.
- (27) a. She sympathizes **with** the refugees/your proposal.
 b. She has great sympathy **with/*to** the refugees/your proposal.
 c. She is very sympathetic **to/*with** the refugess/your proposal.
- (28) V-N-A tuples with differing selected Ps or direct objects

such as $\langle \{ D, P \} \rangle$ fails to account for the category-sensitivity, predicting optionality of either. The second problem is that allomorphic rules apply too late; these alternations feed wh-movement as in (31), and the P in the derived position cannot be inserted by the rule in (30) because the context required is no longer local.

(31) The legislature passed the proposal to which we were opposed.

2.1 Categorizing heads may have two selectional features

I will instead propose that categorizing heads select for some roots and not others: these idiosyncrasies are listed as the set of selectional features that a particular category head takes. It is necessary in any case to code (by index or other means) which nominalizers can occur with which roots (e.g., to distinguish *dependence*, *dependency* from *independence*, **independency* and many more); we therefore posit that the nominalizer N come in varieties that also encode two selectional facts: which roots it may appear with, and which PPs those roots can appear with. Examples are given in (32)-(34); the nominalizer N_{in} , for example, selects first for the roots it may combine with (including the root $\sqrt{\text{PRD}}$) and then a PP headed by *in*.

$$(32) \quad N_{in} \left[\begin{array}{l} \text{CAT} \quad [N] \\ \text{SEL} \quad [\langle \{ \bullet\sqrt{\text{PRD}}, \bullet\sqrt{\text{TRUST}}, \bullet\sqrt{\text{FAITH}}, \dots \}, \bullet\text{in} \rangle] \end{array} \right]$$

$$(33) \quad V_{on} \left[\begin{array}{l} \text{CAT} \quad [V] \\ \text{SEL} \quad [\langle \{ \bullet\sqrt{\text{PRD}}, \bullet\sqrt{\text{RELI}}, \dots \}, \bullet\text{on} \rangle] \end{array} \right]$$

$$(34) \quad A_{of} \left[\begin{array}{l} \text{CAT} \quad [A] \\ \text{SEL} \quad [\langle \{ \bullet\sqrt{\text{PRD}}, \bullet\sqrt{\text{DESIR}}, \dots \}, \bullet\text{of} \rangle] \end{array} \right]$$

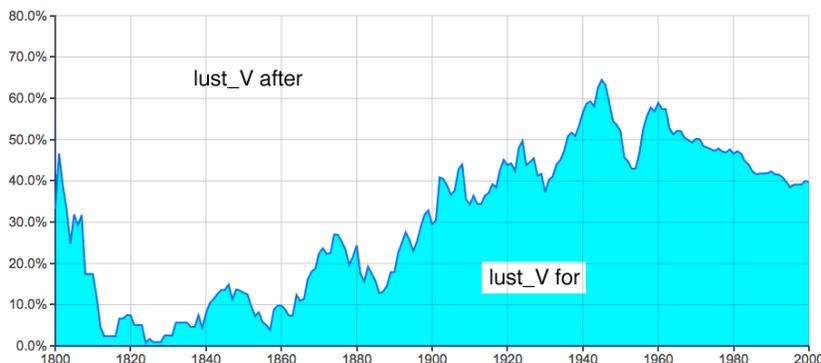
Merge in (2) applies iteratively: the first selectional feature on the list licenses the construction of the N/V/A + root:

$$(35) \quad \text{Merge} \left(\begin{array}{c} N_{in} \\ \langle \bullet\sqrt{\text{PRD}}, \bullet\text{in} \rangle \end{array}, \sqrt{\text{PRD}} \right) = \begin{array}{c} N_{in} \\ \langle \bullet\text{in} \rangle \\ \swarrow \quad \searrow \\ N_{in} \quad \sqrt{\text{PRD}} \end{array}$$

The second selectional feature on the list licenses the Merger of the PP:

$$(36) \quad \text{Merge} \left(\begin{array}{c} N_{in} \\ \langle \bullet\text{in} \rangle \\ \swarrow \quad \searrow \\ N_{in} \quad \sqrt{\text{PRD}} \end{array}, \begin{array}{c} \text{in} \\ \swarrow \quad \searrow \\ \text{in} \quad \text{Chicago} \end{array} \right) = \begin{array}{c} N_{in} \\ \swarrow \quad \searrow \\ N_{in} \quad \text{in} \\ \swarrow \quad \searrow \quad \swarrow \quad \searrow \\ N_{in} \quad \sqrt{\text{PRD}} \quad \text{in} \quad \text{Chicago} \end{array}$$

(42) Relative frequency of verbal *lust for* vs *lust after*:



One can conclude that selectional features are stochastic; adapting the rule parameter from probabilistic context-free grammars, we could posit parameters (the sum of which equals 1 over the entire vocabulary) on selectional features.

2.3 Inner vs. outer selection

On this approach, the categorizing head is the locus of communication between the root and the selected PP; only the first categorizing head can be sensitive to both the identity of the root and of the head of the PP. And additional categorizing heads beyond the first one, cannot see into the syntactic object constructed by Merge; that is, those higher heads' selectional features cannot select for the root. This makes the prediction that we should find idiosyncratically nonuniform l-selection only with inner categorizing heads (such as those in (43)), not with outer ones (such as those in (44)). Categorizing heads that take already categorized XPs cannot alter the selectional properties of those XPs.

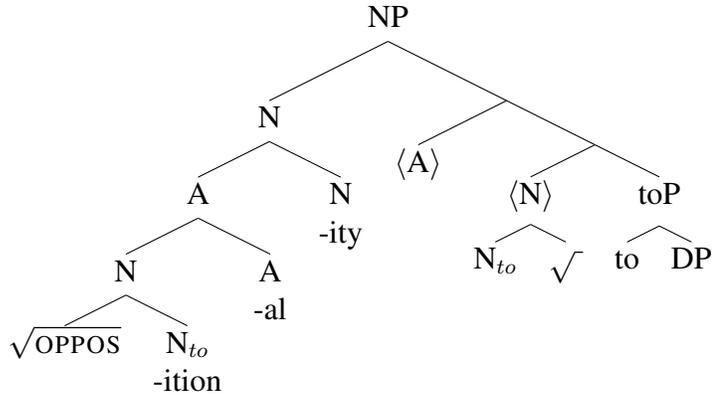
(43) Inner: \emptyset , -al, -ance, -ant/ent, -ed, -ful, -ible, -ive, -(t)ion, -(u)ous

(44) Outer: -ness, -hood, -ity, -ish, -al, (see Nevins 2015 on *-al* as a root)

This correctly predicts common patterns such as that in (45); because the noun *opposition* takes a *to*-PP, the adjective *oppositional*, which embeds the noun, will as well; likewise for the noun *oppositionality*, whose structure (after head movement to the N realized as *-ity*) is given in (46).

(45) oppose (*to), opposition to, oppositional to, oppositionality to

(46)

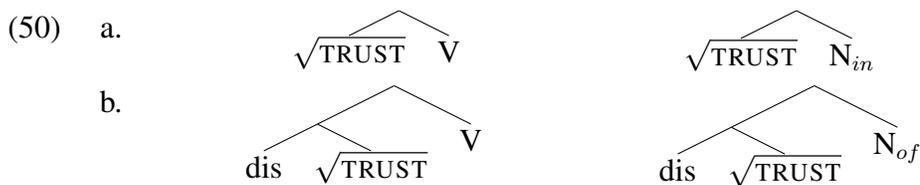


A suffix such as *-er* attaches to V; therefore, the verbal selectional feature persists:

- (47) a. Sam was the first responder to/*of the accident.
 b. Abigail is a firm believer in/*of the power of yoga to improve one's life.
 c. Conscientious objectors to/*of the war were put in prison.
- (48) a. Buckley was the attacker of/*on more than a dozen of the victims.
 b. Abby is a supporter of/*for equal rights.

If this generalization is correct, it leads to some unusual conclusions about morphosyntactic structure in some cases. For example, given the nonuniform selectional behavior illustrated in (49) we must conclude that *dis-* in *distrust* is root-attaching (a conclusion that seems secure for some instances of *dis-* at least, such as in *disgust*). The final structures are given in (50).

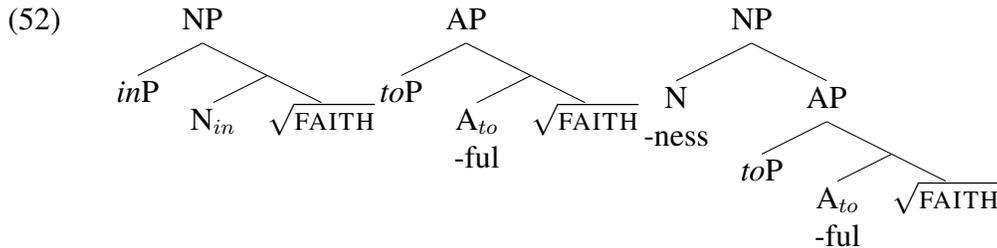
- (49) a. They trust me. Their trust *of/in me is not misplaced.
 b. They distrust me. Their distrust of/*in me is utterly unfounded.



A similar conclusion must hold of *-ful*: it must in some cases at least be root-attaching, in order to select for an *in*-PP; the resulting structures are given in (52).

- (51) a. She exhibits great faith **in** God.

- b. She is very faithful **to** God.
 c. She exhibits great faithfulness {**to**/***in**} God.



2.4 Neeleman's Generalizations

Neeleman 1997 discovers two important generalizations in this domain, both of which he derives from the putative requirement that the P LF-incorporate into the verb in order to facilitate θ -marking, an explanation unavailable to us. First, there can be at most one idiosyncratic PP per root. Neeleman argues convincingly that apparent counterexamples such as the *about*-PP and *on*-PP in (53) involve adjunct, not complement, PPs. He points out that these PPs can occur with idioms (in (53c)) and as predicates (as in (53d,e)).⁶

- (53) a. Abby talked to Ben about the weather.
 b. Abby reported to Ben on the the weather.
 c. Abby spilled the beans to Ben about the weather.
 d. The story/book/article/talk/speech/report was about/on the weather.
 (Adger 2013:82)
 e. The report was to Ben, not to you.

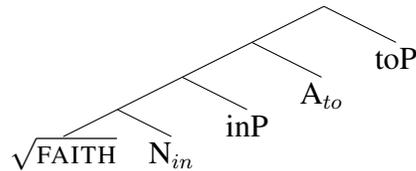
This follows from the present system if such PPs can only be selected by the categorizing head; additional PPs (e.g., *about*P) and DP arguments are introduced by *v* (or *Appl*, or *v_{Appl}*) heads.

This explanation leaves the case where more than one categorizing head is plausible; even in such cases, however, we don't find multiple *l*-selected PP arguments. In other words, outer categorizers simply lack *l*-selectional features. This is not an accident that must be stipulated, however: it follows from the semantics

⁶The latter test is of possibly questionable value, as some *l*-selected PPs can occur as predicates as well (*Their sensitivity was to light*). Distinguishing between these and those that can't (**Their audibility was to the people on the street*) is an urgent task.

of the roots and the heads. Consider the putative double argument PPs in (54a), with a structure as in (54b).

- (54) a. *faithful in God to his commands
 b.



While the syntax might be well-formed, the semantic computation fails. The root $\sqrt{\text{FAITH}}$ is a predicate with one internal argument, which returns a state of faith. It can compose with one l-selected PP (*in God*), which supplies its sole semantic argument. Any additional PP like *to his commands* simply has no way to compose with the result.

- (55) a. $\llbracket \sqrt{\text{FAITH}} \rrbracket = \lambda x \lambda s [faith(s)(x)] : \langle e, vt \rangle$
 b. $\lambda x \lambda s [faith(s)(x)] (\llbracket in\ God \rrbracket) \rightsquigarrow \lambda s [faith(s)(god)] : \langle vt \rangle$
 c. $\llbracket to\ his\ commands \rrbracket = his.commands : \langle e \rangle$
 d. $\lambda s [faith(s)(god)] \circ his.commands \not\rightarrow$

Second, Neeleman points out that there are no idiosyncratic PP subjects:

- (56) a. *In jazz will interest everyone here.
 b. *It would be surprising if on this land abounded (with) high-quality grains.
 c. *It would be surprising for on this land to abound (with) high-quality grains.

There are many possible reasons for this state of affairs. First, this could be a subcase of Ramchand's Generalization (Ramchand 2008). Second, we could imagine that Agree is blocked by PP (though both **It was worked on many alternatives* and **There were worked on many alternatives* are unacceptable; see Preminger 2014). Third, perhaps only category heads, lacking any semantic contribution, can truly l-select: *v*, etc. (the neo-Davidsonian menagerie of argument-introducing heads) cannot select PP without imposing a θ -requirement on them (e.g., v_{on} in *They embroidered stars on the jacket* is $\llbracket v_{on} \rrbracket = \lambda r : r \in LocativeRelations \in \llbracket on \rrbracket [r]$).

2.5 Psych predicates

There are thirty-two object experiencer psychological verbal predicates (see Landau 2010) in our database. These correspond to nouns and adjectives which do not share the unusual alignment found in the verb: with nouns and adjectives, the experience is the subject, and the cause or theme of the psychological state is marked by an idiosyncratic PP. A sample of these cases is given in (57)-(61).

- (57) a. I anger him. (*He angers at me.)
b. His anger at me is baffling.
c. He is angry at me.
- (58) a. Jazz interests me. (*I interest in jazz.) (They interested me in jazz.)
b. My interest in jazz has never flagged.
c. I am interested in jazz. (?I interested myself in jazz.)
- (59) a. That frightens me.
b. My fright at/?over/*in/about his absence was real.
c. I am (very/un-) frightened at/?over/*in/about/by his absence.
- (60) a. (*His absence remorsees me.) (*I remorse (myself) at his absence.)
b. My remorse at/?over/*in/about his absence was real.
c. I am quite remorseful at/?over/*in/about his absence.
- (61) a. The movie upset me.
b. (*My upset at the movie was fleeting.) (Cf. The team's upset of/*at their opponents was amazing.)
c. I am very upset at the movie.

There is little that can be securely deduced about the correct analysis of this unusual pattern at this juncture.

2.6 Uniform (category-insensitive) selection

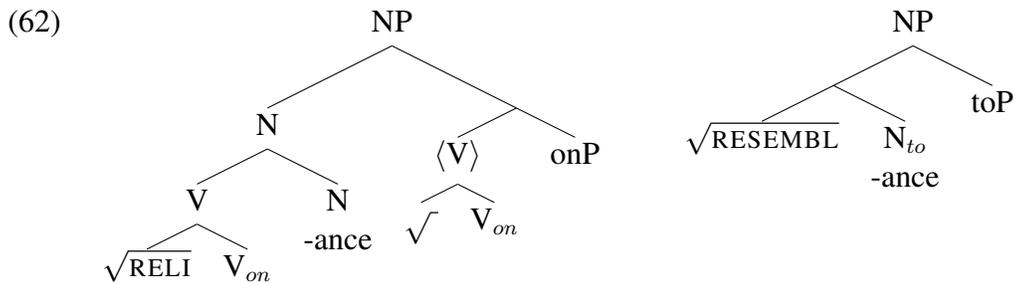
Finally, how does this analysis fare on the cases we began with, which showed uniform, category-independent, lexical selection, such as *rely on*, *reliance on*, *reliant on*, from (3) above? There are at least five logical possibilities.

First, we may live in the worst of all possible worlds, where some selectional features go on the 'root' after all. That is, some but not all nouns (etc.) come

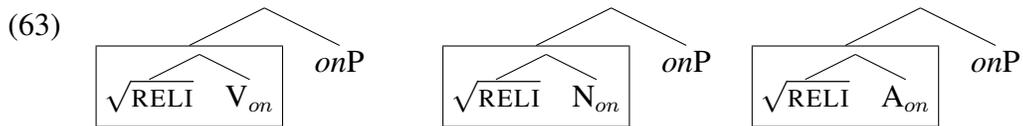
categorized; so for example *objection to* would be due to a *to*-selectional feature on the unanalyzed root *objection*. This approach abandons the parallel of *object:ion::opposition*.

Second, perhaps we have discovered ‘joint selection’, with selectional features activated on roots by higher category nodes (perhaps parallel to a V-movement feature on T activated by matrix C in Scandinavian).

Third, these cases may all involve layered categorizers: additional affixes on low (presumably verbal) categorized stems (so *reliance* and *resemblance* have differing amounts of structure; cf. Bruening 2014, Alexiadou et al. 2015 on adjectival passives):



Fourth, the generalizations (and predictive power) may be over larger chunks of structure, as in theories that use spanning (Merchant 2015), or fragment grammars (O’Donnell 2015).



And fifth, in a traditional lexicalist theory, “Regularities involving only selectional features might in principle be stated as redundancy rules of the lexicon” (Chomsky 1970:213). We might imagine that there are default rules extracted from the regular patterns as in (64), which instantiate a more general rule in (65).

(64) [...X...]_V ↔ [...X...]_A, [...X...]_V ↔ [...X...]_N, [...X...]_N ↔ [...X...]_A

(65) [...X...]_α ↔ [...X...]_β

But there is no logical reason why such redundancy rules should apply only to word-level lexical entries and their subcategorization frames, as Chomsky proposed. Instead, such patterns can be applied directly to the pieces of the syntactic computation—in this case, to the categorial heads themselves. When the learner

encounters an adjective like *reliant* built from a stem $\sqrt{\text{RELI}}$ and the A head A_{on} , the learner posits, in the absence of conflicting, more specific evidence, a corresponding verbal categorizing head with the same selectional list.

$$(66) \quad V_{on} \left[\begin{array}{l} \text{CAT} \quad [V] \\ \text{SEL} \quad [\langle \bullet \sqrt{\text{RELI}}, \bullet \text{on} \rangle] \end{array} \right] \leftrightarrow A_{on} \left[\begin{array}{l} \text{CAT} \quad [A] \\ \text{SEL} \quad [\langle \bullet \sqrt{\text{RELI}}, \bullet \text{on} \rangle] \end{array} \right]$$

Adjudicating between these options will be task made easier once we understand better the nature of lexical selection and the structure of selective heads.⁷

3 Conclusions

There is *category-sensitive selection*: the lexical category can determine the idiosyncratic, non-semantically predicable preposition that a complement PP is headed by. This can be modeled if categorizing heads have selectional features.

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⁷Based on examples like (i), we can securely conclude at least that the resolution/inheritance mechanism for *one*-anaphora must have access to the selectional features of its (potentially complex) N antecedent, *pace* Payne et al. 2013

- (i) a. Vicious attacks on Bernie were more frequent than tongue-in-cheek ones on Trump.
 b. Her first objection to the bill was more effective than her second one to the law itself.
 c. Reliable chemical reactions to salt are easier for the students to observe than the unreliable ones to tungsten.
 d. Volatile investments in stocks pay more than stable ones in bonds.

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