Constructions:

Domain of locality and (un)boundedness
The Principle of Lexical Head Government (PLHG):
Both bounded and unbounded syntactic dependencies are specified by the lexical syntactic type of their head.

Syntactic derivation is purely syntactic type driven; LF cannot undo a derivation (like GB/MP, and unlike HPSG and LFG).
In a strictly lexicalised grammar, the domain of locality can only be defined by the lexical type of the head (there is no other locus to define it).

Domain of locality of pronouns is another point of departure for CCG.

CCG without GZ combinators leaves condition B (binding of pronouns) to discourse (i.e. pronouns are not pro-terms in LF).

Something like Centering Theory (Grosz et al., 1995) or a discourse grammar (Webber, 2004) is needed for its capture. See e.g. Yüksel and Bozsahin (2002) for the use of centering theory for coreference possibilities that are left open by condition B of the binding theory.
Pronominal reference possibilities are well-known to nest or intercalate (Jacobson, 1999), unlike syntactic dependencies, which either nest or cross (but not do both):

\[
\text{Every man}_i \text{ thinks that every boy}_j \text{ said that his}_j \text{ mother loves his}_i \text{ dog.}
\]

\[
\text{Every man}_i \text{ thinks that every boy}_j \text{ said that his}_i \text{ mother loves his}_j \text{ dog.}
\]

It is debatable whether binding restrictions on pronouns are combinatorial in nature.

But the issue is deeper, involving interaction of binding and extraction, leading ultimately to having a linguistic LF or model-theoretic syntax, although both approaches are type-driven; cf. (Jacobson, 1999; Szabolcsi, 1992; Steedman, 2005b) for further discussion.
Since a lexical item is only represented by an LF and a syntactic type, and its syntactic behaviour is regulated only by its syntactic type, the (un)boundedness of a construction must be a conspiracy of its syntactic type and LF.

\[
\text{that} := (\mathbf{N} \setminus \mathbf{N})/(\mathbf{S} \setminus \mathbf{NP}) : \underbrace{\lambda P \lambda Q \cdot \text{and}'}_{e \mapsto t}(P x)(Q x)
\]

\[
\text{want} := (\mathbf{S} \setminus \mathbf{NP})/(\mathbf{S}_{\text{inf}} \setminus \mathbf{NP}) : \underbrace{\lambda P \lambda x \cdot \text{want}'}_{e \mapsto t}(P(\text{and}' x))x
\]

Although the syntactic type of their arguments is susceptible to long-distance composition, we know that relativisation is unbounded and control is not:
Çocuk$_i$ [[-i/*j adam-a$_k$ [-k/*i/*j kitab-i oku]]-t-mak] ist-iyor

child man-DAT book-ACC read-CAUS-INF want-PROG

‘The child wants to have the man read the book.’ Bozsahin 2004

* for ‘The child$_i$ wants the man (or someone) to have him$_i$/her$_i$ read the book.’

Although subjects can be controlled in Turkish, the subject of read is far too embedded for the control verb to ‘see’ it.
Unboundedness of relativisation and boundedness of control follow from different syntactic manifestation of the $e \mapsto t$ type of $P$ in their LF:

$$that := (N \setminus N) / (S \setminus NP) : \lambda P \lambda Q.\text{and}^{\prime} (Px)(Qx)_{e \mapsto t}$$

$$want := (S \setminus NP) / (S_{\text{inf}} \setminus NP) : \lambda P \lambda x.\text{want}^{\prime} (P(\text{ana}^{\prime} x))x_{e \mapsto t}$$

$P$ is of the form $\lambda z.\text{pred}^{\prime} \cdots z \cdots$ for the relative pronoun:

a. The man$_x$ that Anna gave the book \hspace{1cm} $P = \text{give}^{\prime} x \text{book}^{\prime} \text{anna}^{\prime}$

b. The man$_x$ that Anna saw \hspace{1cm} $P = \text{see}^{\prime} x \text{anna}^{\prime}$

c. The book$_x$ that Anna showed the man \hspace{1cm} $P = \text{show}^{\prime} \text{man}^{\prime} x \text{anna}^{\prime}$
If $P$ in turn takes a sentential or a VP complement for $z$, the $x$ argument can be passed down indefinitely (argument category $S/NP$ can be obtained by repeated composition):

$$\text{The man}_x \text{ that Manny says } [\text{you claim that}]_{S/S} [\text{Anna gave the book}]_{S\backslash NP}$$

$$P = \lambda x. \text{say}'(\text{claim}'(\text{give}'x \text{ book}' \text{ anna}') \text{ you}') \text{ manny}'$$

$P$ is of the form $\lambda z. \text{pred}' \cdots z$ for the controlled complement of $\text{want}$; only the subject can be missing, not a complement (hence no possibility of passing down $x$ indefinitely).

This is determined by the PCTT: infinitival VPs have all their complements (non-1s); a type such as $\lambda z. \text{pred}' \cdots z \cdots$ for English violates PCTT (not for Dyirbal, more on this later).
Domains of locality for relativisation and control are embodied in their lexical syntactic category:

The relative pronoun (as head) can only take non-subject residues ($S_{\Diamond}NP$ type).

The controller-controllee relation can only be between the controlling argument ($NP$) and the subject of the controlled clause (because $P$ below is of the form $\lambda z.\text{pred}' \cdots z$).

\begin{align*}
\text{that} & := (N \setminus N) / (S_{\Diamond}NP) : \lambda P \lambda Q. \text{and}'(Px)(Qx) \\
\text{want} & := (S \setminus NP) / (S_{\text{inf}} \setminus NP) : \lambda P \lambda x. \text{want}'(P(\text{and}'x))x
\end{align*}
Subject and Object Control

Control is a lexical property. Control verb’s syntactic type and LF must encode domain of locality and the controller-controllee relation.

If $x_i$ is the term for the controller, then $(ana' x_i)$ is the term for the controllee, with $ana'$ providing the bound argument interpretation for $ana' x$. The controller LF-commands the controllee.

Since control is a lexical property, it is conceivable that what is controlled can be syntactically or semantically restricted (because, apart from a phonological form, that’s all we have in the category of a lexical item).

Bozsahin and Steedman (2005) claim that a fundamental asymmetry determines the categories of heads of constructions if they single out one argument against all others (more on that later):
(1) *The Principle of Lexicalised Asymmetry*:

Syntactic asymmetries are mediated by $s$, and semantic asymmetries are mediated by 1, as determined by the syntactic or semantic type of the lexical category of the head of the construction.

PLA requires that the syntactic type of $s$ and the semantic type of 1 be discernible in the category of the lexical item.*

This is possible in a purely lexicalised grammar, and it significantly constrains the notion of “possible categories” in the lexicon.

*PLA might be derivable from simpler considerations—as one reviewer noted, such as ineffability; all verbs have an $s$, no matter what their LF is, and all verbs have a 1, no matter what their syntactic type is. Other restrictions would exclude a certain lexical sub-class of verbs. Eg. for intransitive subjects, control might be imaginable but syntactically impossible if eg. 2-argument can regulate control.*
(2)a. promise := (S\NP)/(S_{inf}\NP)/NP : \lambda x_2 \lambda P \lambda x_1 . promise' (P(ana' x_1)) x_2 x_1

b. persuade := (S\NP)/(S_{inf}\NP)/NP : \lambda x_2 \lambda P \lambda x_1 . persuade' (P(ana' x_2)) x_2 x_1

The categories above capture the fact that syntactic subjects are the only controllees in English.

(3)a. John wants to clean the window.

b. The dog wants to be petted.

c. Susie wants to grow up.

The controller is either the subject or the object.
Example (4) shows control of the unaccusative subject. NB. LF of *grow up*.

\[
\text{NP} \quad (S\backslash NP)/(S_{\text{inf}}\backslash NP) \quad (S_{\text{inf}}\backslash NP)/(S\backslash NP) \quad S\backslash NP
\]

\[
: \quad \text{susie'} : \lambda P \lambda x.\text{want'}(P(\text{and'} x))x
\]

\[
: \quad \lambda Q.Q
\]

\[
: \quad \lambda x.\text{growup'}x\text{one'}
\]

\[
\text{S}_{\text{inf}}\backslash NP \quad \rightarrow
\]

\[
S\backslash NP \quad \rightarrow
\]

\[
S \quad:\quad \text{want'}(\text{growup'}(\text{and'} \text{susie'})\text{one'})\text{susie'}
\]
Agents of unergatives and transitives can be controlled, because they are also syntactic subjects (in accusative languages):

(5)a. John promised him [to exercise]
“Exceptional” case marking is not exceptional at all; *him* is an argument of *persuade*, and there is no “surface linking” of it to the controlled clause:

(6)a. John persuaded him [to read the novel]

\[
\text{NP} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}}
\]

\[
\cdots \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}} \quad \frac{\text{NP}}{\text{NP}}
\]

\[
\text{S}: \text{persuade'(read'novel'(ana'him'))him'john'}
\]
Given the category of the infinitival VP for English, there can be no control of the complements or adjuncts of the controlled clause:

(7) *John persuaded him [Sue see]

\[
\begin{align*}
np & \rightarrow (S\backslash NP)/(\text{S}_{\text{inf}}\backslash NP)/\text{NP} \\
(S\backslash NP)/(\text{S}_{\text{inf}}\backslash NP) & \rightarrow T \\
S/(S\backslash NP) & \rightarrow B \\
S/\text{NP} & \rightarrow B
\end{align*}
\]

This example works well in Dyirbal, and this is predicted by CCG because the category $\text{VP}_{\text{inf}} = (\text{S}_{\text{inf}}\backslash \text{NP})$ is lexicalised.
In summary, control’s domain of locality encompasses a controller (NP), and a controlled clause (VP$_{\text{inf}}$), both of which are lexically specified. There is no other domain that the control verb can control.

It is bounded, because the syntactic type of the controlled clause, VP$_{\text{inf}}$, cannot pass the controller information down to its complements; only the non-subcategorised argument can be missing.

This argument coincides with the maximally LF-commanding argument in transitives of accusative languages (i.e. 1). It is not necessarily so in ergative languages (e.g. Tagalog and Dyirbal).
Coordination: Ross’s (1967) Coordinate Structure Constraint (coord. structure is an island)

This man loves animals and he dislikes children.

Animals this man loves and children dislike him.

Animals love this man and he dislikes children.

*a man who(m) loves animals and he dislikes children.

*a man who(m) animals love and children dislike him.
Across-the-board exception (ATB) to CSC: extraction is ok if the NP is missing from *all* conjuncts:

A man who(m) animals love and children dislike.

A man who loves animals and dislikes children.

Exceptions to ATB exception: the extracted argument must bear the same grammatical relation in all conjuncts:

*a man who dislikes children and animals love.*

*a man who(m) animals love and dislikes children.*
CCG’s account of coordination moved from syncategorematic rules to lexicalisation.

\[ \text{and} := (X \star X)/(X) : \lambda p \lambda q. p \land q \]

Lexical control of conjuncts assure like-category coordination (Baldridge, 2002, p.97–99), without syncategorematic rules (e.g. \( X \text{ conj } X \rightarrow X \))
In OpenCCG:

cem-english> tccg
Loading grammar from URL: file:/home/bozsahin/openccg/grammars/cem-english/grammar.xml

Enter strings to parse.
Type ':r' to realize selected reading of previous parse.
Type ':h' for help on display options and ':q' to quit.

tccg> shoots and he misses
Unable to parse

tccg> and he misses
1 parse found.

Parse: s/*s
____________________
(lex)  and :- s\1\/*(s\1)/*(s\1)
(lex)  he :- np
(lex)  misses :- s\.np
(<)    he misses :- s
(>)    and he misses :- s\*/s
Lexicalisation implies that languages might have different kinds of coordination. Malagasy uses *ary* for sentential coordination, and *sy* for phrasal coordination:

(8)a. *Misotro taoka  Rabe ary mihinam bary Rabe*
    
    drink   alcohol R   and eat   rice R
    
    ‘Rabe is drinking alcohol and Rabe is eating rice.’

b. *Misotro taoka  sy  mihinam bary Rabe*
    
    drink   alcohol and eat   rice R
    
    ‘Rabe is drinking alcohol and eating rice.’
As in GPSG (Gazdar, 1981), coordination is type-dependent, rather than structure-dependent (Steedman, 2000):

\[ *\text{Anna} [\text{met Manny}]_{S/NP} \text{ and } [\text{married}]_{(S/\NP)/NP} \]

Across-the-board rule application (Williams, 1978) and other structure-dependent accounts need extra conditions on surface forms.

LFs of conjuncts get their copy of the variable, but there is no syntactic operation for that; the lexically-specified LF ‘copies’ them.

This is possible because \( X \)’s in syntactic types and \( \land \) in semantic type are schematisations over valencies (Partee and Rooth, 1983):

\[ \text{and} := (S\backslash S)_{\ast S}: \lambda p \lambda q. p \land q \]
Anna met and married Manny

NP : $d'$ : $\lambda x_1 \lambda x_2 . \text{meet}' x_1 x_2$

$(S \backslash NP)/NP$ : $(S \backslash S$)$/S$

$(S \backslash NP)/NP$ : $\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2$

$(S \backslash NP)/NP$ : $\lambda q \lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land q [y] [x])$

$((S \backslash NP)/NP) \backslash ((S \backslash NP)/NP)$ : $\lambda q \lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land q [y] [x])$

$((S \backslash NP)/NP) \backslash ((S \backslash NP)/NP)$ : $\lambda q \lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x] \land q [y] [x])$

$S \backslash NP$ : $\lambda y . \text{marry}' \text{manny}' y \land \text{meet}' \text{manny}' y$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$

$\lambda x \lambda y . (\lambda y_1 \lambda y_2 . \text{marry}' y_1 y_2 [y] [x]) \land \lambda x_1 \lambda x_2 . \text{meet}' [y] [x])$
We can expect the schematised syntactic types (Xs) to eliminate otherwise legitimate LFs (NB. syntactic derivation is blind to LF):

* the man who married Mary and John disliked

\[
\begin{align*}
\frac{(S\backslash NP)/NP \quad NP \quad (S\backslash S)/(S\backslash S) \quad S\backslash S}{S\backslash NP} \quad \frac{NP \quad (S\backslash NP)/NP}{S/(S\backslash NP)^T} \quad \frac{NP}{S/\backslash NP} \quad \frac{S/\backslash NP}{B}
\end{align*}
\]

\[\text{and'}(\text{marry' man'})(\text{dislike' man' john'})\]

The Xs (S$ above) are not token-identical but type-identical.

Since these are lexical types, we would expect different constructions to impose different requirements (of agreement etc.) via their heads:

*I like/*likes vodka, and Mary, beer.*
As in GPSG, the type-dependent account of extraction and coordination, as opposed to the standard account using structure-dependent rules, makes the across-the-board condition (ATB) on extractions from coordinate structures (including the “same case” condition) a prediction of CCG.

a. A saxophonist [that \((N \diamond N)/(S/\text{NP})\) [[Johnson admires]_{S/\text{NP}} and [Monboddo detests]_{S/\text{NP}}]]_{S/\text{NP}}\_N \diamond N

b. A saxophonist [that \((N \diamond N)/(S/\text{NP})\) *[Johnson admires]_{S/\text{NP}} and [detests Monboddo]_{S/\text{NP}}]]_{S/\text{NP}}_{S/\text{NP}}{N \diamond N}

c. A saxophonist [that \((N \diamond N)/(S/\text{NP})\) *[Johnson admires]_{S/\text{NP}} and [Monboddo detests him]_{S}]]_{S}

d. A saxophonist that \((N \diamond N)/(S/\text{NP})\) *[Johnson admires him]_{S} and [Monboddo detests]_{S/\text{NP}}]_{S/\text{NP}}
We would also expect that, in a verb-peripheral language (say SOV) with flexible word-order, the “same case restriction” is mediated not by the slash, but by morphological case; all arguments are on the same side of the verb:

(9) *Kız-ı [adam gördü]S\NP_{acc} [çocuğ-a da baktı]S\NP_{nom}
girl-ACC man.NOM saw child-DAT and looked at
* for ‘The man saw the girl and the girl looked at the child.’

Still, the syntactic type is doing all the work.
Scrambling
(or lack of it)

Although some languages have very flexible word order (like Warlbiri), most flexible-WO languages converge on basic word order(s):

Steele (1978) reports that for VSO languages, VOS is also observed to be very frequent; for SOV languages, OSV seems to be an alternative.

Some syntactic processes, such as gapping, put the basicness of word order to the test.
**Gapping**: identical verb deletion under coordination (direction of deletion depends on word order and—it seems—on nothing else; cf. Ross (1970) and ensuing discussion)

In a purely lexicalised grammar, the only word order is the lexical category of the verbs; there is not other locus for word order to arise.

Unlike Kayne (1994), there can be no universally assumed word order in CCG. Lexicalised word orders ought to reflect the limited cross-linguistic diversity in syntax (e.g. forward gapping, backward gapping, both).
Backward gapping (Japanese):

- *Ken-ga Naomi-o, Erika-ga Sara-o tazuneta*
  
  K-NOM N-ACC E-NOM S-ACC visit-PAST.CONCL
  
  ‘Ken visited Naomi, and Erika, Sara.’  Japanese

- *Ken-ga Naomi-o tazunete, Erika-ga, Sara-o.*
Forward gapping (Irish and English):

- \textit{Chonaic Eoghan Siobhán agus Eoghnaí Ciarán.}
  saw Eoghan Siobhán and Eoghnaí Ciarán
  ‘Eoghan saw Siobhán, and Eoghnaí, Ciarán.’ Irish

\textit{*Eoghan Siobhán agus chonaic Eoghnaí Ciarán.}

- John likes whisky, and Stuart wine.

\textit{*John whisky, and Stuart likes wine.}
Both (Turkish):

- Adam dergi-yi oku-du, kız da kitab-ı
  man.NOM magazine-ACC read-PAST girl.NOM and book-ACC
  ‘The man read the magazine, and the girl, the book.’

  Dergi-yi adam oku-du, kitab-ı da kız

- Adam dergi-yi, kız da kitab-ı oku-du
  man.NOM magazine-ACC girl.NOM and book-ACC read-PAST
  ‘The man read the magazine, and the girl, the book.’

  Dergi-yi adam, kitab-ı da kız oku-du
Steele’s observation on common cooccurrence of SOV and OSV, and VSO and VOS, can be captured with a single verbal category in CCG:

- **SOV and OSV**
  \[ S \backslash \{NP_{\text{nom}}, \, NP_{\text{acc}}\} = S \backslash \{NP_{\text{nom}}, \, NP_{\text{acc}}\} \quad \text{Turkish} \]

- **VSO and VOS**
  \[ S \slash \{NP_{\text{nom}}, \, NP_{\text{acc}}\} = S \slash \{NP_{\text{nom}}, \, NP_{\text{acc}}\} \quad \text{Tagalog} \]

- **SOV only**
  \[ (S \backslash NP) \backslash NP \quad \text{Ijo}^* \]

- **VSO only**
  \[ (S \slash NP_{\text{acc}}) / NP_{\text{nom}} \quad \text{Irish} \]

- **SVO only**
  \[ (S \backslash NP) / NP \quad \text{English} \]

- **any order**
  \[ S \{ |NP_{\text{nom}}, \, |NP_{\text{acc}}\} \quad \text{Latin} \]

*Ijo seems to have no case, cf. Greenberg (1963:10).*
Set-CCG (Hoffman, 1995) allows schematisation over lexical categories to be formulated in the lexicon. Set-modal CCG (Baldridge, 2002) adds modalities for lexical control over the combinatory aspects of the domain of locality of a construction.

Convention for syntactic type-LF pairing in set-based categories: The sets of syntactic and semantic arguments are paired in left-to-right order

\[\text{vur} ('\text{hit}') := S\{\text{NP}_{\text{acc}}, \text{NP}_{\text{nom}}\} : \lambda \{x, y\}.hit' xy\]

This schematisation corresponds to a finite set of fully ordered categories:

\[\{ S \text{NP}_{\text{acc}} \text{NP}_{\text{nom}}: \lambda x_1 \lambda x_2 . hit' x_2 x_1, S \text{NP}_{\text{nom}} \text{NP}_{\text{acc}}: \lambda x_2 \lambda x_1 . hit' x_2 x_1 \} \]
SVO and OVS cannot be captured with a single category, as eg.

\((S\setminus NP)/NP\)

If binding conditions do not reverse in OVS languages, these orders ought to lead to different LFs:

SVO: \((S\setminus NP)/NP: \lambda x\lambda y.\text{pred}' xy\)

OVS: \((S\setminus NP)/NP: \lambda x\lambda y.\text{pred}' yx\) Hixkaryana (Derbyshire, 1977)

Another alternative for OVS is \((S/\setminus NP)/NP: \lambda x\lambda y.\text{pred}' xy\)

The latter would be the right category if O [SV] and [SV] coordination is possible in the language (to be checked!)
The following word orders of Turkish are “unmarked” if Turkish is considered verb-final, not just SOV:

adam  kitab-ı  oku-du
man.NOM book-ACC read-PAST

NP_{nom}  NP_{acc}  S\{NP_{acc}, NP_{nom}\}

S\NP_{nom}  <
S

kitab-ı  adam  oku-du
book-ACC man.NOM read-PAST

NP_{acc}  NP_{nom}  S\{NP_{acc}, NP_{nom}\}

S\NP_{acc}  <
S
In OpenCCG:

tccg> adam kitab i okudu
1 parse found.

Parse: s
----------------------------------------
(lex) adam :- n
(T)  adam :- s$1/@i(s$1@in)
(lex) kitab :- n
(lex) i :- n*/n
(lex) kitab i :- n
(lex) okudu :- s\n.n.n
(T)  kitab i okudu :- s\n.n
(T)  adam kitab i okudu :- s

tccg> kitab i adam okudu
1 parse found.

Parse: s
----------------------------------------
(lex) kitab :- n
(lex) i :- n*/n
(T)  kitab i :- n
(T)  kitab i :- s$1/@i(s$1@in)
(lex) adam :- n
(T)  adam :- s$1/@i(s$1@in)
(lex) okudu :- s\n.n.n
(T)  adam okudu :- s\n.n
(T)  kitab i adam okudu :- s
Non-verb-final orders require backgrounding (detopicalisation) of the argument: They need **contraposition**: reversal of directionality along with change in information structure (Bozsahin, 2002).*

(10) Leftward Contraposition \(< \mathbf{T}_x\): \( \mathbf{NP}: a \Rightarrow \mathbf{S}/(\mathbf{S}/_{\times \mathbf{NP}})_{\mathbf{top}}: \lambda f. f a \)

Rightward Contraposition \(> \mathbf{T}_x\): \( \mathbf{NP}: a \Rightarrow \mathbf{S} \setminus (\mathbf{S} \setminus_{\mathbf{NP}})_{\mathbf{top}}: \lambda f. f a \)

\(< \mathbf{T}_x\) is topicalisation, and \(> \mathbf{T}_x\) detopicalisation/backgrounding.

This is a lexical rule, referring to substantive categories only.

*This schema simplifies and corrects the one in the paper.
The rule refers to modalities that are in the full repertoire of set-modal CCG:

\[
\begin{array}{c}
\ast \\
\triangleleft \times & \diamond \\
\triangleleft & \triangleleft \\
. \\
\end{array}
\]

NB. With this set, the $\times$ modality becomes a schema over the slashes ‘/’ and ‘\’

$\times$ is same as $\triangleleft \times$, and $/\times$ is same as $/\times\triangleright$. The modality in eg. $\times\triangleright$ cannot be suppressed.
kitab-ı oku-du adam
book-ACC read-PAST man.NOM

NP_{acc} \quad S \{ \text{NP}_{acc}, \text{NP}_{nom} \} \quad \text{NP}_{nom}

S \backslash \text{NP}_{nom} \quad \rightarrow T_{x}

S \backslash (S \backslash \times \text{NP}_{-top,nom})

S

adam oku-du kitab-ı
man.NOM read-PAST book-ACC

NP_{nom} \quad S \{ \text{NP}_{acc}, \text{NP}_{nom} \} \quad \text{NP}_{acc}

S \backslash \text{NP}_{acc} \quad \rightarrow T_{x}

S \backslash (S \backslash \times \text{NP}_{-top,acc})

S
oku-du
read-PAST

S\{\text{NP}_{\text{acc}}, \text{NP}_{\text{nom}}\}

kitab-ı
book-ACC

\text{NP}_{\text{acc}} \xrightarrow{T_{\times}} \text{NP}_{\text{nom}}

S\backslash (S\backslash \times \text{NP}_{\text{-top,acc}}) \xleftarrow{\text{B}} S\backslash \text{NP}_{\text{nom}}

\text{adam}
man.NOM

\text{NP}_{\text{nom}} \xrightarrow{T_{\times}} S\backslash (S\backslash \times \text{NP}_{\text{-top,nom}})
Long-distance scrambling can be lexically controlled: Turkish allows it, Japanese does not (example from Baldridge 2002:148; slightly modified):

\[
\begin{array}{l}
\text{Bu kitab-ı Fatma oku-mak iste-diğ-im-i bil-iyor ben-im} \\
\text{NP}_{\text{acc}} \quad \text{Fatma F.NOM} \quad \text{oku-mak read-INF} \quad \text{iste-diğ-im-i want-COMP-AGR.1s-ACC} \quad \text{bil-iyor know-PROG} \quad \text{ben-im; I-GEN} \\
\hline
\text{NP}_{\text{nom}} \quad \text{NP}_{\text{gen}} \quad \text{S}_{\text{inf}}\{\text{NP}_{\text{gen}}, \text{NP}_{\text{acc}}\} \quad \text{S}_{\text{vacc}}\{\text{S}_{\text{inf}}\} \quad \text{S}\{\text{NP}_{\text{nom}}, \text{S}_{\text{vacc}}\} < B \\
\hline
\text{S}_{\text{vacc}}\{\text{NP}_{\text{gen}}, \text{NP}_{\text{acc}}\} < B \\
\hline
\text{S}\{\text{NP}_{\text{nom}}, \text{NP}_{\text{gen}}, \text{NP}_{\text{acc}}\} < \\
\hline
\text{S}\{\text{NP}_{\text{gen}}, \text{NP}_{\text{acc}}\} < \\
\hline
\text{S}\{\text{NP}_{\text{gen}}\} < \\
\hline
\text{S}\{\text{S}\{\text{NP}_{\text{top}}, \text{gen}\}\} < \\
\hline
\text{S}
\end{array}
\]

‘Fatma knows that I want to read this book.’

Such derivations fail in Japanese at the point of \(> T_x\). Verb’s arguments would have the \(\text{◊}\) modality, rather than the most permissive \(\text{\_}\).
English topicalisation is an instance of leftward contraposition:* 

\[
\text{This book, } \quad \text{I think you recommended that } \quad \text{Mary read}
\]

\[
S/(S/\times_{\text{top}} \text{NP}) \quad S/\text{S}_{\text{fin}} \quad S/\text{S}_{\text{fin}} \quad S/\text{NP}
\]

\[
S/\text{NP} \quad S
\]

*NB. The composition \( S/\text{S} \quad S/\text{NP} \) yields \( S/\text{NP} \), which projects NP’s slash modality, rather than \( S/\text{NP} \), which does not.
Rightward contraposition should be disallowed (somehow) in the English lexicon to avoid examples like the following:

\[
\begin{align*}
*I think & \quad \text{recommended that} & \quad \text{Mary read this book} & \quad \text{your brother}_i \\
S / S_{\text{fin}} & \quad (S \backslash \text{NP}) / S_{\text{fin}} & \quad S & \quad S \backslash (S \backslash \times \text{NP}_{-\text{top}}) \\
\hline
S \backslash \text{NP} & \quad S
\end{align*}
\]

One possibility, proposed by Baldridge (2002:114) but not adopted by him,\* is to type the English subject NP as \( \backslash_\triangleright \text{NP} \), rather than \( \backslash \text{NP} \), which would maintain English subject/object asymmetry in extraction without overgenerating for rightward displacement of the subject above.

\*The concern was that this type would necessitate an instance of crossing composition that seems inactive in English. The example above might be the evidence that \( \backslash_\triangleright \) and \( \backslash _{\times} \) modalities are active.
English is still a rigid word-order language without collapsing into Turkish-style local or long-distance scrambling (example from Baldridge, p.74):

\[
\begin{align*}
\ast \quad \text{John} \quad \text{Brazil}_i \quad \text{knew} \quad \text{that} \quad \text{would} \quad \text{defeat} \quad \text{China} \\
\text{NP} & \quad \text{NP} & \quad (S \downarrow \text{NP}) / S_{\text{fin}} & \quad S / S & \quad S \downarrow \text{NP} \\
\end{align*}
\]
The lexical category of the verbs is the source of cross-linguistic variation for the possibility of scrambling, and its range.

Universal combinatory syntax of CCG can only project these properties onto surface derivation.

Thus the syntactic consequences of having scrambling or no scrambling are directly accounted for, e.g. in coordination and topicalisation; cf. Baldridge (2002) and Bozsahin (2005) for more on this issue.
Summary of universally available combinatory rules:

\[
\begin{align*}
X \rightarrow Y \quad & Y \Rightarrow X \\
Y \quad & X\rightarrow Y \Rightarrow X \\
X \rightarrow Y \quad & Y \rightarrow Z \Rightarrow X \rightarrow Z \quad (> B) \\
Y \rightarrow Z \quad & X \rightarrow Y \Rightarrow X \rightarrow Z \quad (< B) \\
X \rightarrow Y \quad & Y \rightarrow Z \Rightarrow X \rightarrow Z \quad (> B \times) \\
Y \rightarrow Z \quad & X \rightarrow Y \Rightarrow X \rightarrow Z \quad (< B \times)
\end{align*}
\]
Summary of universally available lexical rules

Type Raising

\[ A : a \Rightarrow T/(T \setminus A) : \lambda f.f\,a \]  
\[ (> \, T) \]

\[ A : a \Rightarrow T\setminus(T/A) : \lambda f.f\,a \]  
\[ (> \, T) \]

Contraposition

\[ NP:a \Rightarrow S/(S\times\text{NP}_{\text{top}}) : \lambda f.f\,a \]  
\[ (> \, T_{\times}) \]

\[ NP:a \Rightarrow S\setminus(S\times\text{NP}_{\text{top}}) : \lambda f.f\,a \]  
\[ (< \, T_{\times}) \]