Locality effects in grammar and language acquisition: Theory and experimentation.

Luigi Rizzi
The acquisition of movement configurations: a rough overview

Different kinds of constructions involving movement are mastered at different times in acquisition:

- V to T movement: early  (Pierce 1992)  
- T to C movement: early  (Poeppel & Wexler 1993)  
- Subject movement to EPP pos.: early  
- Unaccusatives: early  (Snyder et al. 1995, Lorusso 2010)  
- Passive: late  (Maratzos et al 1985, Borer & Wexler 1987)  
- Raising across an overt experiencer: late  (Hirsch & Wexler 2007)  
- Easy to please: late  (C.Chomsky 1969)  
- Subject relatives and questions: early  
- (Certain) Object relatives and questions: late  (Brown 1972, etc.)
Intervention as a dimension of computational complexity

A movement dependency is “difficult” when it crosses an intervener, a syntactic position which bears some similarity to the positions involved in the movement relation:

(1) \[ \ldots X \ldots \text{Intervener} \ldots Y \ldots \]
Simple and complex movement in acquisition

(1) Jean rencontr+era [ ____ Marie ]       H-mvt:  Early

(2) John will  [ leave ___ ] ]                A-mvt:  Early

(3) John  was [ Ext.Arg. fired ___ ]        A-mvt:  Late

(4) John seems to Mary [ __ to be sick ]  A-mvt:  Late

(5) John is easy [ PRO to help ___ ]         A/A’-mvt:  Late

(6) The boy that [ ____ is pushing the girl ] A’-mvt:  Early

(7) The boy that [ the girl is pushing ___ ] A’-mvt:  Late
Intervention locality in children and adults

The problematic nature of intervention configurations may manifest itself in different ways in different structural environments and populations:

- **Degraded acceptability** (with distinct degrees of deviance) for adult speakers in Weak Island contexts;
- **Incapacity to compute** the configuration in object A’-dependencies for children (and in different forms of language-related pathologies);
- **Slower processing** in adults.

• **Question:** Are intervention effects in these domains amenable to a partially unified formal approach?

• **A project:** take the detailed formal approach to intervention worked out in formal syntax in the Relativized Minimality tradition, and try to extend it, *mutatis mutandis*, to the other domains.
Constraints on extractions from Weak Islands

(1) What do you think John could buy __?
(2) * What do you wonder who could buy __?

(1’) **What** do you think **John** could buy __?

(2’) * **What** do you wonder **who** could buy __?
Intervention locality is computed on hierarchical representations

(3) You wonder [who left *at five*]

(4) *When do you wonder [ who  left  ___ ]

\[ X \quad Z \quad Y \]

\[ \uparrow \quad * \quad \]

(5) [The uncertainty [about [who won]]] dissolved *at five*

(6) *When did [the uncertainty [about [who won ]]]] dissolve ___ ?

\[ X \quad Z \quad Y \]

\[ \uparrow \quad OK \quad \]
(1) When did the dissolve <when> uncertainty about who won OK X Z Y
When do you wonder who left <when>
Featural Relativized Minimality  \( fRM \) (Rizzi 2004, building on Rizzi 1990, Starke 2001)

In \( \ldots X \ldots Z \ldots Y \ldots \) a local relation between \( X \) and \( Y \) is disrupted when

1. \( Z \textbf{c-commands} Y \) and \( Z \) does not c-command \( X \) (intervention configuration).

2. \( Z \textbf{matches} X \) in terms of Relevant Morphosyntactic Features (RMF).

\( \text{NB: if we are looking at a local relation created by movement, RMF are features triggering movement.} \)
Young children understand subject relatives but not object relatives. Inspired by Grillo 2008 on agrammatism, FBR 2009 put forth the hypothesis that headed object relatives are hard in children (3;7 – 4;10) because they involve an intervention configuration, in which the subject acts as an intervener:

(1) Show me **the elephant** that ___ is washing the lion   (90%)

(2) Show me **the elephant** that **the lion** is washing ___   (55%)

+R+NP       +NP
Relatives sujet vs Relatives objet

L’asymétrie relative sujet vs relative objet a été observée expérimentalement dans plusieurs langues, en production et en compréhension:

- **Français**
  - Labelle (1996), Délage et al. (2008), Hamann & Tuller (2010), Bentea (2016), Bentea & Durrleman (2016)

- **Italien**
  - Belletti & Contemori (2010), Adani et al. (2010), Contemori & Belletti (2013)

- **Portugais**
  - Costa et al. (2011), Costa et al. (2012)

- **Roumain**
  - Avram (2012), Bentea (2016)

- **Allemand**
  - Arosio et al. (2012), Hamann et al. (2017)

- **Anglais**
  - De Villier et al. (1979), Crain (1990), Contemori & Marinis (2014)

- **Catalan**
  - Gavarró et al. (2012)

- **Grec**
  - Stavrakaki (2001), Guasti et al. (2012)

- **Suédois**
  - Håkansson & Hansson (2000)

- **Hébreu**

- **Chinois**
  - Hsu et al. (2009), Hu (2014), Hu et al. (2015, 2016)

- **Basque**
  - Gutiérrez-Mangado & Ezeizabarrena (2013)

- **D’autres langues étudiées : Espagnol, Danois, Polonais, Néerlandais (cfr. Cost Action A/33).**
Testing the relevance of RM (Child Hebrew)

FBR manipulated either the relative head or the intervener to make them featurally dissimilar, thus turning inclusion into disjunction: the RM approach correctly predicts an improvement in children (3;7 – 4;10):

(1) Headed object relative:

Show me the elephant that the lion is washing ____  (55%)
+R+NP +NP

(2) Free object relative:

Show me who the lion is washing ____  (79%)
+R +NP

(3) Headed object relative with a pronominal subject:

Show me the elephant that (they) are washing ____ (81%)
+R+NP +Pron
RM and bare vs. restricted wh-questions in children 3;7 – 4;10 (FBR 2009) in Child Hebrew

Bare wh object questions:

**Who**  **the cat**  bites  ***___***
+Q       +NP       (75%)

Which N object questions:

**Which dog**  **the cat**  bites  **___**
+Q+NP     +NP       (58%)
The comprehension of which and who questions
Why is +NP relevant? Lexical restriction as an attractor: North Eastern Italian Dialects  Munaro 1999

Munaro et al.: in certain North Eastern Italian dialects (Bellunese, etc.) lexically restricted and bare wh elements occupy different positions:

(1) **Con che tosat** à-tu parlà?
    ‘With which boy did you speak?’

(2) **Avé-o parlà de chi?**  (Munaro 1999)
    ‘Have you spoken of whom?’

So, there must be distinct attractors for lexically restricted and bare wh elements.

(3) ... +Q+NP ...  H ...  +Q ....  [ip .... ]
A discrepancy between adults and children with headed object relatives and lexically restricted object wh-questions

Headed object relatives and lexically restricted wh-questions are problematic for young children, but adults fully accept them and interpret them correctly:

(1) Show me the elephant that the lion is washing ____
   +R+NP +NP

(2) Which elephant is the lion washing ____?
   +Q+NP +NP
A unique gradation of featural distinctness between positions with different cut-off points for children and adults.

Disjunction: X is distinct from Z and Z is distinct from X

Inclusion: X is distinct from Z

Identity: X is non-distinct from Z and Z is non-distinct from X

Children and adult systems assume different cut-off points in the scale of distinctness, in a system which is otherwise uniform.

The child system is more restrictive in that it only rules in the configuration with maximal distinctness (disjunction) between target and intervener.

If we think of this system in terms of penalties associated to the degree of match between Z and X, the child system is less tolerant to such penalties, in a way presumably connected to its weaker computational resources.
Set theoretic feature relations between $X$ and $Z$ in $X \cdots Z \cdots Y \cdots$ and the distinctness hierarchy

1. **DISJUNCTION:**

2. **INCLUSION:**

3. **IDENTITY:**
Complexity of certain object $A'$ dependencies in adult processing


(1) a. The reporter [ that the senator attacked ___ ] disliked the editor.
   b. The reporter [ that ___ attacked the senator ] disliked the editor.
Figure 1. Results of Experiment 1. The mean reading time by word (with 95% confidence intervals) is shown for sentences with subject-extracted and object-extracted relative clauses. The sample sentences show the alignment of reading times with words in the sentence.
Inclusion and disjunction in adult processing

Inclusion:

(1) The banker [ that the barber praised __ ] climbed the mountain
   +R+NP +NP

Disjunction:

(2) The banker [ that you praised __ ] climbed the mountain
   +R+NP
Gordon, Hendrick, Johnson (2001)

Figure 2. Results of Experiment 2. The mean reading time by word (with 95% confidence intervals) is shown for sentences with subject-extracted and object-extracted relative clauses with descriptions and with pronouns. The sample sentences show the alignment of reading times with words in the sentence.
Interim Conclusion

• **Featural Relativized Minimality**, combined with set theoretic considerations and a grammar-based feature hierarchy generates a distinctness hierarchy involving targets and interveners in movement relations.

These ingredients provide a partially unified grammar-based system which, combined with different cut-off points, captures

• Adult graded judgments in weak island environments,

• Children’s difficulties with object A’-dependencies,

• Complexity effects in adult parsing.
Intervention effects in acquisition: grammar-based or extra-grammatical?

• As an alternative to the grammar-based (GB) approach, one could entertain the hypothesis that such effects are fundamentally extra-grammatical (EG): for instance, it could be that the child’s failure to interpret object A’-dependencies is a pure parsing problem DIRECTLY caused by domain general memory limitations, e.g. because the parser cannot hold in memory chunks with too many words.

• So there could be a mere parsing problem, related to the linear distance of object A’-dependencies, without the mediation of a grammatical principle.

• Three considerations seem to me to favor a grammar-based approach.
Three arguments

• Symmetry or asymmetry between **comprehension** and **production**?
  - **GB**: symmetry is expected because the grammar is involved in both comprehension and production.
  - **EG**: no direct prediction is made on production.

• Sensitivity to **C-command** or to **linear** intervention?
  - **GB**: sensitivity to C-command.
  - **EG**: sensitivity to linear intervention.

• **Selectivity** or **non-selectivity** of the features determining intervention effects?
  - **GB**: selectivity is expected because the grammatical principle is selective, sensitive to certain morphosyntactic features only.
  - **EG**: non-selective: any featural difference could be used as a differentiating cue to overcome the difficulty with intervention.
Elicited Production: the preference task with SR
(based on Friedmann and Novogrodsky 2006. and extensively used in Belletti & Contemori 2011, Contemori and Belletti 2013)

• Elicitation of SR:

Preamble: There are two girls.
One girl is hugging grandma
The other girl is hugging grandpa
Which girl would you rather be? Answer by saying «I would rather be the girl....»

Target: I would rather be the girl that ___ is hugging grandma/grandpa
Production: the preference task with OR
(based on Friedmann and Novogrodsky 2006. and extensively used in Belletti & Contemori 2011,
Contemori and Belletti 2013)

• Elicitation of OR:

Preamble: There are two girls.
            Grandma is hugging one girl
            Grandpa is hugging the other girl
            Which girl would you rather be? Answer by saying «I would rather be the girl....»

Target: (I would rather be) the girl that grandma/grandpa is hugging __
Martini et al (2016) based on Belletti & Contemori (2011), (2013): how frequently is the other DP reproduced in the elicited relative?

Elicited subject relatives

I would rather be the girl that __ is hugging \textit{grandma}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart1}
\caption{Elicited subject relatives}
\end{figure}

Elicited object relatives

I would rather be the girl that \textit{grandma} is hugging __

\begin{figure}
\centering
\includegraphics[width=\textwidth]{chart2}
\caption{Elicited object relatives}
\end{figure}

**OR:** (Which one is...)
xiaomao da __ de xiaougou
cat hit __ De dog

_The dog that the cat hit__

**SR:** (Which one is...)
__ da xiaomao de xiaougou
__ hit cat De dog

_The dog that__ hit the cat

(1)

```
(1)  DP
   CP
      dog
      CP
         C
def
      TP
         Cat
         VP
            hit
            <__>
```

(2)

```
(2)  DP
   CP
      dog
      CP
         C
def
      TP
         VP
            hit
            cat
```

Prediction of a linear intervention approach: OR > SR

Prediction of a hierarchical intervention approach: SR > OR

Fig. 1. A set of pictures used in the experiment.

(9) a. Na yi-ge shi da xiaogou de xiaomao?
   which one-CL is hit dog DE cat
   ‘Which one is the cat that hits the dog?’

a. Na yi-ge shi waipo hua de xiaohai?
   which one-CL is grandma paint DE child
   ‘Which one is the child that the grandma paints?’

<table>
<thead>
<tr>
<th>Groups</th>
<th>Subject RCs</th>
<th></th>
<th>Object RCs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>3 y.o.</td>
<td>47·8</td>
<td>75/157</td>
<td>24·8</td>
<td>39/157</td>
</tr>
<tr>
<td>4 y.o.</td>
<td>61·3</td>
<td>98/160</td>
<td>23</td>
<td>37/160</td>
</tr>
<tr>
<td>5 y.o.</td>
<td>72·5</td>
<td>116/160</td>
<td>20·6</td>
<td>33/160</td>
</tr>
<tr>
<td>6 y.o.</td>
<td>76·3</td>
<td>122/160</td>
<td>45</td>
<td>72/160</td>
</tr>
<tr>
<td>7 y.o.</td>
<td>99·4</td>
<td>159/160</td>
<td>45·6</td>
<td>73/160</td>
</tr>
<tr>
<td>8 y.o.</td>
<td>100</td>
<td>160/160</td>
<td>95·6</td>
<td>153/160</td>
</tr>
<tr>
<td>Adults</td>
<td>100</td>
<td>160/160</td>
<td>100</td>
<td>160/160</td>
</tr>
</tbody>
</table>
Hu et al 2016 show that, in a character – sentence matching task SR are significantly easier to understand than OR, consistently throughout the six age groups of the study (age 3 – age 8).

This supports the view that intervention is calculated hierarchically, as predicted by a grammar-based approach, and not linearly.

NB: in the literature, results are mixed; the authors claim that character-sentence matching is more reliable than, e.g., picture – sentence matching or act out, which could simply rely on word order for OR.

Hu et al 2015 show that the SR advantage is also found in elicited production in the acquisition of Mandarin Chinese.
Argument 3: The effects are featurally selective

• An approach based on RM leads one to expect that only certain features characterizing X and Z are relevant for the computation of locality.

• As we are looking at locality on syntactic chains, the expectation is that only features with a clear morphosyntactic role, in particular features involved in the triggering of movement are taken into account.

• An extra-grammatical approach does not immediately lead to predicting such a selectivity. It could be that any salient feature differentiating the two arguments can improve comprehension.

• The different role of gender mismatch in Hebrew and Romance (BFBR 2012), as well as the contrast between gender and number in Romance (Adani et al. 2012) in acquisition has been discussed in this connection.
Argument 3 - Evidence for featural selectivity: The irrelevance of overt object marking

• Bentea (2016) shows that overtly marked object relatives with pe in Romanian are not better understood by children than object relatives without an explicit marker (same for overtly marked dative relatives).

• Friedmann, Belletti, Rizzi (2016) show that overtly object marked lexically restricted wh-questions with et in Hebrew are not better understood by children than object questions without an explicit marker.
Bentea (2016) care and pe care

Subject relative (SR)
• Arată-mi elefantul care stropește crocodilul.
  show-me elephant.the.M.SG which splashes crocodile.the.M-SG
  ‘Show me the elephant that splashes the crocodile.’

Direct object relatives with overt case-marking (DORpe)
• Arată-mi elefantul pe care crocodilul îl stropește.
  show-me elephant.the.M.SG PE which crocodile.the.M.SG him splashes
  ‘Show me the elephant that the crocodile splashes.’

Direct object relatives without overt case-marking (DOR)
• Arată-mi elefantul care crocodilul îl stropește.
  show-me elephant.the.M.SG which crocodile.the.M.SG him splashes
  ‘Show me the elephant that the crocodile splashes.’
Bentea (2016): object relatives with overt or null Case marking across a preverbal subject in Romanian (30 children 4;0 – 6;10) (NB: here what is counted is character selection)

Lexically restricted object questions in Hebrew with and without the object marker et:

(1) Et eize pil ha-arie martiv?
   acc which elephant the-lion wets?

(2) Eize pil ha-arie martiv?
   which elephant the-lion wets?
Belletti, Rizzi, Friedmann (2016) No case for Case in locality: Case does not help interpretation when intervention blocks A-bar chains, in Glossa, 2017. NB: what is counted here is picture selection
Argument 3 - Selectivity: The irrelevance of overt object marking (based on the discussion in Friedmann et al 2016)

- Why is overt Case not used to improve comprehension of object relatives and questions in Hebrew and Romanian?

- Non-grammar-based approaches would naturally expect Case to offer a powerful cue for the correct theta role assignment in object A’-dependencies, but it does not.

- The grammar-based approach predicts this form of featural selectivity: Case is a feature of the goal in the A-system, but it never is a property of the probe in the A or A’ system, hence it never is an attracting feature.

- Therefore, if fRM is only sensitive to attracting features, Case will not be taken into account in the computation of locality, and will not help children to overcome an intervention violation.
Case is not taken into account in the calculation of locality

(1) (ACC) which elephant the lion wets ___

+ACC  +Q  +NP  +ACC  +Q  +NP

* +NOM  +NP

The overt case mismatch is not taken into account, so the structure remains one of inclusion, problematic for the child.

- The different case feature unambiguously identifies the initial DP as the object
- the child has fully mastered the distributional properties of case at this stage, as corpus studies show,
- but that information is not taken into account to overcome the locality violation, and the structure remains problematic for the child.
In conclusion

• Symmetry between production and comprehension

• Sensitivity to hierarchical, rather than linear, intervention

• Selectivity in the identification of the relevant features

are expected properties under a grammar-based approach to the development of A’-dependencies.