

Local and Universal

On the interaction of universal parsing principles and grammatical variation.

Nino Grillo

22 April 2021 – DLLD Ghent

University of York

A collaborative effort

Results discussed today were obtained through collaborative effort with:

- Andrea Santi, Wing-Yee Chow, Sally Habboub (UCL)
- Giorgos Spathas (ZAS)
- Miriam Aguilar (Universidade de Lisboa)
- João Costa, Bruno Fernandes, Margarita Tomaz (U.Nova de Lisboa)
- Barbara Hemforth, Giuseppina Turco, Céline Pozniak (CNRS-Paris 7)
- Oana Lungu (Université de Nantes)
- Keir Moulton (University of Toronto)
- Maria-do-Carmo Lourenço Gomes (Universidade do Minho)

- Illusions, Ambiguity and Language Processing
- Economy in processing: Locality
- The problem of cross-linguistic variation in parsing
- The role of grammatical variation: Syntax and semantics of (Pseudo) Relatives Clauses
- *PR-first* Hypothesis
- Experimental Results
 - attachment questionnaire
 - acceptability judgment
 - self-paced reading
 - eye-tracking
 - sentence completion

Seeing the invisible



Figure 1: The Cornsweet Illusion

Seeing the invisible

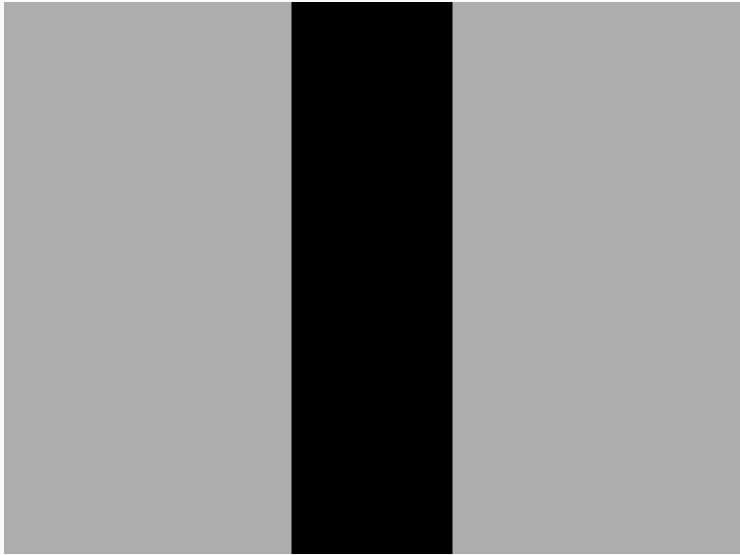


Figure 2: The Cornsweet Illusion, covered and revealed

Adelson 1995: Checkersshadow Illusion

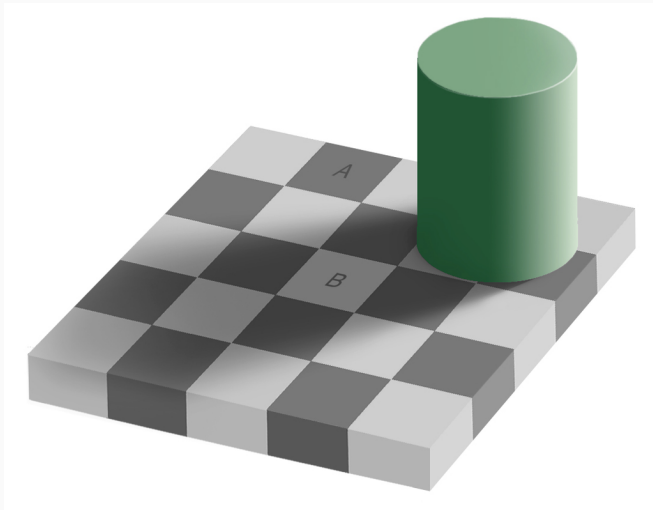
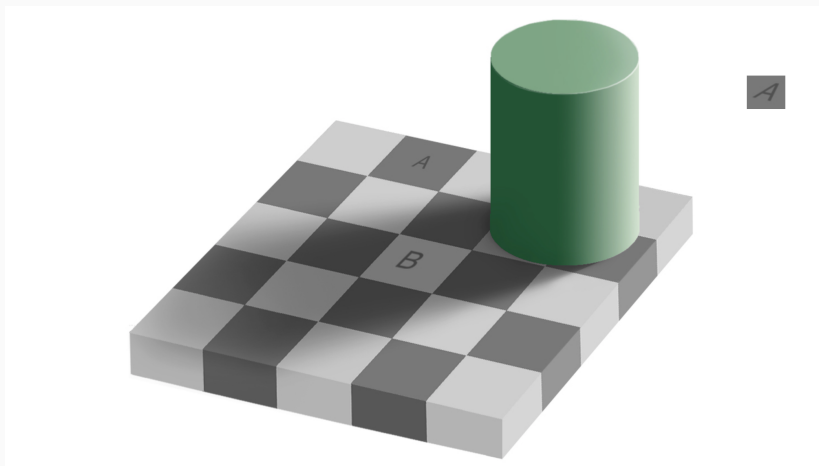
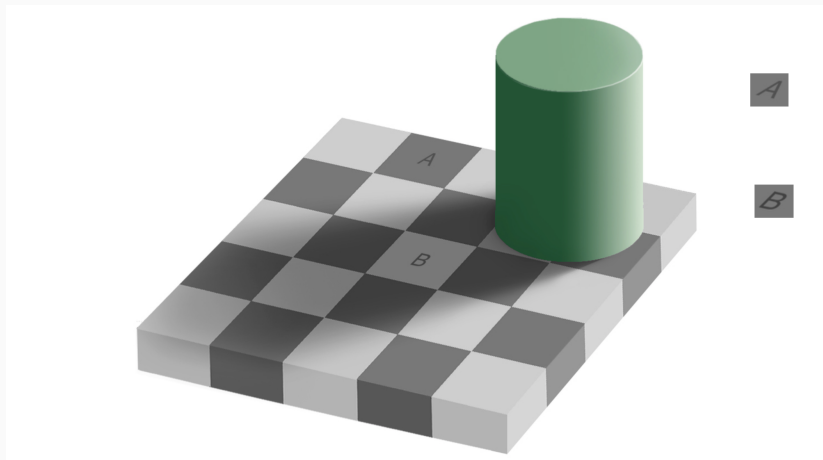


Figure 3: Adelson's Checkersshadow illusion. 1995, Edward H. Adelson.

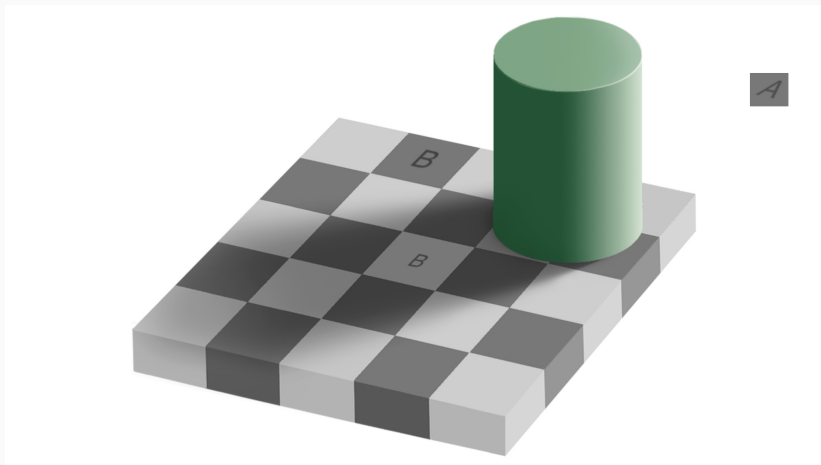
When the same looks different



When the same looks different



When the same looks different



For an explanation of the effect see:

<http://persci.mit.edu/gallery/checkershadow/description>

Ambiguity in vision



Figure 4: An ambiguous picture of a young lady or an old woman

Seeing the invisible

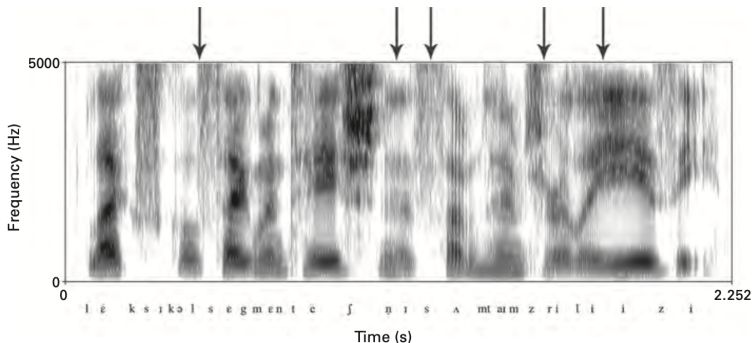
- illusions and ambiguities are interesting because they show us the functioning of the mind
- they allow us to see how we never simply register information from outer space
- we constantly and automatically build internal representations of external stimuli, applying laws that put some order on the incoming stimuli
- these representations are built on increasingly complex levels, which resist reduction to lower level explanations

Hearing the inaudible

- Going back to language, we find ourselves facing very much the same problems:

Language is a shared illusion

- Take for example the continuous nature of speech
- Where are the boundaries between words?



This is just the simplest possible case, think of how:

- sentences are parsed into words,
- categories assigned,
- phrases formed,
- dependencies built,
- silent categories postulated . . .

Hearing the inaudible

- As we see the invisible, (i.e. we apply internal rules that shape and assign a sense to what we see) we hear the inaudible
- Exposed to the physics of speech our brain “hears” far beyond what’s in the physical signal and out of conscious control
- Understanding the inaudible, and how it is built, is (more or less) what the study language processing, and more generally of (psycho)linguistics, is all about

Ambiguity in language processing

I'm a linguist, I love ambiguity more than most people

- Ambiguity resolution window into language processing
- One of the problem the language processor has to solve is to choose between different analyses of the same ambiguous utterance



Incrementality

- Garden Path effects show that when we hear or read connected words we immediately start projecting syntactic structure
- This phenomenon is known as *incrementality*
- Most evidence for incremental syntactic processing (*parsing*) comes from the study of the processing of ambiguity.

Economy in Sentence processing

- Resolving ambiguities involves making choices between alternative structures
- One reasonable assumption:
 - When resolving ambiguities, The parser chooses the first available analysis (Frazier 1987)
- That is: the parser applies principles of economy

Locality is one well-studied principle of economy

(1) Late Closure: (Frazier, 1979)

If grammatically permissible, attach new items into the clause or phrase currently being processed (i.e., the clause or phrase postulated most recently).

(2) John said that Bill arrived yesterday.

a. John [VP said [CP that [IP Bill [VP arrived yesterday]]]].

b. John [VP said [CP that [IP Bill [VP arrived]]] yesterday].

Garden path theory

Late Closure is a general principle that applies across different categories (examples from [De Vincenzi and Job 1993](#)):

- **adverbs:**

John said that Bill arrived yesterday

- **particles:**

Joe called the friend that had smashed his new car up

- **possessives:**

I met the boy whom Sam introduced to Mary's friend

- **PPs:**

John read the note, the memo, and the letter to Mary

- **PPs (more):**

A gift to a boy in a box (Abney, 1998)

- **Reduced Relative Clauses (reduced-RCs):**

Il vino dello zio allungato con l'acqua

The wine of the uncle diluted with water

RC attachment is another domain of application of Late Closure:

- (3) Someone shot the maid of the actress [that was on the balcony].
 - a. Someone shot the maid of **the actress** [that was on the balcony].
 - b. Someone shot **the maid** of the actress [that was on the balcony].

Asymmetries in RC Attachment

Cuetos and Mitchell (1988): Speakers of different languages show different preferences for RC attachment

Someone shot **the maid** of **the actress** [that was standing on the balcony]
Algúien disparó contra **la criada** de **la actriz** [que estaba en el balcón]

Arabic	Abdelghany and Fodor (1999); Quinn et al. (2000)
Basque	Gutierrez-Ziardegi et al. (2004)
*Bulgarian	Sekerina et al. (2003)
Chinese	Shen (2006)
English	Cuetos and Mitchell (1988); Mitchell and Cuetos (1991), Gilboy et al. (1995); Fernández (2003), Frazier and Clifton (1996)
*German	Augurzky (2005); Murray et al. (2000)
Norwegian	Ehrlich et al. (1999)
*Portuguese	Miyamoto (1999)
Romanian	Ehrlich et al. (1999)
Swedish	Ehrlich et al. (1999)

Table 1: Summary of studies reporting LA for the languages indicated. Note: “*” precedes contrasting results.

Afrikaans	Mitchell et al. (2000)
*Bulgarian	Sekerina et al. (2003)
Serbo-Croatian	Lovrić (2003)
Dutch	Brysbaert and Mitchell (1996); Mitchell and Brysbaert (1998), Mitchell et al. (2000); Desmet et al. (2002)
French	Mitchell et al. (1990); Frenck-Mestre and Pynte (2000), Zagar et al. (1997); Colonna et al. (2000), Colonna and Pynte (001a)
Galician	Fraga et al. (2005)
*German	Hemforth et al. (1996, 1998), Hemforth et al. (2000b)
Greek	Papadopoulou and Clahsen (2003)
Italian	De Vincenzi and Job (1993, 1995)
*Portuguese	Ribeiro (1998, 2005), Maia and Maia (2001), Maia et al. (2006), Miyamoto (2005)
Russian	Sekerina (1997, 2004)
Spanish	Cuetos and Mitchell (1988); Carreiras and Clifton (1993), Carreiras and Clifton (1999); Cuetos et al. (1996), Gibson et al. (1999); Igoa et al. (1998), Gilboy et al. (1995); Mitchell et al. (1990)

Table 2: Summary of studies reporting HA for the languages indicated.

Asymmetries in RC attachment

- These findings at odds with uniform LOCAL / low attachment preference found for other structures in the same languages (e.g. PPs) i.e. strength of local attachment (Phillips and Gibson, 1997).
- They lead to question the universality of parsing principles, in particular of *Right Association* (Kimball, 1973) / *Late Closure* (Frazier, 1979) / *Recency* (Gibson, 1991) / *Merge Right* (Phillips, 1996);
- They pose serious problems to theories of acquisition and processing (Fodor, 1998a,b);

Asymmetries in RC attachment

We could abandon Locality and or assume that it is subject to a certain degree of parametrization.

However . . .

Asymmetries in RC attachment

Cross-linguistic variation in parsing principles is highly problematic:

- Children need to parse the language they hear to acquire its grammar.
- This will be very hard, if not impossible, if principles of parsing have to be acquired themselves.
- Principles of parsing can hardly be acquired as long as there is no grammar to base this process on.

Asymmetries in RC attachment

“The whole explanatory project [. . . based on the hypothesis that the processing mechanism is fully innate and applies differently to different languages only to the extent that their grammars differ . . .] is in peril because of the discovery that Late Closure is not universal.”

(Fodor, 1998a, p. 285)

Asymmetries in RC Attachment

- Several factors have been shown to influence RC-attachment **in similar ways across languages**, including syntactic, pragmatic, prosodic and individual differences in memory span
(De Vincenzi and Job, 1993; Hemforth et al., 1998, 2000b,a; Konieczny and Hemforth, 2000; Gilboy et al., 1995; Frazier and Clifton, 1996; Fodor, 1998a,b; Swets et al., 2007, a.o.),
- Residual (significant) asymmetries still observable across languages once these factors are controlled for.
- Today's account aims at completing, **not replacing**, previous accounts.

The role of Pseudo Relatives

(Grillo, 2012; Grillo and Costa, 2014):

- Asymmetric availability of **Pseudo Relatives** confounded previous work on RC attachment:
- In Spanish (and other High Attachment languages) RCs are string identical to so called Pseudo Relatives (PRs), i.e. a type of Small Clause.
- Other languages, including English, do not allow PRs.

Pseudo Relatives

Pseudo-relatives (PRs) are constructions found in many languages that look superficially like RCs but are comparable to an English Small Clause:

- (4) a. Jean a vu **Bolt qui courait**. (French)
J. has seen Bolt that ran.IMPF.
'John saw Bolt running'
- b. Jean l'a vu qui courait.
J. him.has seen that run.IMPF.
'John saw him running.'
- c. *John saw him that was running.

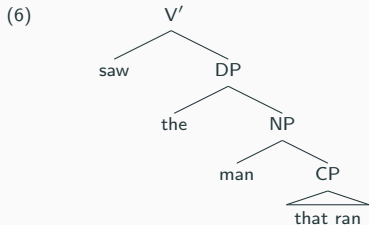
... Also available in Spanish, Greek, Dutch, Catalan, Galician, Asturian, Serbo-Croatian, Greek, a.o.

(Radford, 1975; Kayne, 1975; Graffi, 1980; Burzio, 1986; Guasti, 1988, 1992; Luigi, Cinque, 1992; Grillo and Costa, 2014; Grillo and Moulton, tted, 2016; Rafel, 1999, Casalicchio, 2013, a.o.).

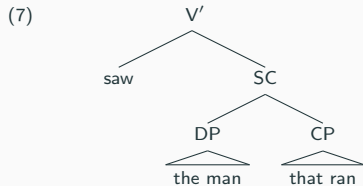
RCs vs. PRs: Structure

- (5) Jean a vu l'homme qui courait.
J. has seen the'man that run.IMPF.
'John saw the man (that was) running.'

RELATIVE CLAUSE



PSEUDO RELATIVE



RCs vs. PRs: Meaning

RELATIVE CLAUSE

John saw the man that runs



$\exists e$ [see(e) & EXPERIENCER(e)(John) & STIMULUS(the unique man that ran)(e)]

PSEUDO RELATIVE

John saw the man running



$\exists e \exists e'$ [see(e) & EXPERIENCER(e)(John) & STIMULUS(e')(e) & run(e') & AGENT(e')(the man)]

note: Simplified syntax/semantics, see [Moulton and Grillo \(2015\)](#); [Grillo and Moulton \(2016\)](#).

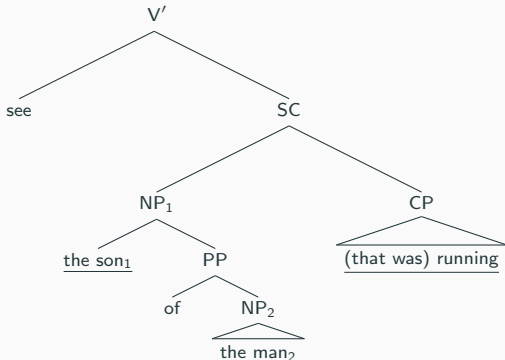
Asymmetries between RCs and PR/SC

Property	RCs	PRs	SCs
Long distance 'gap'	✓	X	X
Refers to individuals	✓	X	X
Available w. objects	✓	X	X
Available w. Rel. Pronouns	✓	X	X
NP modifier	✓	X	X
Conjunction with RC	✓	X	X
Conjunction with SCs	X	✓	✓
Refers to events	X	✓	✓
Available in SC environments	X	✓	✓
Available w. Proper Names	X	✓	✓
VP modifier	X	✓	✓
Aspectual restrictions	X	✓	✓
Tense restrictions	X	✓	✓
Restrictions on matrix V	X	✓	✓

Obligatory "High Attachment" with PRs

With PRs & SCs, NP1 is the only accessible subject

- (8) a. Jean a vu [_{PR} le fils de l'homme qui courait.]
b. John saw [_{SC} the son of the man running.]



(Grillo, 2012; Grillo and Costa, 2014) When PRs are available they will be preferred over RCs.

Everything else being equal:

- A. Low Attachment preference is observed, across languages and structures, with genuine RCs, i.e. when PRs are not available.
- B. High Attachment preference is observed in languages and structures which allow for a PR reading.

PR-first Hypothesis

(Grillo, 2012; Grillo and Costa, 2014) Why?: PRs are structurally and interpretively simpler than RCs

- PRs (SCs) have simpler syntax /semantics than RCs
- PRs, but not RCs, are relevant for the main assertion (cf. *Relativized Relevance*, Frazier 1990)
- PRs carry fewer unsupported presuppositions than RCs, e.g. they do not require a contrast set (Crain and Steedman, 1985; Altmann and Steedman, 1988)

On generalized RC avoidance see also Staub et al. (2018)

Testing the Hypothesis

- Cross-linguistic survey of previous results
- Direct Testing:
 - Techniques: questionnaires, self-paced reading, eye-tracking, sentence completion
 - Languages Tested: Italian, English, French, Greek, Spanish, European Portuguese

PR availability and RC-attachment across languages

- To the extent that a distinction between High vs. Low Attachment languages is meaningful
- There is a tight relation between Attachment preference and PR-availability

Language	Attachment	PRs
English	Low	*
Romanian	Low	*
Basque	Low	*
Chinese	Low	*
Norwegian	Low	*
Spanish	High	✓
Galician	High	✓
Dutch	High	✓
Italian	High	✓
French	High	✓
Serbo-Croatian	High	✓
Japanese	High	✓
Korean	High	✓
Greek	High	✓
Portuguese	High	✓
German	High/Low	*
Russian	High/Low	*
Bulgarian	High/Low	*

How do we test for PR-effects?

- One way to test PR-availability effects on RC-attachment is to manipulate the properties of the Matrix Verb
- Not all verbs allow PRs

PRs, and eventive SCs, are allowed with perceptual verbs, but not with stative predicates:

- (9) a. Jean a vu Bolt qui courait.
J. has seen B. that run.IMPF.
'John saw Bolt running.'
- b. *Jean vivait avec Bolt qui courait.
J. lived with B. that run.IMPF
'*John lived with Bolt running.'

V-Type keeps Complex-NP+RC identical & manipulate \pm PR

Effects of PR-availability within a language

Attachment Questionnaire

Contrast:

- (10) a. Gianni **ha visto** il figlio del medico che correva. PERCEPTUAL
John **saw** the son of the doctor that was running.
- b. Gianni **vive con** il figlio del medico che correva. STATIVE
John **lives with** the son of the doctor that was running.

Effects of PR-availability within a language

Attachment Questionnaire

Contrast:

a. John **saw** the son of the doctor that was running.

b. John **lives with** the son of the doctor that was running.

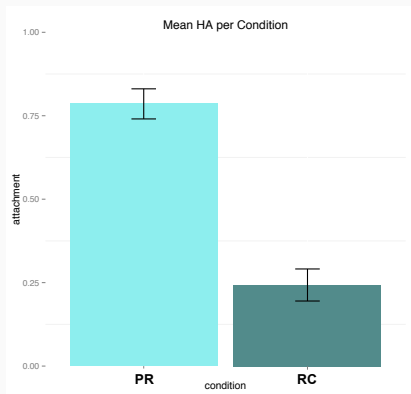
PERCEPTUAL

STATIVE

ITALIAN

(Grillo and Costa, 2014, *Cognition* 133)

Eventive	Stative
78.6% HA	24.2% HA



Coefficient	SE	z-score	p-value
-3.95604	0.51992	-7.609	< .0001

Comparable results from other PR-languages

- French (Grillo et al., 2015c,d,b; Pozniak et al., 2019)
- Greek (Grillo and Spathas, 2014)
- Portuguese (Grillo et al., 2012a,b, 2013a,b; Fernandes, 2012; Tomaz et al., 2014; Costa et al., 2016; Fernandes, 2021)
- Spanish (Grillo et al., 2012b; Aguilar and Grillo, 2016, 2018, 2021; Aguilar, 2020; Aguilar et al., 2021)

PR-availability or plausibility?

(Grillo et al., 2015a, *Cognition* 144):

- RC-Attachment appears largely influenced by PR-availability
- PR-availability, however, covaries with semantics of the main predicate (e.g. perceptual vs. stative).
- Essential to test a nonPR language (e.g. English) to assess whether predicate distinction alone can account for the results (cf. Rohde et al. 2011).

Effects of PR-availability within a language

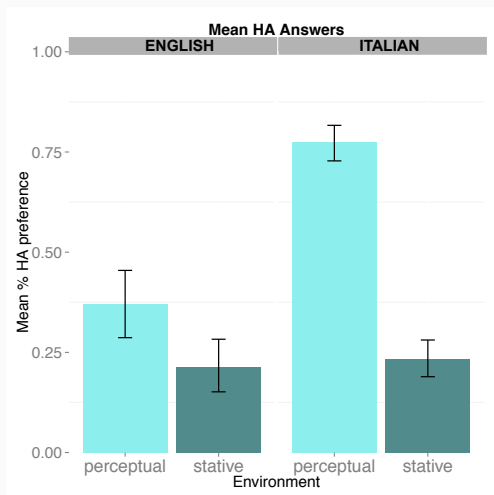
Attachment Questionnaire

Contrast:

- (11) a. John **saw** the son of the doctor that was running. PERCEPTUAL
b. John **lives with** the son of the doctor that was running. STATIVE

PR-availability or plausibility?

(Grillo et al., 2015a, *Cognition* 144)



Preference for Small Clause over Restrictive reading (or for events over entities) also found comparing *reduced* RCs and:

- Eventive Small Clauses in English (Grillo et al., 2015a, *Cognition* 144)
- Prepositional Infinitive Constructions in European Portuguese (Fernandes, 2012; Grillo et al., 2013a, *CUNY*)

Summary

- When PRs/SCs are not available, LA is found across languages and structures (all else being equal)
- When PRs/SCs are available, High Attachment is found
- Differences in RC-attachment are rooted in grammatical differences

Beyond Attachment

- Previous studies tested consequences of *PR-first* for RC-attachment
- It is possible to directly test *PR-first* in the absence of attachment ambiguities
- How? We used Tense to force RC-reading in otherwise PR-compatible environments
- Techniques: Acceptability, Eye-Tracking while reading, Sentence completion

PRs require matching Tense between matrix & embedded V:

- (12) Marie a vu l'homme qui courait. PR/RC
M. saw.PAST the man that ran.PAST .

Mismatching Tense forces RC interpretation:

- (13) Marie voit l'homme qui courait. RC only
M. sees.PRES the man that ran.PAST .

PRs are easier than RCs

Grillo (2015 *CUNY*), Pozniak, Hemforth, Haendler, Santi, and Grillo (2019, *JML*):

- Force RC-reading in PR-licensing environments with Tense Mismatch
- Acceptability Judgment (Italian, French, English)
- Eye-tracking while reading (French, English)

VERB TYPE	TENSE	Sample Sentence
<i>Perceptual</i>	<i>Match</i>	Jean a vu la fille qui poussait la femme. John saw the girl that pushed the lady.
<i>Perceptual</i>	<i>Mismatch</i>	Jean voit la fille qui poussait la femme. John sees the girl that pushed the lady.
<i>Stative</i>	<i>Match</i>	Jean était marié à la fille qui poussait la femme. John was married to the girl that pushed the lady.
<i>Stative</i>	<i>Mismatch</i>	Jean est marié à la fille qui poussait la femme. John is married to the girl that pushed the lady.

Pozniak et al. (2019); Fernandes et al. (2018): Consistent results from eye-tracking and acceptability studies

- Forcing RC-reading leads to :
 - Lower acceptability (in both Italian and French)
 - Longer regression path duration at ROI
 - Higher proportion of regressions-out of the ROI
- No effects with identical manipulation in globally unambiguous RC-environments
- No effects in English (nonPR language).

Effects of PR-availability not reducible to independent interpretive mechanisms

Conclusions

- PR-availability modulates RC-attachment across languages
- Parsing preference for PR over RC interpretation
- *PR-first* accounts for residual variation in RC-attachment results not explained by other known factors
- Cross-linguistic Asymmetries in RC-attachment are epiphenomenal
- Locality principles apply universally

References

- Abdelghany, H. and Fodor, J. (1999). Low attachment of relative clauses in arabic. Poster presented at the 5th Annual Conference on Architectures and Mechanisms for Language Processing (AMLaP), Edinburgh, UK, September 23-25.
- Aguilar, M. (2020). *On Pseudorelatives and Human Sentence Parsing*. PhD thesis, Universidade Nova de Lisboa, Lisbon, Portugal.
- Aguilar, M. and Grillo, N. (2016). Testing the effect of pseudo relatives on relative clause attachment in Spanish. In *AMLaP (Architectures and Mechanisms for Language Processing)*, Bilbao, Spain.
- Aguilar, M. and Grillo, N. (2018). Aspectual make-up modulates adaptation to relative clause parse. In Knoeferle, P., editor, *AMLaP 2018, Architectures and Mechanisms for Language Processing*, page 214, Berlin, Germany.
- Aguilar, M. and Grillo, N. (2021). Spanish is *not* different: On the universality of minimal structure and locality principles in relative clause attachment. *Under review in Glossa: a journal of general linguistics*.
- Aguilar, M., José M., G., Pilar, F., A., H. J., and Josep, D. (2021). The actress was on the balcony after all: Eye-tracking locality effects on relative clause attachment in spanish. *Under Review in Cognition*.
- Altmann, G. and Steedman, M. (1988). Interaction with context during human sentence processing. *Cognition*, 30(3):191–238.
- Augurzy, P. (2005). *Attaching Relative Clauses in German: The Role of Implicit and Explicit Prosody in Sentence Processing*. PhD thesis, University of Leipzig.
- Brysbaert, M. and Mitchell, D. (1996). Modifier attachment in sentence parsing: Evidence from dutch. *Quarterly Journal of Experimental Psychology*, 49A:664–695.
- Burzio, L. (1986). *Italian Syntax: A Government and Binding Approach*. D. Reidel, Dordrecht.
- Carreiras, M. and Clifton, C. (1993). Relative clause interpretation preferences in Spanish and English. *Language and Speech*, 36:353–372.
- Carreiras, M. and Clifton, C. (1999). Another word on parsing relative clauses: Eye-tracking evidence from Spanish and English. *Memory and Cognition*, 27:826–833.

References ii

- Casalicchio, J. (2013). *Pseudorelative, gerundi e infiniti nelle varietà romanze: Affinità solo superficiali e corrispondenze strutturali*. PhD thesis, Università degli Studi di Padova.
- Cinque, G. (1992). The Pseudo-Relative and Acc-ing constructions after verbs of perception. In *University of Venice Working Papers in Linguistics*. Università di Venezia.
- Colonna, S. and Pynte, J. (2001a). Relative clause attachment in french: The role of fodor's "same size sister" constraint. Poster presented at the Prosody in Processing workshop, Utrecht, July 5-6.
- Colonna, S., Pynte, J., and Mitchell, D. (2000). Relative clause attachment in french: The role of constituent length. Poster presented at the 13th Annual CUNY Conference on Human Sentence Processing, La Jolla, CA, March 30 - April 1.
- Costa, J., Vaz, S., Fernandes, B., and Grillo, N. (2016). Pseudo-relatives and PIC in the parsing and acquisition of European Portuguese. *Probus*, 28:119–143.
- Crain, S. and Steedman, M. (1985). *On not being led up the garden path: the use of context by the psychological syntax processor*, pages 320–358. Cambridge University Press, United States. Cambridge Books Online.
- Cuetos, F., Mitchell, D., and Corley, M. (1996). Parsing in different languages. In Carreiras, M., García-Albea, J., and Gallés, N. S., editors, *Language processing in Spanish*, pages 145–187, Mahwah, N.J. Lawrence Erlbaum.
- Cuetos, F. and Mitchell, D. C. (1988). Cross-linguistic differences in parsing. *Cognition*, 30:73–105.
- De Vincenzi, M. and Job, R. (1993). Some observations on the universality of the late closure strategy. *Journal of Psycholinguistic Research*, 22:189, 206.
- De Vincenzi, M. and Job, R. (1995). An investigation of late closure: The role of syntax, thematic structure, and pragmatics in initial interpretation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21:1303–1321.
- Desmet, T., De Baecke, C., and Brysbaert, M. (2002). The influence of referential discourse context on modifier attachment in Dutch. *Memory and Cognition*, 30:150–157.
- Ehrlich, K., Fernández, E., Fodor, J., Stenshoel, E., and Vinereanu, M. (1999). Low attachment of relative clauses: New data from Swedish, Norwegian and Romanian. Poster presented at the 12th Annual CUNY Conference on Human Sentence Processing. New York, NY, March 18-20.

- Fernandes, B. (2012). Attachment preferences in Prepositional Infinitive Constructions. Master's thesis, Centro de Linguística da Universidade Nova de Lisboa.
- Fernandes, B. (2021). *Pseudorelatives: Parsing Preferences and their Natural Concealment*. PhD thesis, Universidade Nova de Lisboa, Lisbon, Portugal.
- Fernandes, B., Alexiadou, A., Chow, W.-Y., Santi, A., and Grillo, N. (2018). Adaptation to complex cues in sentence comprehension. In *31st CUNY Conference on Human Sentence Processing*, pages 441–442. UC Davis.
- Fernández, E. (2003). *Bilingual sentence processing: Relative clause attachment in English and Spanish*. John Benjamins, Amsterdam.
- Fodor, J. D. (1998a). Learning to Parse? *Journal of Psycholinguistic Research*, 27:285–319.
- Fodor, J. D. (1998b). Parsing to Learn? *Journal of Psycholinguistic Research*, 27:339–374.
- Fraga, I., García-Orza, J., and Acuña, J. (2005). La desambiguación de oraciones de relativo en Gallego: nueva evidencia de adjunción alta en lenguas romances. *Psicológica*, 26:243–260.
- Frazier, L. (1979). *On comprehending sentences: Syntactic parsing strategies*. PhD thesis, University of Massachusetts.
- Frazier, L. (1990). Parsing modifiers. special purpose routines in the human sentence processing mechanism? In Balota, D. and d'Arcais, G. F., editors, *Comprehension Processes in Reading*, pages 303–330. Lawrence Erlbaum, Hillsdale, N.J.
- Frazier, L. and Clifton, C. (1996). *Construal*. MIT Press, Cambridge, MA.
- Frenc-Mestre, C. and Pynte, J. (2000). Romancing syntactic ambiguity: Why the French and the Italians don't see eye to eye. In Kennedy, A., Radach, R., Heller, D., and Pynte, J., editors, *Reading as a Perceptual Process*, pages 549–564. Elsevier, Oxford, UK.
- Gibson, E. (1991). *A computational theory of human linguistic processing: Memory limitations and processing breakdown*. PhD thesis, Carnegie Mellon University.
- Gibson, E., Pearlmutter, N., and Torrens, V. (1999). Recency and lexical preferences in spanish. *Memory & Cognition*, 27:603–611.
- Gilboy, E., Sopena, J., Clifton, C., and Frazier, L. (1995). Argument structure and association preferences in spanish and english complex NPs. *Cognition*, 54:131–167.
- Graffi, G. (1980). Su alcune costruzioni "pseudorelativa". *Rivista di Grammatica Generativa*, 5:115–139.

References iv

- Grillo, N. (2012). Local and universal. In Bianchi, V. and Chesi, C., editors, *Enjoy Linguistics! Papers offered to Luigi Rizzi on the occasion of his 60th birthday*, pages 234–245. CISCL Press, Siena, Italy.
- Grillo, N. and Costa, J. (2014). A novel argument for the universality of parsing principles. *Cognition*, 133(1):156–187.
- Grillo, N., Costa, J., Fernandes, B., and Santi, A. (2015a). Highs and Lows in English Attachment. *Cognition*, 144:116–122.
- Grillo, N., Fernandes, B., and Costa, J. (2012a). Attachment preferences in Prepositional Infinitive Constructions in European Portuguese. In *AMLAP (Architectures and Mechanisms for Language Processing)*, Riva del Garda, Italy.
- Grillo, N., Fernandes, B., and Costa, J. (2012b). Universally local attachment: New evidence from PIC. In *ERP Experimental Psycholinguistics Conference*, Madrid, Spain.
- Grillo, N., Habboub, S., and Lungu, O. (2015b). Matrix verb type modulates similarity based intervention. In Kaiser, E., Mintz, T., Pancheva, R., and Zevin, J., editors, *28 CUNY Conference on Human Sentence Processing*, Los Angeles. University of Southern California.
- Grillo, N., Hemforth, B., Pozniak, C., and Santi, A. (2015c). Pseudo Relatives are easier than Relative Clauses: Evidence from Tense. In Kaiser, E., Mintz, T., Pancheva, R., and Zevin, J., editors, *28th CUNY Conference on Human Sentence Processing*, Los Angeles. University of Southern California.
- Grillo, N., Hemforth, B., Pozniak, C., and Santi, A. (2015d). Pseudo Relatives are easier than Relative Clauses: Eye Tracking evidence from Tense. In *AMLAP (Architectures and Mechanisms for Language Processing)*.
- Grillo, N. and Moulton, K. (2016). Event kinds and the pseudo relative. In Prickett, B. and Hammerly, C., editors, *NELS 46: Proceedings of the Forty-Sixth Annual Meeting of the North East Linguistics Society*, volume 2, pages 11–20, Amherst MA. GLSA.
- Grillo, N. and Moulton, K. (submitted). Sorting out pseudo relatives: Clausal determiners and AGREE. *Natural Language and Linguistic Theory*.
- Grillo, N., Santi, A., Fernandes, B., and Costa, J. (2013a). Highs and Lows in English attachment. In *26th CUNY Conference on Human Sentence Processing*, Columbia, South Carolina.
- Grillo, N. and Spathas, G. (2014). Tense and Aspect modulate RC attachment: Testing the PR hypothesis in Greek. In *Experimental and theoretical approaches to relative clauses reconciled*, Marburg, Germany. 36 DGfS (Jahrestagung der Deutschen Gesellschaft für Sprachwissenschaft).

- Grillo, N., Tomaz, M., Lourenço Gomes, M., and Santi, A. (2013b). Pseudo relatives vs. Relative clauses: Greater preference, Lower costs. In *AMLaP (Architectures and Mechanisms for Language Processing)*, Marseille, France.
- Guasti, M. (1988). La pseudorelativa et les phénomènes d'accord. *Rivista di Grammatica Generativa*, 13:35–57.
- Guasti, M. (1992). Progressive in the complements of perception verbs. In Bonomi, Casalegno, and Zwarts, editors, *Proceedings of the Gargano Conference on "Perceptual Reports"*.
- Gutierrez-Ziardegi, E., Carreiras, M., and Laka, I. (2004). Bilingual sentence processing: Relative clause attachment in basque and spanish. In *CUNY Conference on Human Sentence Processing*, University of Maryland.
- Hemforth, B., Konieczny, L., and Scheepers, C. (1996). Syntactic and anaphoric processes in modifier attachment. In *9th CUNY Conference on Human Sentence Processing*.
- Hemforth, B., Konieczny, L., and Scheepers, C. (2000a). Modifier attachment: Relative clauses and coordinations. In Hemforth, B. and Konieczny, L., editors, *German Sentence Processing*, pages 161–186. Kluwer, Dordrecht.
- Hemforth, B., Konieczny, L., and Scheepers, C. (2000b). Syntactic attachment and anaphor resolution: Two sides of relative clause attachment. In Crocker, M., Pickering, M., and Clifton, C., editors, *Architectures and Mechanisms for Language Processing*, pages 259–281. Cambridge University Press, Cambridge, UK.
- Hemforth, B., Konieczny, L., Scheepers, C., and Strube, G. (1998). Syntactic ambiguity resolution in German. In Hillert, D., editor, *Syntax and Semantics: A cross-linguistic perspective*, pages 293–312. Academic Press, San Diego.
- Igoa, J., Carreiras, M., and Meseguer, E. (1998). A study on Late Closure in Spanish: Principle-grounded vs. frequency-based accounts on attachment preferences. *Quarterly Journal of Experimental Psychology*, 51A(3):561–592.
- Kayne, R. (1975). *French Syntax: The Transformational Cycle*. MIT Press, Cambridge, MA.
- Kimball, J. (1973). Seven principles of surface structure parsing in natural language. *Cognition*, 2(1):15–47.
- Konieczny, L. and Hemforth, B. (2000). Modifier attachment in German. In Kennedy, A., Radach, R., Heller, D., and Pynte, J., editors, *Reading as a Perceptual Process*, pages 517–526. Elsevier, Oxford, UK.
- Lovrić, N. (2003). *Implicit prosody in silent reading: Relative clause attachment in Croatian*. PhD thesis, City University of New York.
- Luigi, R. direct perception, government and thematic sharing. *Geneva Generative Papers*, 1:39–52.

References vi

- Maia, M., Costa, A., Fernández, E., and Lourenço-Gomes, M. (2006). Early and late preferences in relative clause attachment in Portuguese and Spanish. *Journal of Portuguese Linguistics*, 5:203–226.
- Maia, M. and Maia, J. (2001). The comprehension of relative clauses by monolingual and bilingual speakers of Portuguese and English. Paper presented at the Congresso de Sociedade Internacional de Português como Língua Estrangeira (SIPLE), November 2001.
- Mitchell, D., Cuetos, F., and Zagar, D. (1990). Reading in different languages: is there a universal mechanism for parsing sentences? In Balota, D. and d'Arcais, G. F., editors, *Comprehension processes in reading*, pages 285–302. Lawrence Erlbaum, Hillsdale, N.J.
- Mitchell, D. C. and Brysbaert, M. (1998). Challenges to recent theories of crosslinguistic variation in parsing: Evidence from Dutch. In Hillert, D., editor, *Sentence Processing: A Crosslinguistic Perspective*, pages 313–335. Academic Press, San Diego, CA.
- Mitchell, D. C., Brysbaert, M., and Swanepoel, S. (2000). Modifier attachment in Dutch: Testing aspects of Construal Theory. In A. Kennedy, R. Radach, D. H. and Pynte, J., editors, *Reading as a Perceptual Process*, pages 493–516. Elsevier, Oxford, UK.
- Mitchell, D. C. and Cuetos, F. (1991). The origin of parsing strategies. In Smith, C., editor, *Current issues in Natural Language Processing*, pages 1–12. Center for Cognitive Science, U. of Austin, TX.
- Miyamoto, E. (1999). *Relative clause processing in Brazilian Portuguese and in Japanese*. PhD thesis, MIT, Cambridge, MA.
- Miyamoto, E. (2005). Orações relativas amebiguas e a homogeneidade do processamento de sentenças. In M.Maia and Finger, I., editors, *Processamento da Linguagem*, pages 71–90. Educat, Pelotas.
- Moulton, K. and Grillo, N. (2015). Pseudo relatives: Big but Transparent. In Bui, T. and Ozyildiz, D., editors, *NELS 45: Proceedings of the Forty-fifth Annual Meeting of the North East Linguistic Society*, pages 193–202, MIT Cambridge, MA.
- Murray, W., Rahman, A., and Heydel, M. (2000). Modifier attachment preferences across languages and across structures.
- Papadopoulou, D. and Clahsen, H. (2003). Parsing strategies in L1 and L2 sentence processing: A study of relative clause attachment in Greek. *Studies in Second Language Acquisition*, 25:501–528.
- Phillips, C. (1996). *Order and Structure*. PhD thesis, Massachusetts Institute of Technology, Cambridge, MA.
- Phillips, C. and Gibson, E. (1997). The strength of the local attachment preference. *Journal of Psycholinguistic Research*, 26:323–346.
- Pozniak, C., Hemforth, B., Haendler, Y., Santi, A., and Grillo, N. (2019). Seeing events vs. entities: The processing advantage of pseudo relatives over relative clauses. *Journal of Memory and Language*, 107:128–151.

- Quinn, D., Abdelghany, H., and Fodor, J. (2000). More evidence of implicit prosody in reading. French and Arabic relative clauses.
- Radford, A. (1975). Pseudo-relatives and the unity of subject-raising. *Archivum Linguisticum*, 6:32–64.
- Rafel, J. (1999). *Complex Small Clauses*. PhD thesis, Universitat Autònoma de Barcelona.
- Ribeiro, A. (1998). Um caso de não aplicação de Late Closure no Português do Brasil. Rio de Janeiro: UFRJ / FL. Mimeo.
- Ribeiro, A. (2005). Late Closure em parsing no Português do Brasil. In M. Maia, I. F., editor, *Processamento da Linguagem*, pages 51–70. Pelotas: Educat.
- Rohde, H., Levy, R., and Kehler, A. (2011). Anticipating explanations in relative clause processing. *Cognition*, 118:339–358.
- Sekerina, I. (1997). The Late Closure Principle vs. the Balance Principle: Evidence from on-line processing of ambiguous Russian sentences. In Costa, P., editor, *The Proceedings of the Second European Conference on Formal Description of Slavic Languages*, University of Potsdam, Germany.
- Sekerina, I. (2004). Cross-linguistic variation in gender use as a parsing constraint: Dutch vs. Russian. Paper presented at the 13th Annual Meeting Formal Description of Slavic Languages, 13 FASL, Columbia, February 24-29.
- Sekerina, I., Petrova, K., and Fernández, E. (2003). Relative clause attachment in Bulgarian. Paper presented at the 12th Annual Meeting Formal Description of Slavic Languages, 12 FASL, Ottawa, May 9-11.
- Shen, X. (2006). *Late assignment of syntax theory: evidence from Chinese and English*. PhD thesis, University of Exeter.
- Staub, A., Foppolo, F., Donati, C., and Cecchetto, C. (2018). Relative clause avoidance: Evidence for a structural parsing principle. *Journal of Memory and Language*, 98:26–44.
- Swets, B., Desmet, T., Hambrick, D. Z., and Ferreira, F. (2007). The role of working memory in syntactic ambiguity resolution: A psychometric approach. *Journal of Experimental Psychology-General*, 136(1):64–81.
- Tomaz, M., Lourenço Gomes, M., Santi, A., and Grillo, N. (2014). A concordância de número em construções relativas e pseudorelativas em Português europeu. In *Textos Seleccionados do XXIX Encontro Nacional da Associação Portuguesa de Linguística*.
- Zagar, D., Pynte, J., and Rativeau, S. (1997). Evidence for early-closure attachment on first-pass reading times in French. *Quarterly Journal of Experimental Psychology*, 50A(2):421–438.

- Question: Is PR-preference observable in *Production*?
- Method: Sentence completion tasks in Spanish (PR language) and English (nonPR language)
- Participants: 40 Spanish native speakers and 40 English native speakers
- Materials: 24 Target items /72 fillers

- (14) a. PERCEPTUAL MATRIX VERB - PAST/PRESENT TENSE:
lan **vio/ve** al dentista que...
lan **saw/sees** the dentist that ...
- b. STATIVE MATRIX VERB - PAST/PRESENT TENSE:
lan **trabajó/ trabaja** con el dentista que...
lan **worked with/ works with** the dentist that...

- If predictions built while reading match preferences in comprehension, high level of regularity in a number of properties of embedded clause (with high probability of PR-compatible continuations) is expected under perceptuals in comparison to statives in Spanish.
- A more heterogeneous landscape is predicted in English, with a small modulatory role of verb-type (as in e.g. [Grillo et al., 2015a](#)).

Criteria employed in analysis:

Property	RCs	PRs	SCs
Tense restrictions	*	✓	✓
Outer aspect restrictions	*	✓	✓
Restrictions on embedded predicate	*	✓	✓
Restrictions on adverbial	*	✓	✓
Available w. objects	✓	*	*

Table 3: Criteria distinguishing RCs and PR/SC used in the analysis

Results Completion: Spanish & English

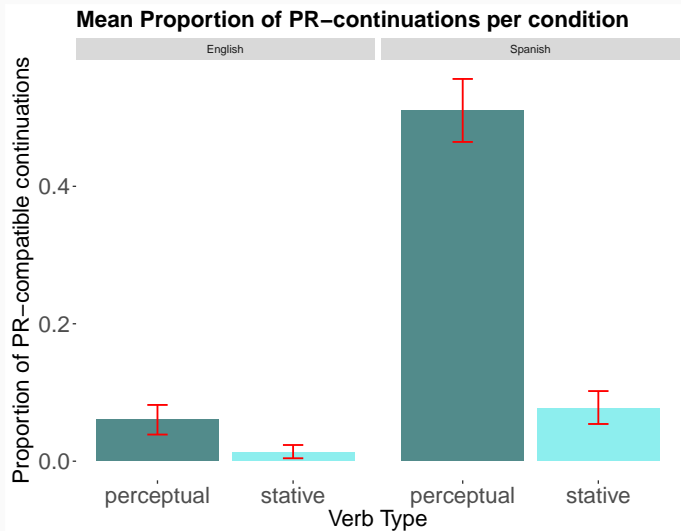


Figure 5: Proportion of PR-compatible continuations in Spanish & English

Results Completion: Italian

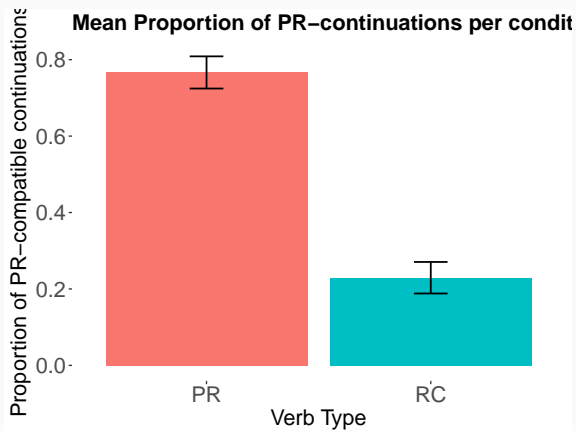


Figure 6: Proportion of PR-compatible completions in Italian across condition

“PR-compatible” = matching the criteria for PR compatibility in Table 3

- Production results match results from comprehension literature
- Strong effect of PR-availability (matrix Verb-Type) in Italian and Spanish but not English
- No difference across languages in nonPR environments (i.e. under stative predicates)
- Difference between PR licensing and non-licensing environments cannot be explained by a predicate semantics effect (in line with [Grillo et al. \(2015a\)](#)).

Conclusions

- PR-availability modulates RC-attachment across languages
- Parsing preference for PR over RC interpretation
- In other terms: stronger prediction for an event (rather than an entity) after perceptual verbs
- *PR-first* accounts for residual variation in RC-attachment results not explained by other known factors
- Cross-linguistic Asymmetries in RC-attachment are epiphenomenal
- Locality principles apply universally

(15) *Italian*

- a. Ho visto **Gianni che correva.** (PR)
I.have seen Gianni that ran-IMPF
'I saw Gianni running'
- b. Ho visto **il ragazzo che correva.** (RC)
I.have seen the guy that ran-IMPF
'I saw the guy that was running'

PRs are not Relative Clauses

Proper N:

- (16) a. Ho visto Gianni che correva. PR / *RC
Have.I seen Gianni that run.IMPF.
'I saw Gianni running.'
- b. Ho visto Gianni, che correva. Appositive

PRs are not Appositive Relative Clauses

Appositive relatives can have Proper Noun heads, but they are set off by intonational pauses.

- (17) a. *John that ran is happy. *restrictive relative*
b. John, who ran, is happy *appositive relative*

- (18) a. *Gianni che correva è felice. *restrictive*
Gianni that ran-IMPF, is happy.
'Gianni who ran is happy.'
- b. Gianni, che correva, è felice. *appositive*
Gianni, that ran-IMPF, is happy.
'Gianni, who ran, is happy.'

PRs are not Appositive Relative Clauses

But PRs do **not** need to be set off by pauses like this:

- (19) Ho visto **Gianni che correva**. (Italian)
I.have seen Gianni that ran-IMPF
'I saw Gianni running'

PRs are not Appositive Relative Clauses

- RCs cannot modify pronouns
- This is true of both restrictive and non restrictive RCs.

(20) L'ho visto che correva. *restrictive*
Him'have.1ST.SING seen that ran-IMPF.
'I saw him that was running.'

PRs do not require proper names

- Notice that we often use proper names to more easily distinguish PRs from RCs,
- PRs, however, do not *require* proper names

- (21) a. Ho visto **Gianni, che correva.** (Italian)
I.have seen Gianni, who was ran-IMPF
'I saw Gianni, who was running'
- b. Ho visto **il ragazzo che correva.** (Italian)
I.have seen the guy that ran-IMPF
'I saw the boy that was running'

No Relative Pronouns:

- (22) *Ho visto Gianni il quale correva.
Have.I seen Gianni the which run.IMPF.
'I saw Gianni who was running.'

PRs are not Relative Clauses

- (23) a. Sento il cane che abbaia.
I.hear the dog that barks.
- b. Sento il cane il quale abbaia.
I.hear the dog the which barks.
'I hear the dog barking'

(Casalicchio 2013)

Restriction to subjects

- (24)
- a. *Luigi ha visto [_{PR} Gianni_i che Maria baciava EC_i].
Luigi saw Gianni that Maria kissed EC.
'*Luigi saw John Mary kissing EC.'
 - b. Luigi ha visto il ragazzo che Maria ha baciato <ragazzo>. RC only
Luigi saw the boy that Mary kissed.
 - c. Few Exceptions:
L'ho visto che lo inseguivano.
Him have seen.I that him followed
'I saw him while they followed him.'

Temporal Interpretation

- the time of the event describe by the PR must overlap (or be simultaneous with) the time of the event/state described by the matrix verb.

Temporal Interpretation

Present matrix must combine with present PR; perfect matrix must combine with imperfective PR.

- (25) a. Vedo Marco che corre
I.see Marco that runs-PRES
'I see Marco running'
- b. Ho visto Marco che correva
I.have seen Marco that run-IMPF
'I saw Marco running'

- (26) a. *Vedo Marco che correva /ha corso /correrà
I.see Marco that runs-IMPF /has run /will.run
- b. *Ho visto Marco che corre /correrà
I.have seen Marco that run-PRES /will.run

But see [Grillo and Moulton \(2016\)](#) for cases in which present tense under an experiential perfect delivers an event kind interpretation in Italian

Temporal interpretation is not quite about matching though:

- (27) a. Vedró Marco che corre.
I.will.see Marco that runs-PRES
'I will see Marco running'
- b. #Vedró Marco che correrá.
I.will.see Marco that will.run.
'I will see Marco that will run'

Anaphoric T:

- (28) Vedró Marco che corre.
I.will.see Marco that runs-PRES
'I will see Marco running'

This shows that Tense is indeed anaphoric and not just matching, as the interpretation that ensues is the same:

→ the matrix event happens within the interval defined by the embedded situation.

Perfective not allowed in PRs.

- (29) Ho visto Gianni che correva / *che è corso a casa.
'I saw Gianni running / that had run home.'

Only stage level predicates allowed

- (30) a. *L'ho visto che conosce l'Inglese.
I saw him that knows English.
- b. Ho visto Gianni che *aveva gli occhi rossi* /
I saw Gianni that had the
**aveva gli occhi blu.*
eyes red / had the eyes blue.
'I saw Gianni with red eyes / *with blue eyes.'

Restrictions on Matrix V:

- (31) a. Ho incontrato Gianni che correva.
I.have met the boy that ran.
'I met the boy running.'
- b. *Vivevo con Gianni che correva.
I.lived with the boy that ran.
'I lived with the boy that ran.'

PRs are not Relative Clauses

None of these restrictions hold of RCs:

- (32) a. Vedo il ragazzo che corre /correva /ha corso
I.see the guy that run-PRES /run-IMPF /has run
/correrà
/will.run
'I see the guy that is running/was running/has run/will run.'
- b. Ho visto il ragazzo che corre /correva /ha corso
I.have seen the guy that run-PRES /run-IMPF /has
corso /correrà
run /will.run
'I have seen the guy that is running/was running/has
run/will run.'