HUMBOLDT-UNIVERSITÄT ZU BERLIN


# Reflexivizing Spanish psych-verbs

## Ambiguities across classes

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# Contents

# Introduction

The *se*-morpheme in Spanish can be interpreted differently:

(1) Ana **se** baña. 'Ana showers **herself**.'

(2) Ana **se** asusta. 'Ana **gets** frightened.'

(3) Ana y Lía **se** ven todos los días. 'Ana and Lía see **each other** every day.'

Reading (1): **true reflexive** (Arad 1998; Grimshaw 1990; Haspelmath 2019)

Reading (2):

- **anti-causativizer** (Schäfer 2008; Alexiadou et al. 2015; Alexiadou & Iordachioaia 2014)
- **inchoativizer** (De Miguel & Fernández 2000; Bar-el 2005; Haspelmath 1993)
- **left-boundary marker** (Marín & McNally 2005, 2011)

**Goal:** unified model of various *se*-morpheme readings to see commonalities and differences (focus of present talk: (1) & (2))

# The psych alternation

- Spanish alternates the EXP from a basic **transitive experiencer-object** (EO) verb (cf. (4)) to an **intransitive experiencer-subject** (ES) verb (cf. (5)) by means of the *se*-morpheme.
- Psych alternation (cf. Landau 2010)

(4) Ana$_{\text{STM}}$ asusta a Carlos$_{\text{EXP}}$. [EO]
Ana frightens to Carlos
'Ana frightens Carlos.'

(5) Carlos$_{\text{EXP}}$ **se** asusta. [ES]
Carlos SE frightens
'Carlos gets frightened.'

# Research Questions

In Spanish, how can we model...

- ... **two of the different readings** of the *se*-morpheme in the psych domain, i.e. reflexive reading and left-bounded state reading,
- ... the **left boundary** with psych-verbs,
- ... the different **subtypes of psych-verbs**, i.e. punctuals and non-punctuals
- ... the **alternation** between:
  - the morphologically simpler but semantically more complex verb, e.g. *asustar* 'frighten'
  - to the morphologically more complex but semantically more simple verb, e.g. *asustarse* 'get frightened'

In order to answer those questions:

- ontology of eventualities enriched by boundaries (Piñón 1997)
- lexically modeling the different readings of *se*-morpheme (lexical rules)
- Head-driven Phrase Structure Grammar

# Psych-verb classes and *se*-morpheme readings

In the psych domain, the *se*-morpheme combines with **different sub-classes** of psych-verbs yielding to **different readings** (cf. e.g. Belleti & Rizzi 1988, MyP&FH 2018):

- (true) reflexive reading
- left-bounded state reading

| EXAMPLE | TYPE | *se* READING | $\theta$-ROLE | CLASS |
|---|---|---|---|---|
| **gustar*(*se*) | state | — | EXP | 1 |
| *divertir*(*se*) | non-punctual | true reflexive | EXP + STM | 2 |
| | | left-bounded state | EXP | 2 |
| *asustar*(*se*) | punctual | true reflexive | EXP + STM | 2 |
| | | left-bounded state | EXP | 2 |
| *amar*(*se*) | state | true reflexive | EXP + STM | 3 |

Table 1: *se*-morpheme and Spanish psych-verbs (MyP&FH 2018)

# True reflexive reading

- semantically transitive predicates with two theta-roles:
  - a STM with proto-agent properties, and
  - an EXP with proto-patient properties
- Both theta-roles are assigned to the same entity (e.g. *Carlos* in (6)).
- *se* reflexive reading (cf. Arad 1998; MyP&FH 2019) with:
  - **class 2**, e.g. 'entertain' and 'frighten' in (6)
  - **class 3**, e.g. 'love' in (7)

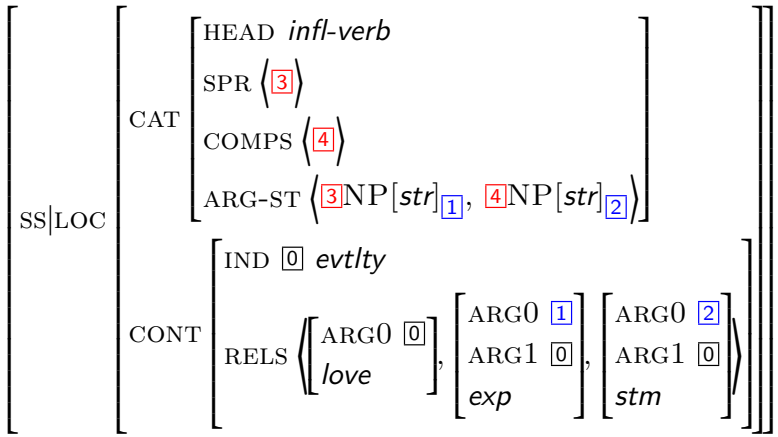
(6) Carlos$_{\text{EXP}/\text{STM}}$ se divierte / se asusta (a sí mismo).
Carlos SE entertains / SE frightens to him self
'Carlos entertains / frightens himself.'

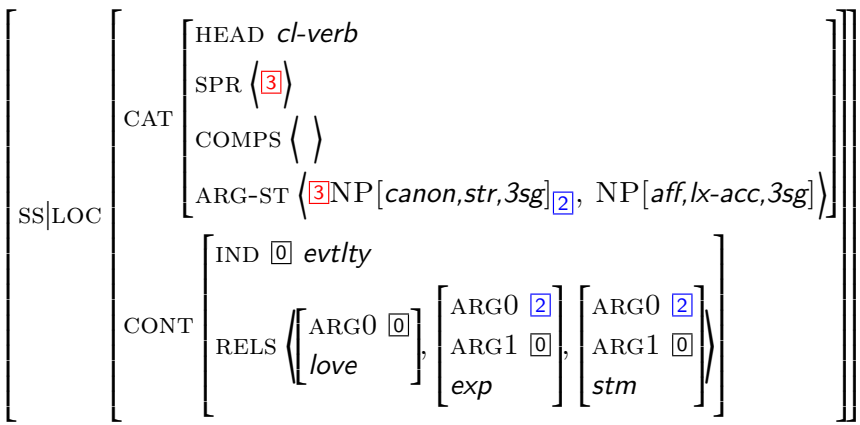
(7) Ana$_{\text{EXP}/\text{STM}}$ se ama (a sí misma).
Ana SE loves to her self
'Ana loves herself.'

# True reflexive *se*

(8) Ana ama a Carlos.
'Ana loves Carlos.'

(9) Ana se ama.
'Ana loves herself.'




**Affixes** (non-canonical arguments) are **not mapped** into the **valency lists**.
(following Miller & Sag 1997; Bouma et al. 2001; Abeillé & Godard 2002)

# Inchoative reading vs. left-bounded reading

- In **class 2**, *se*-morpheme has been generally analyzed as an inchoativizer resulting in a change of state (CoS) verb (cf. Arad 1998; Alexiadou et al. 2015).
- Inchoativity is formalized by means of the BECOME operator (cf. Dowty 1991).
- BECOME models the transition from e.g. not being dry to being dry in (10).
- Telicity and CoS verbs:
  *in*-adverbial measures the interval of an eventuality (cf. 10) (Dowty 1991).

(10) La ropa se secó **en 5 minutos**.
the clothes SE dried in 5 minutes
'The clothes got dried in 5 minutes.'

# Inchoative reading vs. left-bounded reading

- **Class 2** *se* psych-verbs: left-bounded states (Marín & McNally 2005, 2011)
- Instead of an **inchoativizer**, these verbs have a **left boundary** (cf. Piñón 1997).
- The left boundary is the **beginning** of the state the verb refers to.
- Class 2 *se* psych-verbs exclude the interval prior to beginning of the state (in contrast to the inchoative reading).
- Telicity and left-bounded states: **atelic**.
  *In*-adverbial has an **ingressive** reading, i.e. *after* (cf. 11) (Piñón 1997)

(11) Carlos se divirtió / se asustó **en 5 minutos**.
Carlos SE entertained SE frightened in 5 minutes
'Carlos got entertained / got frightened in 5 minutes.'

Class 2 *se* psych-verbs can be divided into 2 sub-classes (Marín & McNally 2011):

- **punctuals**: denote a left boundary (i.e. a point in time) of a state, e.g. 'get frightened' (cf. 13).
- **non-punctuals**: denote a state with a left boundary, e.g. 'get entertained' (cf. 12).

(12) Carlos se divirtió durante 5 minutos.
Carlos SE entertained for 5 minutes
'Carlos got entertained for 5 minutes.'

(13) Carlos se asustó durante 5 minutos.
Carlos SE frightened for 5 minutes
'Carlos got frightened for 5 minutes.'

Differences in reading with *for*-adverbial:

- **non-punctuals**: durative reading (cf. 12)
- **punctuals**: iterative reading (cf. 13)

*se*-morpheme leads to two readings: left-bounded reading (cf. 12 & 13) and true reflexive reading (cf. 6).

# Non-punctual left-bounded *se*

(14) Ana divierte a Carlos. 'Ana entertains Carlos.'

$$\left[\begin{array}{l}\textsc{ss}|\textsc{loc}\left[\begin{array}{l}\textsc{cat}\left[\begin{array}{l}\textsc{head}\ \textit{infl-verb}\\ \textsc{arg-st}\ \langle \textsc{np}[\textit{str}]_{\boxed{1}},\ \textsc{np}[\textit{str}]_{\boxed{2}}\rangle\end{array}\right]\\ \textsc{cont}\left[\begin{array}{l}\textsc{ind}\ \boxed{0}\ \textit{hppng}\\ \textsc{rels}\ \left\langle\left[\begin{array}{l}\textsc{arg0}\ \boxed{3}\ \textit{state}\\ \textit{entertain}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \boxed{2}\\ \textsc{arg1}\ \boxed{3}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \textit{bound}\\ \textsc{arg1}\ \boxed{3}\\ \textit{left-b}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \boxed{0}\\ \textsc{arg1}\ \boxed{3}\\ \textit{beg-pred}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \boxed{1}\\ \textsc{arg1}\ \boxed{0}\\ \textit{stm-csr}\end{array}\right]\right\rangle\end{array}\right]\end{array}\right]\end{array}\right]$$

(15) Carlos se divierte. 'Carlos gets entertained.'

$$\left[\begin{array}{l}\textsc{ss}|\textsc{loc}\left[\begin{array}{l}\textsc{cat}\left[\begin{array}{l}\textsc{head}\ \textit{cl-verb}\\ \textsc{arg-st}\ \langle \textsc{np}[\textit{canon,str,3sg}]_{\boxed{2}},\ \textsc{np}[\textit{aff,lx-acc,3sg}]\rangle\end{array}\right]\\ \textsc{cont}\left[\begin{array}{l}\textsc{ind}\ \boxed{3}\ \textit{state}\\ \textsc{rels}\ \left\langle\left[\begin{array}{l}\textsc{arg0}\ \boxed{3}\ \textit{state}\\ \textit{entertain}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \boxed{2}\\ \textsc{arg1}\ \boxed{3}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \textit{bound}\\ \textsc{arg1}\ \boxed{3}\\ \textit{left-b}\end{array}\right]\right\rangle\end{array}\right]\end{array}\right]\end{array}\right]$$

# Punctual left-boundary *se*

(16) Ana asusta a Carlos. 'Ana frightens Carlos.'

$$\left[\text{SS|LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD}\ \textit{infl-verb}\\ \text{ARG-ST}\ \left\langle \text{NP}[\textit{str}]_{\boxed{1}},\ \text{NP}[\textit{str}]_{\boxed{2}}\right\rangle\end{array}\right]\\ \text{CONT}\left[\begin{array}{l}\text{IND}\ \boxed{0}\ \textit{hppng}\\ \text{RELS}\ \left\langle\left[\begin{array}{l}\text{ARG0}\ \boxed{3}\ \textit{state}\\ \textit{frighten}\end{array}\right],\left[\begin{array}{l}\text{ARG0}\ \boxed{2}\\ \text{ARG1}\ \boxed{3}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\text{ARG0}\ \textit{bound}\\ \text{ARG1}\ \boxed{3}\\ \textit{left-b}\end{array}\right],\left[\begin{array}{l}\text{ARG0}\ \boxed{0}\\ \text{ARG1}\ \boxed{3}\\ \textit{beg-pred}\end{array}\right],\left[\begin{array}{l}\text{ARG0}\ \boxed{1}\\ \text{ARG1}\ \boxed{0}\\ \textit{stm-csr}\end{array}\right]\right\rangle\end{array}\right]\end{array}\right]\right]$$

(17) Carlos se asusta. 'Carlos gets frightened.'

$$\left[\text{SS|LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD}\ \textit{cl-verb}\\ \text{ARG-ST}\ \left\langle \text{NP}[\textit{canon,str,3sg}]_{\boxed{2}},\ \text{NP}[\textit{aff,lx-acc,3sg}]\right\rangle\end{array}\right]\\ \text{CONT}\left[\begin{array}{l}\text{IND}\ \boxed{1}\ \textit{bound}\\ \text{RELS}\ \left\langle\left[\begin{array}{l}\text{ARG0}\ \boxed{3}\ \textit{state}\\ \textit{frighten}\end{array}\right],\left[\begin{array}{l}\text{ARG0}\ \boxed{2}\\ \text{ARG1}\ \boxed{3}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\text{ARG0}\ \boxed{1}\\ \text{ARG1}\ \boxed{3}\\ \textit{left-b}\end{array}\right]\right\rangle\end{array}\right]\end{array}\right]\right]$$

# Semantic arguments

HPSG organizes linguistic information (features, words, phrases, etc.) in **inheritance hierarchies** to capture **generalizations** (cf. Müller & MyP 2019).

- *semarg* is a type for semantic arguments.
  (cf. Flickinger et al. 2003; Copestake et al. 2005)
- *index* is used normally for nouns.
- *eventuality* is used normally for verbs.
- *eventuality* hierarchy is based on Bach (1986), enriched with the concept of boundaries proposed by Piñón (1997).
- *boundary* is defined as being **a point in time** (and not an interval), and always **a boundary of a further eventuality**.

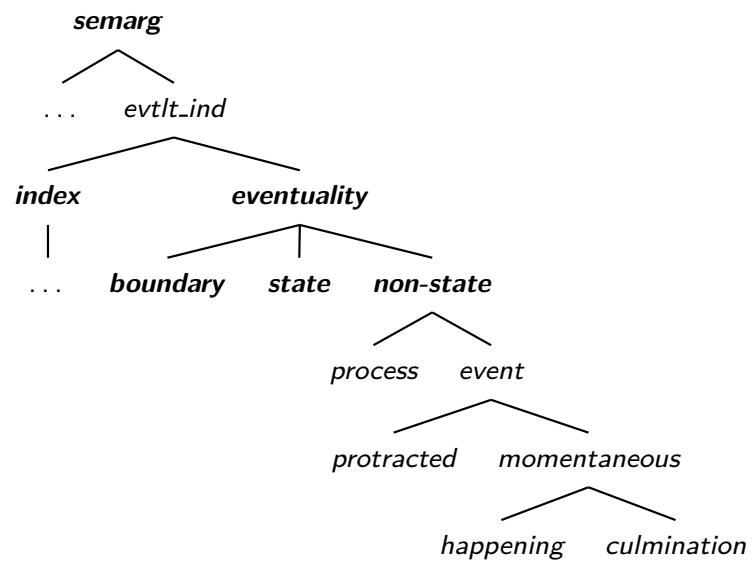



Fig. 1: Type hierarchy for *semarg*

# Semantic relations

- For **predications** we assume a type hierarchy of *semantic relations*.
- We treat $\theta$-**roles** as well as **predicates** as subtypes of *sem-rels* and model $\theta$-roles by means of an **inheritance hierarchy** (MyP&FH 2018).
- We follow a **neo-Davidsonian** (Parsons 1990) approach adapted for HPSG (cf. Copestake 2006; MyP&FH 2018).

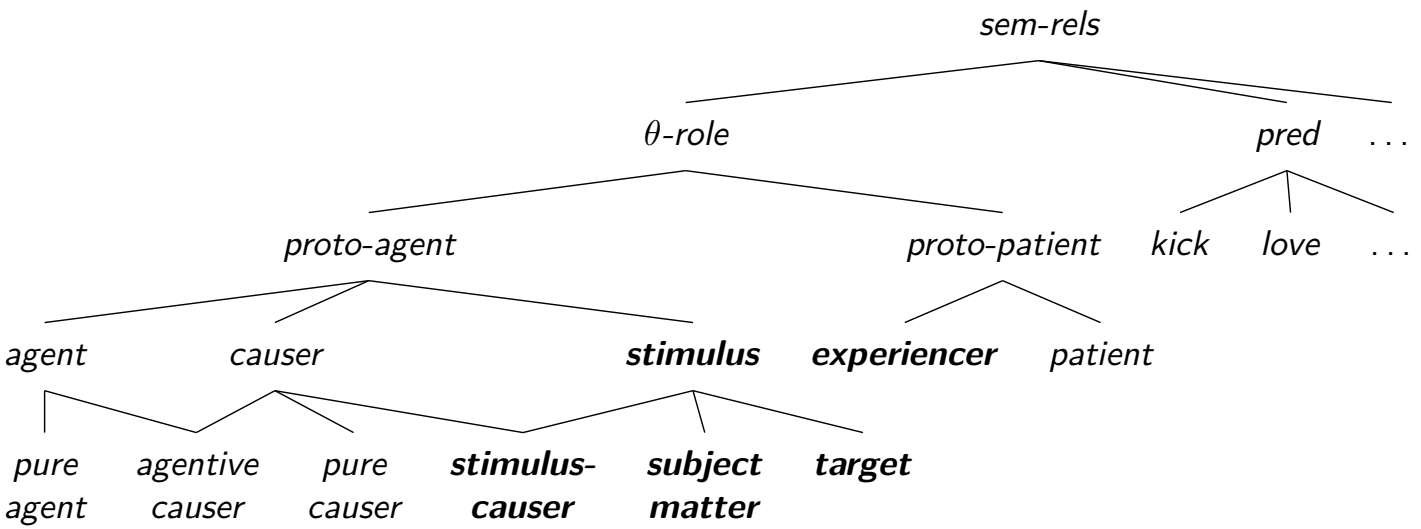



Fig. 2: Type hierarchy for *semantic-relations*

# Lexical rules (LR)

What are the **commonalities** between the **true reflexive** and the **left-bounded** readings with the *se*-clitic?

We propose to account for the similarities between the two structures by means of an **inheritance hierarchy of lexical rules**.

**se-LR:**

- **Input:** inflected verb with 2 arguments with structural case
- **Output:** cliticized verb with one argument with structural case and one affix with lexical accusative

**t-refl-se-LR:**

- **Input:** cliticized verb
- **Output:** argument with structural case is interpreted as having both theta roles (proto-agent and proto-patient)

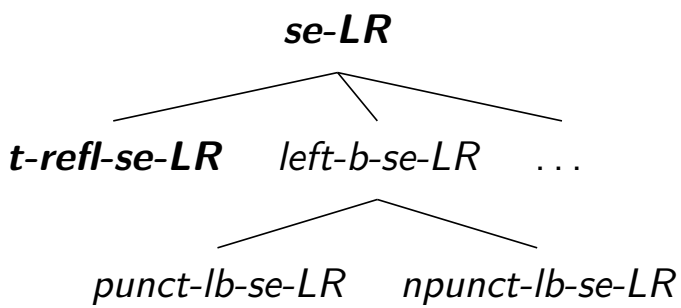



Fig. 3: Lexical Rules for *se*

(18) Ana se ama.
'Ana loves herself.'

**se-LR:**

- Input: inflected verb with 2 arguments with structural case
- Output: cliticized verb with one arguments with structural case and one affix with lexical accusative

**left-b-se-LR:**

- Input: cliticized verb
- Output: argument with structural case is interpreted as an experiencer of a state, furthermore, there is a left boundary of the state

**punct-lb-se-LR:**

- Input: left bounded verb
- Output: the eventuality denoted by the verb is the boundary

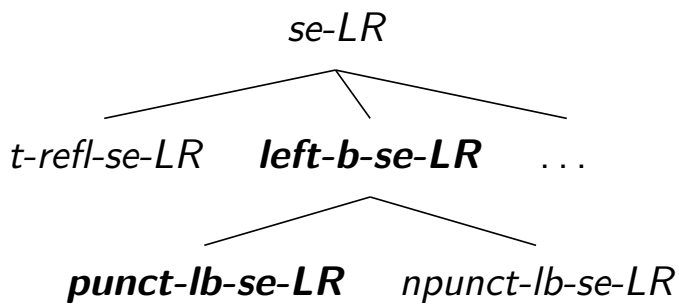



Fig. 4: Lexical Rules for *se*

(19) Carlos se asusta.
'Carlos gets frightened.'

**se-LR:**

- Input: inflected verb with 2 arguments with structural case
- Output: cliticized verb with one arguments with structural case and one affix with lexical accusative

**left-b-se-LR:**

- Input: cliticized verb
- Output: argument with structural case is interpreted as an experiencer of a state, furthermore, there is a left boundary of the state

**npunct-lb-se-LR:**

- Input: left bounded verb
- Output: the eventuality denoted by the verb is the (left-bounded) state

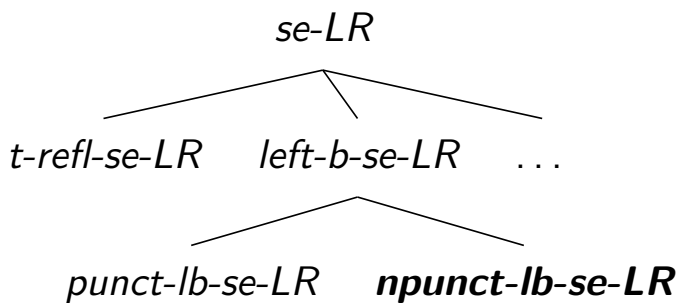



Fig. 5: Lexical Rules for *se*

(20) Carlos se divierte.
'Carlos gets entertained.'

# Agentivity

Some items of the group of **non-punctual** (*divertir* 'entertain') favor an agentive reading, while others (*deprimir* 'depress') disfavor it → not a homogeneous class

(21) Ana divirtió a Carlos.
'Ana entertained Carlos.'

(22) Carlos se divirtió (a sí mismo).
'Carlos entertained (himself).'

(23) ? Ana deprimió a Carlos.
'Ana depressed Carlos.'

(24) ? Carlos se deprimió (a sí mismo).
'Carlos depressed (himself).'

**Non-punctual** verbs show gradience, while **punctual** verbs do not.

(25) Ana sorprendió a Carlos.
'Ana surprised Carlos.'

(26) Carlos se sorprendió (a sí mismo).
'Carlos surprised (himself).'

# Test

- The transitive alternants of punctuals and non-punctuals have been tested.
- **Online Survey (OnExp)** (cf. Fritz-Huechante et al. i.p.; Verhoeven 2017):
  - Embedding of target psych verbs in a subject control verb of decision: *decidir* 'decide'
  - Matrix verb implies subject control over the event in the subordinate clause.

(27) Ana decidió divertir a Carlos.
'Ana decided to entertain Carlos.'

(28) ? Ana decidió deprimir a Carlos.
'Ana decided to depress Carlos.'

- Participants corroborated the predictions:
  - **Punctuals** behave **homogeneously**, allowing the "agentive" reading.
  - **Non-punctuals** show **gradient acceptability** w.r.t. an "agentive" reading.

(29) Carlos decidió divertirse.
'Carlos decided to get entertain.'

(30) ? Carlos decidió deprimirse.
'Carlos decided to get depressed.'

# Conclusions

- Description of 3 different readings for the *se*-morpheme in a unified account
- Dative verbs (e.g. *gustar* or *amar* with dative) cannot build the *se*-form.
- Verbs of the class of *amar* (with accusative) cannot build the left-bounded readings.
- Verbs like *divertir* and *asustar* can have a true reflexive as well as a left-bounded reading.
- The analysis shows the similarities between the analyzed structures.
- Similarities to passive and medio-passive constructions can also be seen.
- The proposed analysis takes a morphologically simple but semantically more complex item (e.g. *asustar*), and derives a morphologically more complex but semantically more simple item (e.g. *asustarse*).
- An analysis in terms of boundaries enriches the type hierarchy for eventualities in HPSG and provides a more fine-grained classification of psych-verbs, i.e. a distinction between punctuals and non-punctuals.

# Left-bounded reading in Marín & McNally (2011)

Following Marín & McNally (2011): Class II *se*-verbs can be further divided into 2 subclasses:

- **Punctuals**: denote a left boundary (i.e. a point in time) of a state, e.g. 'get frightened' (cf. 13).
  $[\![ asustarse ]\!]$
  $= \lambda x \lambda e \exists e' [\mathrm{BEG}(e, e', \lambda e'' [\mathit{frightened}(e'', x)])]$
- **Non-punctuals**: denote a state with a left boundary, e.g. 'get entertained' (cf. 12).
  $[\![ divertirse ]\!]$
  $= \lambda x \lambda e \exists e', e'' [\mathrm{BEG}(e', e'', \lambda e''' [\mathrm{entertained}(e''', x)]) \wedge e = (e'' \oplus e')]$

# Stimulus recover or stimulus implicature?

Class II *se*-verbs (cf. (31)) can add the stimulus back by means of a preposition.

(31) Carlos se divirtió / se asustó con Ana.
Carlos SE entertained SE frightened with Ana
'Carlos got entertained / got frightened by (because of) Ana.'

However, *con Ana* is not an argument of the verb anymore (as in the transitive alternant (cf. (4))) but an adjunct (Vanhoe 2004).

The stimulus does not need to be implied, but it can be implicated (cf. (32)).

(32) Carlos se divirtió / se asustó de la nada.
Carlos SE entertained SE frightened of the nothing
'Carlos got entertained / got frightened out of nothing.'

# Background for the analysis

Following previous HPSG analyses on clitics in Romance languages, we analyze the *se* **clitization** as **morphological** and not as a syntactic process (cf. Miller & Sag 1997; Abeillé & Godard 2002; Crysmann 2003; Bildhauer 2007).

We make a distinction between **inflectional morphology** and morphological changes that **affect the** ARG-ST of a lexeme, (33)–(36).

(33) asust- -ar -se
fear- -INF -SE
'get frightened'

(34) * se asust- -ar
SE fear- INF
'get frightened'

(35) * asust- -a -se
fear- -3SG.PRS -SE
'get frightened'

(36) se asust- -a
SE fear- -3SG.PRS
'get frightened'

# Background for the analysis

- **inflectional LR** takes a **stem**, e.g. *asust-*, and derives the different **word forms** of the lexeme.

(37) asust-ar [Infinitive]

(38) asust-a [Finite]

- **LR for clitization** has to take the type of **word form** into account (vgl. Haspelmath (2019) for other languages):
  1. because of the position of the clitic

     (39) asustarse$_{\text{INF}}$ vs. se asusta$_{\text{FIN}}$

  2. because the form of the clitic: *me*, *te*, *se*, ...

     (40) a. Yo$_{1.\text{SG}}$ me$_{1.\text{SG}}$ asusto$_{1.\text{SG}}$.

     b. Él$_{3.\text{SG}}$ se$_{3.\text{SG}}$ asusta$_{3.\text{SG}}$.

# Underspecified *se-LR*

(41) **Constraint for *se*-LR:**

$$\begin{bmatrix} \text{SS|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{infl-verb} \\ \text{ARG-ST} & \left\langle \text{NP}[\textit{str}],\ \boxed{4}\text{NP}[\textit{str}] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{IND} & \boxed{0}\ \textit{evtlty} \\ \text{RELS} & \left\langle \begin{bmatrix} \text{ARG0} & \boxed{0} \\ \textit{pred} & \end{bmatrix}, \boxed{6} \begin{bmatrix} \text{ARG0} & \textit{ind} \\ \textit{prt-pat} & \end{bmatrix}, \begin{bmatrix} \text{ARG0} & \textit{ind} \\ \textit{prt-ag} & \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \mapsto \begin{bmatrix} \text{SS|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD} & \textit{cl-verb} \\ \text{ARG-ST} & \left\langle \boxed{4},\ \text{NP}[\textit{aff,lx-acc}] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{IND} & \textit{evtlty} \\ \text{RELS} & \left\langle \boxed{6} \right\rangle \oplus \textit{list} \end{bmatrix} \end{bmatrix} \\ \textit{cl-verb} \end{bmatrix}$$

# *true-reflexive-se-LR*

(41) Constraint for *se*-LR:

$$\begin{bmatrix} \text{SS|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD } \textit{infl-verb} \\ \text{ARG-ST } \left\langle \text{NP}[\textit{str}], \boxed{4}\text{NP}[\textit{str}] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{IND } \boxed{0}\ \textit{evtlty} \\ \text{RELS } \left\langle \begin{bmatrix} \text{ARG0 } \boxed{0} \\ \textit{pred} \end{bmatrix}, \boxed{6} \begin{bmatrix} \text{ARG0 } \textit{ind} \\ \textit{prt-pat} \end{bmatrix}, \begin{bmatrix} \text{ARG0 } \textit{ind} \\ \textit{prt-ag} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \end{bmatrix} \mapsto \begin{bmatrix} \text{SS|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD } \textit{cl-verb} \\ \text{ARG-ST } \left\langle \boxed{4}, \text{NP}[\textit{aff,lx-acc}] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{IND } \textit{evtlty} \\ \text{RELS } \left\langle \boxed{6} \right\rangle \oplus \textit{list} \end{bmatrix} \end{bmatrix} \\ \textit{cl-verb} \end{bmatrix}$$

(42) **Constraint for *t-refl-se-LR*:**

$$\textit{cl-verb} \mapsto \begin{bmatrix} \text{SS|LOC} \begin{bmatrix} \text{CAT} \begin{bmatrix} \text{HEAD } \textit{cl-verb} \\ \text{ARG-ST } \left\langle \text{NP}[\textit{str}]_{\boxed{2}}, \text{NP}[\textit{aff}] \right\rangle \end{bmatrix} \\ \text{CONT} \begin{bmatrix} \text{IND } \boxed{0}\ \textit{evtlty} \\ \text{RELS } \left\langle \begin{bmatrix} \text{ARG0 } \boxed{0} \\ \textit{pred} \end{bmatrix}, \begin{bmatrix} \text{ARG0 } \boxed{2} \\ \textit{prt-pat} \end{bmatrix}, \begin{bmatrix} \text{ARG0 } \boxed{2} \\ \textit{prt-ag} \end{bmatrix} \right\rangle \end{bmatrix} \end{bmatrix} \\ \textbf{\textit{t-refl-cl-verb}} \end{bmatrix}$$

# *left-bounded-se-LR*

(41) Constraint for *se*-LR:

$$\left[\text{SS|LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD } \textit{infl-verb}\\ \text{ARG-ST } \left\langle \text{NP}[\textit{str}],\ \boxed{4}\text{NP}[\textit{str}]\right\rangle\end{array}\right]\\ \text{CONT}\left[\begin{array}{l}\text{IND } \boxed{0}\ \textit{evtlty}\\ \text{RELS } \left\langle\left[\begin{array}{l}\text{ARG0 } \boxed{0}\\ \textit{pred}\end{array}\right],\ \boxed{6}\left[\begin{array}{l}\text{ARG0 } \textit{ind}\\ \textit{prt-pat}\end{array}\right],\left[\begin{array}{l}\text{ARG0 } \textit{ind}\\ \textit{prt-ag}\end{array}\right]\right\rangle\end{array}\right]\end{array}\right]\right] \mapsto \left[\begin{array}{l}\text{SS|LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD } \textit{cl-verb}\\ \text{ARG-ST } \left\langle \boxed{4},\ \text{NP}[\textit{aff,lx-acc}]\right\rangle\end{array}\right]\\ \text{CONT}\left[\begin{array}{l}\text{IND } \textit{evtlty}\\ \text{RELS } \left\langle \boxed{6}\right\rangle \oplus \textit{list}\end{array}\right]\end{array}\right]\\ \textit{cl-verb}\end{array}\right]$$

(43) **Constraint for *left-b-se-LR*:**

$$\textit{cl-verb} \mapsto \left[\begin{array}{l}\text{SS|LOC}\left[\begin{array}{l}\text{CAT}\left[\begin{array}{l}\text{HEAD } \textit{cl-verb}\\ \text{ARG-ST } \left\langle \text{NP}[\textit{str}]_{\boxed{2}},\ \text{NP}[\textit{aff}]\right\rangle\end{array}\right]\\ \text{CONT}\left[\begin{array}{l}\text{IND } \textit{evtlty}\\ \text{RELS } \left\langle\left[\begin{array}{l}\text{ARG0 } \boxed{0}\ \textit{state}\\ \textit{pred}\end{array}\right],\left[\begin{array}{l}\text{ARG0 } \boxed{2}\\ \text{ARG1 } \boxed{0}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\text{ARG0 } \textit{bound}\\ \text{ARG1 } \boxed{0}\\ \textit{left-b}\end{array}\right]\right\rangle\end{array}\right]\end{array}\right]\\ \textit{left-b-cl-verb}\end{array}\right]$$

# *non-punctual-left-bounded-se-LR*

(43) Constraint for *left-b-se-LR*:

*cl-verb* ↦

$$\left[\begin{array}{l}\textsc{ss|loc}\left[\begin{array}{l}\textsc{cat}\left[\begin{array}{l}\textsc{head}\ \textit{cl-verb}\\ \textsc{arg-st}\ \left\langle \textsc{np}[\textit{str}]\boxed{2},\ \textsc{np}[\textit{aff}]\right\rangle\end{array}\right]\\ \textsc{cont}\left[\begin{array}{l}\textsc{ind}\ \textit{evtlty}\\ \textsc{rels}\ \left\langle\left[\begin{array}{l}\textsc{arg0}\ \boxed{0}\ \textit{state}\\ \textit{pred}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \boxed{2}\\ \textsc{arg1}\ \boxed{0}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \textit{bound}\\ \textsc{arg1}\ \boxed{0}\\ \textit{left-b}\end{array}\right]\right\rangle\end{array}\right]\end{array}\right]\\ \textit{left-b-cl-verb}\end{array}\right]$$

(44) **Constraint for *npunct-lb-se-LR*:**

*left-b-cl-verb* ↦

$$\left[\begin{array}{l}\textsc{ss|loc}\left[\begin{array}{l}\textsc{cat}\left[\begin{array}{l}\textsc{head}\ \textit{cl-verb}\\ \textsc{arg-st}\ \left\langle \textsc{np}[\textit{str}]\boxed{2},\ \textsc{np}[\textit{aff}]\right\rangle\end{array}\right]\\ \textsc{cont}\left[\begin{array}{l}\textsc{ind}\ \boxed{0}\\ \textsc{rels}\ \left\langle\left[\begin{array}{l}\textsc{arg0}\ \boxed{0}\ \textit{state}\\ \textit{pred}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \boxed{2}\\ \textsc{arg1}\ \boxed{0}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\textsc{arg0}\ \textit{bound}\\ \textsc{arg1}\ \boxed{0}\\ \textit{left-b}\end{array}\right]\right\rangle\end{array}\right]\end{array}\right]\\ \textbf{\textit{npunct-lb-cl-verb}}\end{array}\right]$$

# *punctual-left-bounded-se-LR*

(43) Constraint for *left-b-se-LR*:

*cl-verb* ↦

$$\left[\text{SS|LOC}\left[\text{CAT}\left[\begin{array}{l}\text{HEAD } \textit{cl-verb}\\ \text{ARG-ST } \left\langle \text{NP}[\textit{str}]\boxed{2},\ \text{NP}[\textit{aff}]\right\rangle\end{array}\right]\right.\right.$$
$$\left.\left.\text{CONT}\left[\begin{array}{l}\text{IND } \textit{evtlty}\\ \text{RELS } \left\langle\left[\begin{array}{l}\text{ARG0 } \boxed{0}\ \textit{state}\\ \textit{pred}\end{array}\right],\left[\begin{array}{l}\text{ARG0 } \boxed{2}\\ \text{ARG1 } \boxed{0}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\text{ARG0 } \textit{bound}\\ \text{ARG1 } \boxed{0}\\ \textit{left-b}\end{array}\right]\right\rangle\end{array}\right]\right]\right.$$
$$\left.\textit{left-b-cl-verb}\right]$$

(45) **Constraint for *punct-lb-se-LR*:**

*left-b-cl-verb* ↦

$$\left[\text{SS|LOC}\left[\text{CAT}\left[\begin{array}{l}\text{HEAD } \textit{cl-verb}\\ \text{ARG-ST } \left\langle \text{NP}[\textit{str}]\boxed{2},\ \text{NP}[\textit{aff}]\right\rangle\end{array}\right]\right.\right.$$
$$\left.\left.\text{CONT}\left[\begin{array}{l}\text{IND } \boxed{3}\\ \text{RELS } \left\langle\left[\begin{array}{l}\text{ARG0 } \boxed{0}\ \textit{state}\\ \textit{pred}\end{array}\right],\left[\begin{array}{l}\text{ARG0 } \boxed{2}\\ \text{ARG1 } \boxed{0}\\ \textit{exp}\end{array}\right],\left[\begin{array}{l}\text{ARG0 } \boxed{3}\ \textit{bound}\\ \text{ARG1 } \boxed{0}\\ \textit{left-b}\end{array}\right]\right\rangle\end{array}\right]\right]\right.$$
$$\left.\textbf{\textit{punct-lb-cl-verb}}\right]$$

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