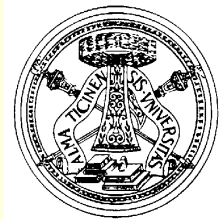


# Semantic Coercion in Language: Beyond Distributional Analysis

Elisabetta Jezek  
Università di Pavia



Rovereto, February 12, 2009

# Foreword

---

- Joint work on the interaction between empirical analysis and lexicon design
- Reference
  - Pustejovsky J. and E. Jezek 2008. Semantic Coercion in Language: Beyond Distributional Analysis. In *Italian Journal of Linguistics* 20 (2).

# Basic claim

---

- The distributional properties extracted from linguistic corpora for a word are regarded by many as the principle contribution to its meaning.
  - [Harris 1954](#); for an overview [Sahlgren 2006](#).
- While largely sympathetic to this view, we argue that lexical semantic representations which are built from evidence of distributional behaviour alone are unable to explain the rich variation in linguistic meaning in language.

# Why is that?

---

- Word meaning is modulated/adjusted in context and contextual semantic operations have an impact on the behaviour that words exhibit
  - Cruse 1986, Pustejovsky 1995, Recanati 2002.
- In order to make sense of corpus data, next to distributional analysis, we need a theory which models how this modulation takes place.
  - A theoretical lens to interpret distributional data!

# What is a Document?

---

- *read* {book, newspaper, bible, article, letter, poem, novel, text, page, passage, story, comics script, poetry, report, interview, label, speech, verse, manual}
- *publish* {report, book, newspaper, article, pamphlet, edition, booklet, result, poem, document, leaflet, newsletter, volume, treatise, catalogue, findings, guide, novel, handbook, list}
- *send* {message, letter, telegram, copy, postcard, cheque, parcel, fax, card, document, invoice, mail, memo, report}
- *translate* {bible, text, instructions, abstract, treatise, book, document, extract, poem, menu, term, novel, message, letter}

# The compositionality principle

---

- The compositionality principle, in its most general form, can be expressed as follows:
- “The meaning of an expression is a function of the meaning of its parts and of the way they are syntactically combined”.
- (cf. Partee 1995, 153)

# Problems

---

- “In a compositional language, the meaning of an expression **only depends on two things**: the meaning of its immediate constituents (the simpler expressions into which it can be analysed) and the way they are put together. **Nothing else counts.**”
- “**Top-down** or **lateral** influences of meaning are ruled out by the compositional procedure. Yet, according to some authors, such influences are **precisely what we observe.**”
- (cf. Recanati 2009).

# Evidence

---

## drop

- ‘most students here drop *geography* in the final year (studying)
- ‘most students here drop *geography lectures* in the final year (attending)
- ‘most students here drop *geography lectures reading assignments* in the final year (executing)



# Evidence (cont'd)


---

- |  |            |
|--|------------|
| ‘we canceled <i>the taxi</i> ’         | (booking)  |
| ‘John interrupted <i>the teacher</i> ’ | (speaking) |
| ‘Try to avoid <i>fried food</i> ’      | (eating)   |
| ‘they heard <i>the village dog</i> ’   | (barking)  |

# Semantic flexibility

---

- **Semantic flexibility** is “the property of a language in which the meaning of a word may vary from occurrence to occurrence, and it may vary, in particular, as a function of the other words it combines with.”
- “**Compositionality** and **semantic flexibility** seem to be mutually exclusive properties.”
- (cf. Recanati 2009).

- 
- 
- How are we going to solve the apparent incompatibility between contextualism and compositionality?
  - How can polysemy (i.e. multiple denotation) be modeled?
  - We need to enrich the compositional procedures available to language.

# Narrowing the focus

---

- We focus on semantic compositional processes involved in argument selection.
  - In particular, we focus on the interpretation of nouns filling the argument position(s)
- We intend to account for the multiple denotations exhibited by nouns in context in terms of *semantic coercion*
  - operation of type adjustment induced by a predicate over its arguments when they do not match its selectional properties.
- We present a theory-informed empirical investigation of semantic coercions.

# Types of polysemy (Pustejovsky 2008)

---

## ■ *Inherent Polysemy*

- Restricted to **complex types** or **dot objects**.
  - Two apparent incompatible types are reified in a single type.
- The potential for multiple interpretation is *inherent* to the object itself.
- A key property of complex types is that they allow **co-predication** (i.e. simultaneous access to two distinct senses)
  - “The speech was *long* but *interesting*”
  - “Yesterday’s lunch was *long* but *delicious*”
  - “The book I’m *studying weights* one kilo”

# Types of polysemy (Pustejovsky 2008)

---

## ■ *Selectional Polysemy*

- All other cases of polysemy are selectional in nature.
  - They are induced by the selectional properties of predicates.
  - They are the result of syntagmatic processes.
- 
- Syntagmatic processes act on underspecified and rich lexical representations and exploit their inherent semantic content in different ways.
    - Pustejovsky 1995, 2006.

# Levels of lexical representation (Pustejovsky 1995)

---

- a. **LEXICAL TYPING STRUCTURE** : specifies the semantic type for a word positioned within a type system for the language.
- b. **ARGUMENT STRUCTURE**: specifies the number and nature of the arguments to a predicate.
- c. **EVENT STRUCTURE**: defines the event type of the expression and any subeventual structure it may have.
- d. **QUALIA STRUCTURE**: provides a structural differentiation of the predicative force for a lexical item.

# Qualia Relations (Pustejovsky 1995)

---

- a. **FORMAL**: specifies the basic category which distinguishes the meaning of a word within a larger domain: “what is it?”
  - *book*: **physbobj•information**
  
- b. **CONSTITUTIVE**: specifies the relation between an object and its constituent parts: “what is it made of?”
  - *book* (**information** sense): chapter, paragraph
  - *book*: (**physbobj** sense): cover, page
  
- c. **TELIC**: specifies the purpose or function of an object, if there is one: “what is it for?”
  - *book*: read
  
- d. **AGENTIVE**: specifies the factors involved in the object’s origins: “how did it come into being?”
  - *book*: write



# Semantic types (Pustejovsky 2001)

---

- a. **NATURAL TYPES:** Natural kind concepts consisting of reference only to Formal and Constitutive Qualia Roles
  - *lion*: **animate**, *rock*: **concrete**, *water*: **liquid**
  
- b. **ARTIFACTUAL TYPES:** Concepts making reference to purpose and function. Natural type + Telic and/or Agentive Qualia
  - *violinist*: **animate**⊗<sub>T</sub>play
  - *beer*: **liquid**⊗<sub>T</sub>drink
  - *knife*: **concrete**⊗<sub>T</sub>cut
  
- c. **COMPLEX TYPES:** Concepts making reference to an inherent relation between types
  - *libro*: **physobj**•**information**
  - *porta*: **physobj**•**aperture**
  - *pranzo*: **event**•**food**

# Compositional operations on types (Pustejovsky 2006)

---

- **PURE SELECTION:** (Type Matching) the type selected by the predicate is directly satisfied by the argument.
- **ACCOMMODATION:** the type selected by the predicate is inherited by the argument.
- **COERCION:** (Type Mismatch): the type selected by the predicate does not correspond to the argument type and is imposed on it (type adjustment). This is accomplished by either:
  - **Exploitation:** taking a part of the argument's type to satisfy the selectional requirements of the predicate.
  - **Introduction:** wrapping the argument's type with the type required by the predicate.

# Predictions on compositional operations

		<b>Verb selects:</b>	
<b>Argument is:</b>	<b>NATURAL</b>	<b>ARTIFACT</b>	<b>COMPLEX</b>
<b>NATURAL</b>	Selection/Acc	Introduction	Introduction
<b>ARTIFACT</b>	Exploitation	Selection/Acc	Introduction
<b>COMPLEX</b>	Exploitation	Exploitation	Selection/Acc

- (Asher – Pustejovsky 2006, Pustejovsky 2006)

# Metodology

---

- Corpus ItWaC (Baroni and Kilgarriff 2006)
- Sketch Engine query tool (Kilgarriff et al. 2004)
- Given a  $V$  that selects for type  $\alpha$ , we extract the set of Ns in the following grammatical relations:
  - [Object\\_of](#)
  - [Subject\\_of](#)
- We manually cluster lexical sets into types  $(\alpha_1, \alpha_2, \dots)$ 
  - [Pustejovsky, Hanks and Rumshisky 2004](#)
  - [Rumshisky, Grinberg and Pustejovsky 2007](#)
- We identify mismatches between selected type and argument type.
- Basic assumption: mismatches represent potential candidates for coercion operations.

# Exploitation of Complex Type

---

- *book* (**physical object • information**)
  - Direct Object
    - **physical object**: close, open, shut, throw away, steal, keep, burn, put away, bind, design, store, grab, drop, destroy, dust, hold, shelve, pile, store
    - **information**: ban, consult, edit, find interesting, study, translate, review, love, judge, revise, examine, like, describe, discuss
  - 'Jess almost *dropped* the book, then *replaced* it on the shelf'
  - 'The author *will be discussing* her new book'

# Exploitation of Complex Type

---

- *house* (**physical object•location**)
  - Direct Object
    - **physical object:** built, buy, sell, rent, own, demolish, renovate, burn down, erect, destroy, paint, inherit, repair
    - **location:** leave, enter, occupy, visit, inhabit, reach, approach, evacuate, inspect, abandon
  - ‘they built these houses onto the back of the park’
  - ‘the bus has passed him as he left the house’

# Exploitation of Complex Type

---

- *exit* (**event•location**)
  - Direct Object
    - **event**: make, facilitate, follow, force, hasten, register
    - **location**: block, bar, take, find, mark, indicate, reach, choose, locate
  - ‘I very swiftly *made* my exit through the door’
  - ‘She *was blocking* the exit of a big supermarket’

# Asymmetries

---

- *articolo* (**physical object•information**)
  - Direct Object
    - a. **physical object**: *spostare, ritagliare*
    - b. **information**: *approvare, bocciare, citare, correggere, ignorare, commentare, conoscere, condividere*
  - ‘*ritaglia* tutti gli articoli che lo riguardano’
  - ‘*condivido* interamente il suo articolo’
- Cf. Jezek & Lenci 2007.



# Asymmetries (cont'd)

---

- *romanzo* (**physical object•information**)
  - Direct Object
    - **physical object:** *collocare, portare*
- *libro* (**physical object•information**)
  - Direct Object
    - **physical object:** *bruciare, portare, distruggere, conservare, custodire, buttare*

# Asymmetries (cont'd)

---

- *chicken* (**animal•food**)

- Subject

- a. **animal**: look, wander, come, cross, follow, die

- Direct Object

- a. **animal**: count, chase, kill, shoot, slaughter, skin, pluck, sacrifice, throw
    - b. **food**: eat, serve, prefer, turn, dip, stuff, carve, baste, roast, simmer

- Cf. Rumshisky et al. 2007

# Asymmetries (cont'd)

---

- *Honda* (**producer•product**)

- Subject

- a. **producer**: design, build, produce, create, assemble, accept, invest, work on, hate, introduce, develop, win, support, announce, invest, declare, say, acquire, be confident, be grateful, withdraw, bring out, decide, run, threaten, sponsor
- b. **product**: stand, spin out of control, go on sale, be a missile

- ‘Honda immediately *withdrew* the two affected models’

- ‘Their Honda *spun out* of control’

# Asymmetries (cont'd)

- *door* (**physical object•aperture**)
  - Subject
    - **physical object**: open, slam, close, swing, shut, bang, burst open, click open, fly open, slide open, click shut, hang, face, shake
    - **aperture**: pass, enter
  - Direct Object
    - **physical object** : open, shut, close, slam, push, pull, bolt, bang, kick, knock, smash, hold, open, paint, lock, fasten, secure, hit, remove, damage, replace, decorate
    - **aperture**: lead, go, give access, connect
- ‘somewhere in the house a door *slammed*’
- ‘the main door *went into* a small lobby’

# *Exploitation of Qualia*

---

- *finish* (Body: 'bring to an end'; Arg: **event**)
  - Direct Object:
    - a. **event**: journey, tour, treatment, survey, race, game, training, ironing, shopping
    - b. E-I, Q-E of **phys**⊗<sub>T</sub>: penicillin, sandwich, cigarette, cake, dessert, food
    - c. E-I, Q-E of **liquid**⊗<sub>T</sub>: drink, wine, beer, whisky, coke
  - 'when they *finished* the wine, he stood up'
  - 'just *finish* the penicillin first'

# *Exploitation of Qualia*

---

- *attend* (Body: 'be present at'; Arg: **event**)
  - Direct Object:
    - a. **event**: meeting, wedding, funeral, mass, game, ball, event, service, premiere
    - b. E-I, Q-E of **location** $\otimes_T$ : clinic, hospital, school, church, chapel
  - 'about thirty-five close friends and relatives attended the wedding'
  - 'for this investigation the patient must attend the clinic in the early morning'
  - 'he no longer attends the church'

# *Exploitation of Artifactual Type*

- *glass* (**physobj** ⊗<sub>Telic</sub> hold(liquid))
  - Direct Object:
    - a. **physobj**: raise, clink, lift, break, put down, clean, hold, set down, throw
    - b. **physobj** ⊗<sub>T</sub> hold(liquid): refill, fill, empty
    - c. Q-E where  $T = \text{hold(liquid)}$ : drink, pour, down, swallow
    - d. E-I, Q-E where  $T = \text{hold(liquid)}$ : finish
  - ‘As a rule he only *drank* one glass, but that night he drank three’
  - ‘She *poured* two glasses and *gave* him one’
  - ‘when she'd *finished* the second glass, he was still there’

# Conditions on Qualia Exploitations

---

- Some artifacts enter coercive contexts less easily than others.
  - For instance *knife, car, pen, bed* are not coerced to the events they typically participate in (*cut, drive, write, sleep*).
  - (cfr. Briscoe et. al. 1990, Godard and Jayez 1993, Pustejovsky-Bouillon 1995, Verspoor 1997, Kleiber 1999)
- Qualia can be overridden in context
  - ‘The goat enjoyed the book’
  - (cfr. Asher – Pustejovsky 2006)



# *Introduction of Container*

---

- *open* (Body: 'cause to become open'; Arg: **container**)
  - Direct Object:
    - a. **container**: drawer, bottle, cupboard, envelope, folder, tin, can, box, fridge, bag, cage, suitcase
    - b. **liquid**: wine, champagne, beer
  - ‘*I opened the wine carefully*’
  - ‘Just as he was about to *open* the beer, the doorbell rang’

# *Introduction of Physical object*

---

- *read* (Body: ‘grasp the meaning of’; Arg: **physobj •info**)
  - Direct Object:
    - a. **event•info**: story, description, judgement, quote, reply, speech, proclamation, statement, question, interview
    - b. **sound•info**: music
  - ‘I've read your speeches’
  - ‘I discovered he couldn't read music’
  - ‘I tend not to read long interviews with top celebs’

# *Introduction of Qualia*

---

- *eat* (Body: 'ingest'; Arg: **phys**⊗<sub>T</sub>eat)
  - Direct Object:
    - a. **phys**⊗<sub>T</sub>eat: sandwich, pancake, bread, biscuit, pie, cake, steak, toast, ice-cream, snack, pudding, salad, meat
    - b. **phys** (natural): fish, chicken, worm; apple, banana, orange; mushroom, lettuce, spinach; grass, leaf, hay; fat, nut, rice, flesh

# Up to which point can we coerce?

*listen* (**sound**)

Object

- a. **sound**: voice, noise, ticking, hum, echo, hiss, thud, roar
- b. **sound•info**: music, jazz; concert, opera, overture, tune, lyric, song
- c. **event** (natural): rain, wind
- d. **event** (involving sound production): breathing, whisper, cry; footstep
- e. **event•info** (speech act): announcement, conversation, discussion, debate, speech, talk, dialogue
- f. **phys** $\otimes$ <sub>T</sub>play(sound•info): radio, stereo
- g. **phys•music**: disc, tape, record, album, cassette
- h. **phys** $\otimes$ <sub>T</sub>ring: bell, clock
- i. **human** $\otimes$ <sub>T</sub>sing, human  $\otimes$ <sub>T</sub>speak : singer, speaker
- j. **human** $\otimes$ <sub>A</sub>write(music): Beatles, Mozart, Wagner, Bach
- k. **human**: colleague, nurse, costumer, parent, friend
- l. **phys** (body part): chest, heart

# Concluding observations

---

- Generative mechanisms in the semantics, such as coercion, allow words to behave distributionally in unexpected ways with respect to their selectional properties.
- A distributional analysis is therefore not sufficient to characterize the meaning of words. A lexical semantic theory which accounts for compositional mechanisms of modulation is necessary to interpret distributional data.
- Mutual feeding between corpus investigation and theory design.

# Concluding observations

---

- The distinction between **coercion as exploitation** vs. **coercion as introduction** does not overlap with the traditional distinction between **conventionalized** vs. **unconventionalized metonymy**.
- Rather, it captures a complementary aspect of the genesis of metonymic reinterpretations.
- It assumes a strong distinction between pragmatic and semantic modes of interpretation.
- This distinction is necessary if we wish to model the complexity and provenance of the contributing factors in compositionality.

# Issues for further research

---

- Directionality of modulation: what influences what in a given context?
- Type are insufficient to account for the whole distributional behavior of lexical items.
  - Linguistic members of the same type may exhibit different sets of collocates.
- Further investigation of coercion needs to move beyond types.