

VOLTAIRE WAS MORE EASILY DUPED THAN FORGED:

STRUCTURAL CUES IN PROCESSING POLYSEMY



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Our Research

- Polysemous words may initially activate a semantically vague meaning, consistent with all of its senses
- Processor selects a specific sense when prompted by context or grammatical necessity
- Propose that the processor may also use **structural defaults** to select a more specific meaning
- Provide evidence for a specific structural default in three experiments probing the effect of syntactic voice and general context on metonymy processing

Homophones and Polysemes

Homophones

- Multiple unrelated meanings, e.g., *bank*
 - Location by river
 - Location/institution
- Low level activation immediately
- Dominant meaning reaches activation first, especially if supported by context

Polysemes

- Multiple related senses, e.g., *school*
 - Building
 - Institution
 - Group
- Evidence that the processor may delay selecting a specific sense until required

Polysemy

- Senses typically related by regular/productive rules
 - *Vietnam* (place-for-event, e.g. Frisson and Pickering 1999)
 - *academy* (place-for-institution, e.g. Frisson and Pickering 1999)
 - *newspaper* (concrete-to-abstract, e.g. Frazier and Rayner 1990)
 - *lamb* (count-to-mass, e.g. Kleposniotou, 2002)
 - *Dickens* (producer-for-product, e.g. Frisson and Pickering 1999; Kleposniotou, 2002)

Literal first model

Literal: My great-grandmother *met* Dickens

vs.

Figurative: My great-grandmother *read* Dickens

Access literal meaning

Evaluate meaning in context

Revise as necessary

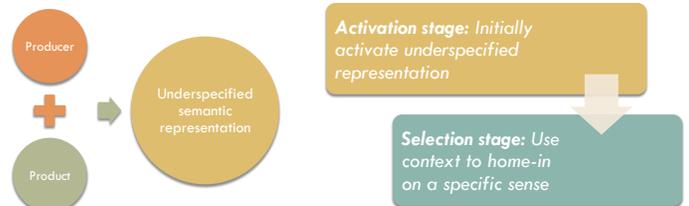
Underspecification model

Frisson & Pickering (1999)

Literal: My great-grandmother *met* Dickens

vs.

Figurative: My great-grandmother *read* Dickens



Underspecification model

Frisson & Pickering (1999)

- No processing differences between literal (met Dickens) and figurative (read Dickens)
- Supports the Underspecification model over the literal first model
 - Frisson & Pickering (2007) follow up
 - Penalty when the name was an unknown author, e.g., Needham
 - Penalty nearly eliminated by informative context
- Processor settles on sense by the end of clause.
 - See also Foraker and Murphy (2012) for a different interpretation.

Homing-in stage

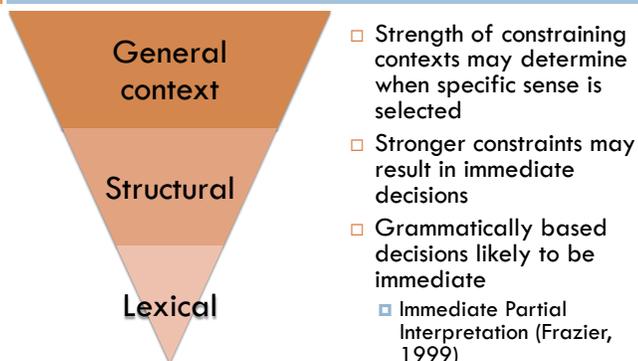
Activation stage:
Initially activate
underspecified
representation

Selection stage:
Use context to
home-in on a
specific sense

- Multiple sources of information used in sense-selection:
 - Requirements and demands of the task
 - Importance of word in sentence
 - Amount of contextual evidence/constraints

Flexibility of processor: Context facilitates selection of a more specific sense when required

Contextual strength



Subject as Agent Principle (SAP)

- Provisionally assign the subject of a clause an agent thematic role, all else being equal.
 - Evidence from aphasics (Grodzinsky, 1986)
 - May only hold for languages lacking strong morphosyntactic markers for case

Claim: Assuming that thematic processing is obligatory and grammatical, the processor uses this default to home-in on a particular sense despite other contextual evidence

Present Research Project

Passive: Voltaire was forged by a petty criminal

Active: A petty criminal forged Voltaire

Predictions:

- Processor uses SAP to provisionally assign agent theta role to Voltaire when in subject position
- Agent role only plausibly consistent with literal sense
- Processor commits to literal sense in Passive sentences, but not Active sentences

Plot

Experiment 1: Active vs. passives in self-paced reading

Experiment 2: Active vs. passives in fill-in-the-blanks

Experiment 3: Passives in context in self-paced reading

Plot spoiler

Experiment 1: Passive vs. Active sentence polysemes in self-paced reading

Results: Penalty for figurative sense when polyseme was Subject, but not Object

Experiment 2: Passive vs. Active sentence polysemes in fill-in-the-blanks

Results: Subject polysemes yielded more literal supporting contexts than Object polysemes did

Experiment 3: Passive polysemes in context in self-paced reading

Results: Contexts supporting the figurative sense reduced, but did not eliminate, the cost found in E1.

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Exp 1 – Overview

- Testing predictions of SAP with self-paced reading
- Manipulation of
 - 1 **Voice** (Active vs. Passive)
 - 2 **Verb-Type** (Literal- vs. Metonymic-Selecting)

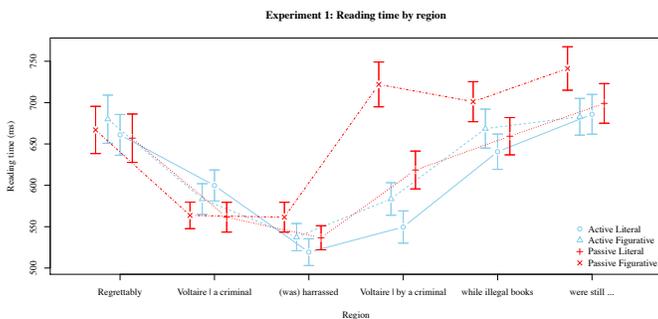
Active: Regrettably, a criminal {harassed/forged} Voltaire while illegal books were still being made.

Passive: Regrettably, Voltaire was {harassed/forged} by a criminal while illegal books were still being made.

Exp 1 – Participants, Methods and Items

- Self-paced reading (N = 32)
- 24 items
 - Critical verbs matched for frequency and length
 - Target sentence presented in 5 regions of 2-3 words
- Exit survey to confirm familiarity with famous figures
 - Yes/no questions, e.g. “Before this experiment, were you aware that Voltaire was an author?”
 - Removed metonyms that were unfamiliar to participants on a participant-by-participant basis

Exp 1 - Results



Exp 1 - Results

- All effects observed on post-verbal region
- Comparison across Voice condition
 - Passives: Penalty for Figurative sense interpretation, $t = 2.09$, $p < 0.05$.
 - Actives: No difference
- Immediately home in on literal sense in Passive

Passives
Mean and SE RTs on Post-Verbal Region

Literal Selecting	Figurative Selecting
660 (37)	752 (31) $d = 92$

Actives
Mean and SE RTs on Post-Verbal Region

Literal Selecting	Figurative Selecting
566 (20)	600 (30) $d = 34$

Exp 1 - Conclusions

- Active sentences results consistent with Frisson and Pickering (1999, et seq)
- Passive sentences results consistent with processor using SAP
 - Processor interprets subject polyseme as agent, homes in on literal sense
 - Cost for processing figurative sense in Passives, but not Actives

Exp 2 – Overview

- Testing predictions of SAP, with fill-in-the-blanks task
- Results support processor using SAP
- Active and Passive sentences with verbs removed
 - PASSIVE
Regrettably, Voltaire was _____ by a criminal while illegal books were still being made.
 - ACTIVE
Regrettably, a criminal _____ Voltaire while illegal books were still being made.
- Subjects were instructed to fill in the blank

Exp 2- Methods, Participants, and Items

- N = 32, recruited with Amazon Mechanical Turk
 - All unique U.S. IP addresses
 - All Turkers had 98% acceptance on 50 previous tasks
- Experiment presented on Ibex Farm
- Task: read sentence frame and supply the first verb that comes to mind
- Included a few catch items to control for participant cooperation and native fluency in English
- 24 items

Plot spoiler

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Results: Subject polysemes yielded more literal supporting contexts than Object polysemes did

Experiment 3: Passive polysemes in context in self-paced reading

Results: Contexts supporting the figurative sense reduced, but did not eliminate, the cost found in E1.

Exp 2 – Prediction

- Bias towards supplying literal verbs for Passive sentences, but not for Active sentences
 - If processor uses SAP, then it will interpret subject metonyms in Passive sentences as agents
 - Fill Passive sentence blanks with verbs that take agents as subjects (literal verbs)
 - No such bias for Active sentence blanks

Exp 2 - Annotation

- Annotation performed by the authors
- Coded participant-supplied verbs by whether they were
 - Figurative-Selecting
 - Literal-Selecting
 - Ambiguous (consistent with both senses)
- Three analyses:
 1. Ambiguous removed
 2. Ambiguous counted as metonymic
 3. Ambiguous counted as literal

Exp 2 - Results

- Under each analysis, same effects were observed
- Significantly fewer Figurative-Selecting verbs supplied for Passive as compared to Active

Analysis 1 (Ambiguous removed)		Analysis 2 (Ambiguous to metonymic)		Analysis 3 (Ambiguous to literal)	
Passive	Active	Passive	Active	Passive	Active
32% (3)	59% (3)	59% (3)	72% (2)	20% (3)	40% (2)

Plot spoiler

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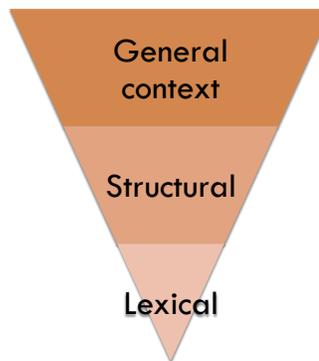
Exp 3 – Overview

- Investigating whether effects of general context are delayed
- Manipulation of
 - Context Bias** (Metonymic-Biasing vs. Neutral)
 - Verb-Type** (Literal- vs. Metonymic-Selecting)

Exp 2 - Conclusions

- Bias against supplying Figurative-Selecting Verb in Passive sentences
- Consistent with predictions of SAP
 - Processor interpreted Passive sentence metonym as agent, supplied literal verbs
 - No such effect for Active sentence polysemes

Contextual Strength



- Grammatical constraints lead to immediate homing in
 - Lexical constraints
 - Thematic role assignment
- General context is weaker form of constraint
- When is general context info utilized?

Exp 3 – Conditions

Metonymic-Biasing

In Renaissance Era France, handwritten editions of books were illegally copied and sold.

Neutral

In Renaissance Era France, illegal activities often went completely unpunished.

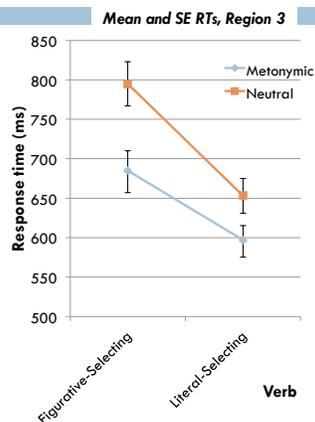
Voltaire was {duped/forged} by a petty criminal who was never brought to justice.

Exp 3 – Participants, Methods and Items

- Self-paced reading task (N = 48)
 - ▣ Context sentence as one block
 - ▣ Target sentence containing Subject-initial polyseme, 5 moving windows
- 24 items
 - ▣ Critical verbs matched for frequency and length
- Items normed for naturalness (N = 16)

Exp 3 - Results

- All effects observed on post-verbal region
- Main effect of Verb-Type
 - ▣ Penalty for literal sentences
- Metonymic context mitigated cost of processing fig. sense
- Main effect of Context
 - ▣ Penalty for Neutral Context



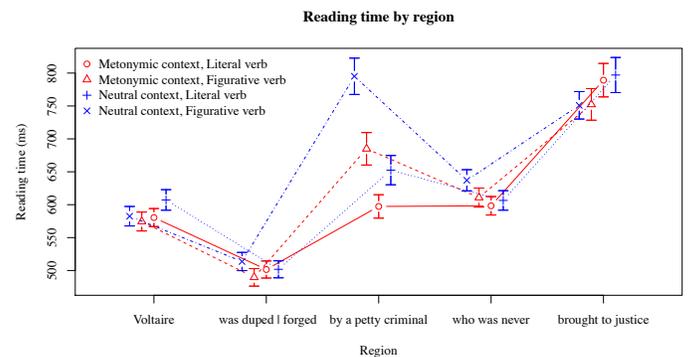
Subject As Agent Principle (SAP)

Provisionally assign the subject of a clause an agent thematic role, all else being equal.

Consistent with Partial Commitment (Frazier, 1999):

- ▣ Grammatically required to assign theta-roles
- ▣ Constrains the interpretation of the metonym
- ▣ Processor commits to literal sense only in subject position

Exp 3 - Results



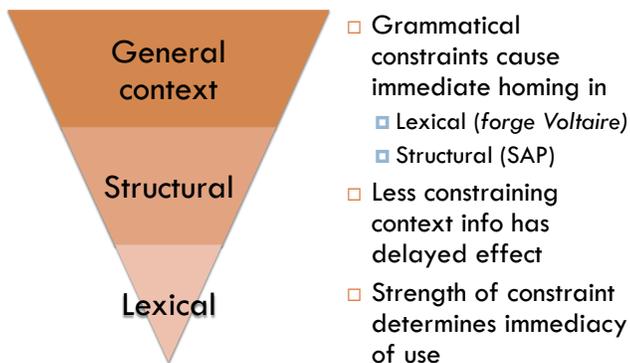
Exp 3 - Conclusions

- Metonymic biasing context mitigated cost of processing figurative sense
- Evidence that general context information has delayed effect
- Stronger constraints dominate weaker constraints

General conclusions

- Processor uses SAP
 - ▣ SPR: penalty for processing Figurative sense when metonym is subject
 - ▣ Fill-in-the-blanks: fewer Figurative-selecting verbs when metonym is subject
- Weaker context information has delayed effect
 - ▣ SPR: cost for processing figurative sense reduced when general context supports figurative interpretation

General conclusions – homing in stage



Future Directions

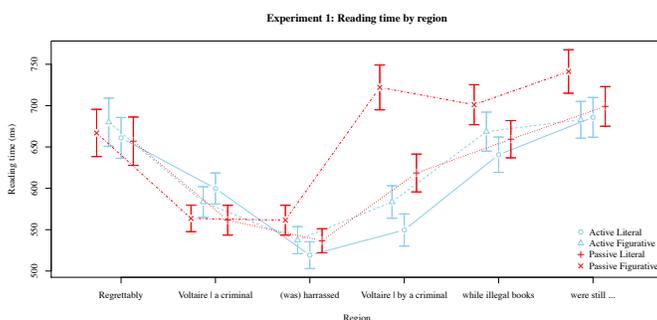
- Further exploration of SAP:
 - Does processor only make this assumption when literal sense is agentive?
 - Nouns not preferentially interpreted as subjects, e.g.
 - *Spain was toured by the famous orchestra.*
 - *Spain was impressed by the famous orchestra.*
- Further probing of General Context effect
 - Can more constraining contexts lead to more immediate homing in?

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Questions?

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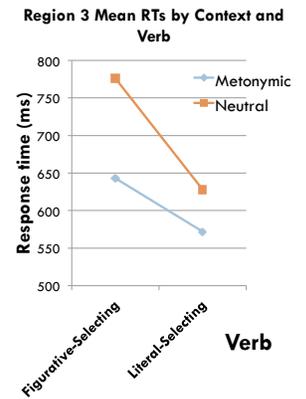
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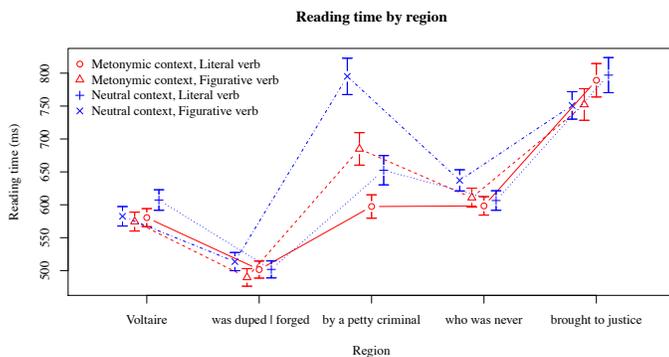
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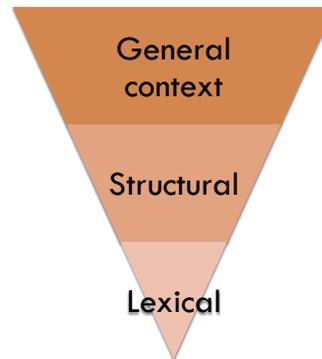
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- Main effect of Verb
 - Penalty for literal sentences
- Metonymic context mitigated cost of processing fig. sense
- Main effect of Context
 - Penalty for Neutral Context



Exp 3 - Results



General conclusions – homing in stage



- Grammatical constraints cause immediate homing in
 - Lexical (*forg* Voltaire)
 - Structural (SAP)
- Less constraining context info has delayed effect
- Strength of constraint determines immediacy of use

Underspecification model

Frisson & Pickering (1999)

Literal: My great-grandmother *met* Dickens

vs.

Figurative: My great-grandmother *read* Dickens

