Does contrastive marking reverse pronominal antecedent biases for implicit causality verbs?

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(1) John impressed Bill because he ...

(2) John admired Bill because he ...
(1) John impressed Bill because he could juggle.

(2) John admired Bill because he was so brave.
implicit causality

(1) John impressed Bill because he could juggle.

(2) John admired Bill because he was so brave.
the focusing hypothesis

the coherence hypothesis

(1) **John** impressed Bill **because he** could juggle.

(2) John admired **Bill** **because he** was so brave.
Focusing Hypothesis

- Certain verb classes have predictable focusing biases
- Connectives also have focusing properties
- Focus changes dynamically with new input
- Focusing effects can be in competition
- **explicit and implicit coherence relations can have different biases**

Coherence Hypothesis

- Pronoun interpretation is a byproduct of understanding how events are related
- Biases arise because of coherence relationship type, not focusing processes
- **predicts the same biases for explicit and implicit coherence relations**
Focusing Hypothesis

(1) John *admired* Bill ...
(1) John admired Bill ...
(1) John admired **Bill** because he
(1) John admired **Bill** because he
Coherence Hypothesis

(1) John admired Bill because he...
Coherence Hypothesis

(1) John admired Bill because he could juggle.
Coherence Hypothesis

(1) John \textcolor{green}{admired} Bill \textcolor{red}{because} he \textcolor{green}{could} juggle.
Coherence Hypothesis

(1) John *admired* Bill *because* he *could* juggle.

(2) John *admired* Bill. He *could* juggle.
Coherence Hypothesis

(1) John admired Bill because he could juggle.

(2) John admired Bill. He could juggle.
John impressed Bill because he was so brave.

John blamed Bill because he spilt the coffee.
change the connective, change the preferences

(1) John impressed Bill but he was so brave.

(2) John blamed Bill but he spilt the coffee.
but marks a Contrast relation

– `denial of expectation’
– type of reverse Cause-Effect Relationship,

(1) John blamed Bill because he spilt the coffee.
(2) John blamed Bill but he spilt the coffee.
but marks a Contrast relation
– `denial of expectation’
– type of reverse Cause-Effect Relationship,

(1) John blamed Bill because he spilt the coffee.
(2) John blamed Bill but he spilt the coffee.
(3) John blamed Bill but he didn’t spill the coffee on purpose.
Ehrlich (1981)

Steve blamed Frank because he spilt the coffee.
but
and

Who spilt the coffee?
Hypothesis:
and and because bias according to verb biases
but reverses biases
Ehrlich (1981)

2 x 3 design:

- type of verb: NP1 biasing or NP2 biasing
  - blame
  - criticize
  - praise
  - confess
  - confide
  - phone

- type of connective: and, because, but

method:

Choose pronoun interpretation for complete sentences
NP1 verbs show a stronger reversal effect than NP2 verbs with but.

% object interpretations

Connective

<table>
<thead>
<tr>
<th>Connective</th>
<th>NP1 verb</th>
<th>NP2 verb</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td>70%</td>
<td>50%</td>
</tr>
<tr>
<td>BECAUSE</td>
<td>10%</td>
<td>45%</td>
</tr>
<tr>
<td>BUT</td>
<td>60%</td>
<td>25%</td>
</tr>
</tbody>
</table>
and with NP1 verbs leads to a reversal greater than what we see with but and leads to equal subj and obj choices with NP2 verbs.

% object interpretations

- **AND**
  - NP1 verb: 70%
  - NP2 verb: 40%

- **BECAUSE**
  - NP1 verb: 10%
  - NP2 verb: 60%

- **BUT**
  - NP1 verb: 50%
  - NP2 verb: 30%
<table>
<thead>
<tr>
<th>NP1 verbs</th>
<th>NP2 verbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. phoned</td>
<td>1. blamed 80%</td>
</tr>
<tr>
<td>2. confessed</td>
<td>2. criticized 83%</td>
</tr>
<tr>
<td>3. confided</td>
<td>3. praised 68%</td>
</tr>
<tr>
<td>NP1 verbs</td>
<td>NP2 verbs</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>phoned</td>
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<tr>
<td>confessed</td>
<td>criticized</td>
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<tr>
<td>confided</td>
<td>praised</td>
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<tr>
<td>frustrated</td>
<td>feared</td>
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<tr>
<td>inspired</td>
<td>pitied</td>
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<tr>
<td>disappointed</td>
<td>hated</td>
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<tr>
<td>frightened</td>
<td>trusted</td>
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<tr>
<td>bored</td>
<td>appreciated</td>
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<tr>
<td>gladdened</td>
<td>admired</td>
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<tr>
<td>amazed</td>
<td>doubted</td>
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<tr>
<td>scared</td>
<td>disliked</td>
</tr>
<tr>
<td>impressed</td>
<td>despises</td>
</tr>
<tr>
<td>mesmerizes</td>
<td>resents</td>
</tr>
<tr>
<td>overwhelms</td>
<td>adores</td>
</tr>
<tr>
<td>intimidates</td>
<td>cherishes</td>
</tr>
</tbody>
</table>
Experiment 1a: Nonsense sentences

1. **Quintin** intimidated **Ivan** because **he** is a dax.
2. Gina criticized **Melissa and she** is a dax.
3. **Max** praised Jerome **but he** is a dax. (NP2 verb)

40 participants via Amazon’s Mechanical Turks
6 random lists, 2 order, 5 observations of each type
6 control items (mixed gender)
Results: Experiment 1a

Connective

% Object interpretations

AND

BECAUSE

BUT

NP1 verb

NP2 verb
Results: Experiment 1a

% Object interpretations

<table>
<thead>
<tr>
<th>Connective</th>
<th>NP1 verb</th>
<th>NP2 verb</th>
</tr>
</thead>
<tbody>
<tr>
<td>AND</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>BECAUSE</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>BUT</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
Experiment 1a

% Object interpretations

AND

BECAUSE

BUT

NP1 verb

NP2 verb

connective
% object interpretations

Connective

NP1 verb
NP2 verb

% Object interpretations

AND
BECAUSE
BUT

AND
BECAUSE
BUT

connective

NP1 verb
NP2 verb
• Difference due to different methodology?
• Nonsense word method allows faster analysis
• Unable to check coherence relation that the answer was based on
• Ehrlich verbs different from other verbs?
Experiment 1b: Sentence Completion

1. **Quintin** intimidated Ivan because **he** ...
2. Gina criticized **Melissa** and **she** ...
3. **Max** praised Jerome but **he** ...

36 participants via Amazon’s Mechanical Turks
6 random lists, 5 observations of each type
6 fillers (mixed gender)
1. **Quintin** intimidated Ivan because he ...  
was a very large man.  
was very aggressive  
was so intelligent.

2. Gina criticized **Melissa and she** ...  
did the same in return.  
glared back at her.  
was very hurt.

3. **Max** praised Jerome but he ...  
did so grudgingly.  
was very condescending.  
was still mad.
Experiment 1b: all verbs

% object completions

Connective

And
Because
But

NP1 verb
NP2 verb
Only Ehlrich verbs

% Object completions

AND  BECAUSE  BUT

connective

NP1 verb  NP2 verb
NP2 verbs show a stronger reversal effect than NP1 verbs with **but**, NP1 effect still strong
Why does but have less effect on NP1 verbs than NP2 verbs?
• Why does but have less effect on NP1 verbs than NP2 verbs?
  – an across the board subject preference contributes?

Larry disappointed Oliver but he ...
• Why does \textcolor{red}{but} have less effect on NP1 verbs than NP2 verbs?
  – an across the board subject preference contributes?

\textbf{Larry} disappointed Oliver \textbf{because he} ...
Conclusions: Exp 1a & 1b

• **but** does reverse biases for NP2 verbs.

• the type of coherence relation might explain the differences with Ehrlich
  – perhaps some **but** continuations are actually parallel, e.g.
  – John admires Bill **but** he hates John.
Transfer verbs

- John kicked the ball to Bill and he ...

- Mike emailed the newsletter to Ed and he
- Subject preference
- First mention preference,
- Grammatical parallelism

Subject bias

Subject
Source

Referent Preference

Object
Goal

50/50
Transfer of possession
Source-Goal verbs

and
so
full stop
because

Goal (object) bias

Stevenson et al. (1994)
Goal bias?

and

so

full stop  Stevenson et al.

full stop  Rohde et al.

because

Subject
Source

Referent Preference

Object
Goal

Stevenson et al. (1994)
Aspect

- Rohde et al. (2006)
  - Incomplete event = less goal bias

(3) John *shipped* a package to Bill. He ...
(4) John *was shipping* a package to Bill. He ...
Transfer of possession verbs

– Source-Goal verbs

kick, fax, ship, throw
Contrast

• Denial of expectation?

(1) Luke gave the package to Mike and he took it to the post office.
(2) Luke gave the package to Mike but he had forgotten to tape it closed.
(3) Luke gave the package to Mike but he forgot to take it to the post office.
Experiment 3: *and vs. but* with aspect

Materials

- 16 Transfer verbs
- Story completion
- 2 x 2 design
  - Connective (*and* or *but*)
  - Aspect (simple past or past progressive)

Subjects = 25 (8 male, mean age =41)
Subject: Source

Referent Preference

Object: Goal

and

but

50/50

simple past
Discussion Exp 3

• Contra Ehrlich (1980), no bias reversal with *but*

• When is there a Goal preference with transfer verbs?
  
    – *And* = can be used to mark many different coherence relations
      
      • *Perhaps our materials (verb choice, object choice, fillers used?) encouraged continuations with coherence relations that associate with source continuations*
      
      • *Need to annotated coherence relation type for each response*
Experiment 4: so & but

- 16 Transfer verbs, 16 fillers (same as Exp 1)
- Connectives: so (result/purpose) and but
  - John kicked the ball to Mitch so he ....

- 37 subjects (13 male, 1 unknown)
- 1 subject excluded (some conditions missing)
- Errors: 2% uninterpretable, 12.5% ambiguous
- Mean age=39 (1 unknown)
Discussion Exp 4

• So displays the strong goal bias expected with these verbs

• But shows expected effect of aspect
  – But not a reversal of goal bias in simple past
  – Need to annotate coherence relations?

• More complicated than expected
Future work

- Annotate coherence relationships
- Try transfer verbs with nonsense words
implicit causality

the focussing hypothesis

(1) John blamed Bill because he spilt the coffee.

(2) John admired Bill because he was so brave.