The Path of Presupposition Projection in Processing: The Case of Conditionals

Florian Schwarz and Sonja Tiemann

University of Pennsylvania & Eberhard-Karls Universität Tübingen

Sinn und Bedeutung 17
September, 2012
Theoretical & Experimental Work on Presuppositions

Exciting times for presuppositions (PSP)!

- Flurry of new theoretical approaches in recent years
- Emerging body of experimental work, asking questions such as
  - Measuring impact on felicity in more precise terms
  - Extent and variation of contextual constraints imposed by PSP triggers
  - Effect of presuppositions on interpretation choices in light of ambiguities
  - Nature of presuppositions in conditionals and under quantification
  - Time course of PSP interpretation online
  - PSP interpretation options under negation and their time-course

Theoretical & Experimental Work on Presuppositions

Exciting times for presuppositions (PSP)!

- Flurry of new theoretical approaches in recent years
- Emerging body of experimental work, asking questions such as
  - Measuring impact on felicity in more precise terms
  - Extent and variation of contextual constraints imposed by PSP triggers
  - Effect of presuppositions on interpretation choices in light of ambiguities
  - Nature of presuppositions in conditionals and under quantification
  - Time course of PSP interpretation online
  - PSP interpretation options under negation and their time-course


Project here:
Time course and processing effects relating to presupposition projection

(Schwarz and Tiemann 2012)
Presupposition Projection

Projection out of embedding context is a core property of presuppositions, whereas asserted content is interpreted relative to embedding.
Presupposition Projection

Projection out of embedding context is a core property of presuppositions, whereas asserted content is interpreted relative to embedding

Tina went ice-skating again today.

**Assertion:** Tina went ice-skating today.

**PSP:** Tina went ice-skating before.
Presupposition Projection

Projection out of embedding context is a core property of presuppositions, whereas asserted content is interpreted relative to embedding.

Tina went ice-skating again today.

**Assertion**: Tina went ice-skating today.
**PSP**: Tina went ice-skating before.

It is not the case that Tina went ice-skating again today.

**Assertion**: Tina didn’t go ice-skating today.
**PSP**: Tina went ice skating before.
Descriptively:

**mismatch** between *syntactic location* and *level of interpretation*

Depending on underlying mechanisms, this could be

- a *challenge* that causes *effort in processing*
- something that happens in an *automated way* without incurring *any effort*
PSP Projection in online processing

- Descriptively: mismatch between syntactic location and level of interpretation

- Depending on underlying mechanisms, this could be
  - a challenge that causes effort in processing
  - something that happens in an automated way without incurring any effort

Schwarz and Tiemann 2012: Evidence for processing costs of projection based on eye tracking reading results
Instances of *wieder* ('again') where its PSP either *was* (i) or *was not* (ii) *supported* by the context
Previous work: Schwarz & Tiemann 2012

- Instances of *wieder* ('again') where its PSP either was (i) or was not (ii) supported by the context
- 2nd factor: *wieder* embedded under negation *(nicht wieder)* or not *(wieder nicht)*
Instances of *wieder* ('again') where its PSP either was (i) or was not (ii) supported by the context

2nd factor: *wieder* embedded under negation (*nicht wieder*) or not (*wieder nicht*)

Example:

C1: Tina went ice skating for the first time last week with Karl. The weather was beautiful, and they had a great time.

C2: Tina wanted to go ice skating for the first time with Karl last week. But the weather was miserable and they gave up on their plan.
Instances of *wieder* ('again') where its PSP either was (i) or was not (ii) supported by the context

2nd factor: *wieder* embedded under negation (*nicht wieder*) or not (*wieder nicht*)

Example:

C1: *Tina went ice skating for the first time last week with Karl. The weather was beautiful, and they had a great time.*
Previous work: Schwarz & Tiemann 2012

- Instances of *wieder* ('again’) where its PSP either **was** (i) or was **not** (ii) **supported** by the context
- 2nd factor: *wieder* embedded under negation (**nicht wieder**) or not (**wieder nicht**)

Example:

C1: *Tina went ice skating for the first time last week with Karl. The weather was beautiful, and they had a great time.*

C2: *Tina wanted to go ice skating for the first time with Karl last week. But the weather was miserable and they gave up on their plan.*
Instances of *wieder* ('again') where its PSP either *was* (i) or *was not* (ii) supported by the context

2nd factor: *wieder* embedded under negation (*nicht wieder*) or not (*wieder nicht*)

Example:

C1: *Tina went ice skating for the first time last week with Karl. The weather was beautiful, and they had a great time.*

C2: *Tina wanted to go ice skating for the first time with Karl last week. But the weather was miserable and they gave up on their plan.*

**Target**

(1) *Dieses Wochenende war Tina {(a) nicht wieder / (b) wieder Schlittschuhlaufen, weil das Wetter so schlecht war.}*

This weekend, was Tina {(a) not again / (b) again not} ice skating because the weather so bad was
C1: Tina went ice skating for the first time last week with Karl. The weather was beautiful, and they had a great time.

C2: Tina wanted to go ice skating for the first time with Karl last week. But the weather was miserable and they gave up on their plan.
**C1:** Tina went ice skating for the first time last week with Karl. The weather was beautiful, and they had a great time.

**C2:** Tina wanted to go ice skating for the first time with Karl last week. But the weather was miserable and they gave up on their plan.

**Target Presuppositions**

(2) **nicht wieder** (not > again)

Tina had been ice-skating before

AND NOT [she went ice-skating this weekend]

(Felicitous with C1)
**C1:** Tina went ice skating for the first time last week with Karl. The weather was beautiful, and they had a great time.

**C2:** Tina wanted to go ice skating for the first time with Karl last week. But the weather was miserable and they gave up on their plan.

**Target Presuppositions**

1. **nicht wieder** (not > again)
   - Tina had been ice-skating before
   - AND NOT [she went ice-skating this weekend]
   
   *(Felicitous with C1)*

2. **wieder nicht** (again > not)
   - There’s a previous time when Tina did not go ice-skating
   - AND this weekend, she did NOT go ice-skating

   *(Felicitous with C2)*
Main Questions

- Is the detection of infelicity reflected in processing, and if so when?

- Does embedding (requiring projection) modulate such effects?
Results for: First Fixation, Go-Past Time and Total Time on the Verb (here: Schlittschuhlaufen)

- sig. interaction
- (main effect of firstword)
- simple effect of felicity for wieder nicht
- simple effect of firstword for Infelicitous
Immediate Computation of Presuppositional Content

\textit{wieder nicht} presupposition is computed & evaluated immediately
Immediate Computation of Presuppositional Content

**wieder nicht** presupposition is computed & evaluated immediately

Strong interaction with embedding

- No felicity effect for **nicht wieder**
  (in fact, opposite effect for total time on verb)
- No sign of significant later effects
Immediate Computation of Presuppositional Content

wieder nicht presupposition is computed & evaluated immediately

Strong interaction with embedding

- No felicity effect for nicht wieder
  (in fact, opposite effect for total time on verb)
- No sign of significant later effects

Follow-up rating study: roughly equivalent levels of perceived infelicity for both orderings
Implementations of Mechanisms for PSP projection

Our Interpretation:

PSP Projection delayed

Fits most naturally with accounts that assume complex process for deriving global presuppositions (e.g., Sandt and Geurts 1991 and Sandt 1992’s DRT analysis)

→ Chain of manipulations on Discourse Representations
Implementations of Mechanisms for PSP projection

Our Interpretation:

**PSP Projection delayed**

Fits most naturally with accounts that assume **complex process for deriving global presuppositions**
(e.g., Sandt and Geurts 1991 and Sandt 1992’s DRT analysis)

→ Chain of manipulations on Discourse Representations

- Comparison of two classical theories:
  - Discourse Representation Theory (DRT)
  - Dynamic Semantics
Our Interpretation:

PSP Projection delayed

Fits most naturally with accounts that assume complex process for deriving global presuppositions (e.g., Sandt and Geurts 1991 and Sandt 1992’s DRT analysis)

→ Chain of manipulations on Discourse Representations

- Comparison of two classical theories:
  - Discourse Representation Theory (DRT)
  - Dynamic Semantics

- What processing predictions, if any, might these alternatives make for PSP projection?
In DRT, the projection path is defined on discourse representations.
In DRT, the projection path is defined on discourse representations.

Example:

Tina AGAIN NOT went ice-skating today.

\[
\begin{array}{|c|}
\hline
x \\
Tina(x) \\
\sim x \text{ went ice-skating before } \langle 0 \rangle \\
\sim x \text{ went ice-skating today} \\
\hline
\end{array}
\]
In DRT, the projection path is defined on discourse representations

Example:

Tina AGAIN NOT went ice-skating today.

Tina NOT AGAIN went ice-skating today.
In DRT, the projection path is defined on discourse representations.

Example:

Tina AGAIN NOT went ice-skating today.

Tina NOT AGAIN went ice-skating today.

→ Projection involves an additional step in manipulating the Discourse Representation, which could incur processing effort.
In dynamic semantics, the meaning of a sentence is determined by the context change potential (ccp) of its parts.

A context update can only be performed if the context entails all the PSPs of a (subparts of) a sentence.
In dynamic semantics, the meaning of a sentence is determined by the context change potential (ccp) of its parts.

A context update can only be performed if the context entails all the PSPs of a (subparts of) a sentence.

Tina AGAIN NOT went ice-skating  Tina NOT AGAIN went ice-skating
In dynamic semantics, the meaning of a sentence is determined by the context change potential (ccp) of its parts.

A context update can only be performed if the context entails all the PSPs of a (subparts of) a sentence.

Tina AGAIN NOT went ice-skating  Tina NOT AGAIN went ice-skating

\[ r = \text{Tina went ice-skating} \]
\[ PSP_r = \text{Tina had been ice-skating before} \]
In dynamic semantics, the meaning of a sentence is determined by the context change potential (ccp) of its parts.

A context update can only be performed if the context entails all the PSPs of a (subparts of) a sentence.

Tina AGAIN NOT went ice-skating

\[ r = \text{Tina went ice-skating} \]
\[ PSP_r = \text{Tina had been ice-skating before} \]

\[ c' = c + \neg r \]

defined iff

\[ c + \neg PSP_r = c \]
\[ c + PSP_r = c \]
Relating the accounts to the processing results

**DRT**

- Extra projection step requires time and effort in processing
- This prevents immediate detection of PSP conflict
Relating the accounts to the processing results

DRT
- Extra projection step requires time and effort in processing
- This prevents immediate detection of PSP conflict

Dynamic Context Update
- No difference in PSP evaluation
- If anything, AGAIN NOT might be harder because the presupposition contains a negation
Relating the accounts to the processing results

**DRT**
- Extra projection step requires time and effort in processing
- This prevents immediate detection of PSP conflict

**Dynamic Context Update**
- No difference in PSP evaluation
- If anything, AGAIN NOT might be harder because the presupposition contains a negation

More elaborate test of the Hypothesis that Projection takes time:
Broader range of projection path lengths in conditionals
Experiment: If ... { not again / again not}
Design Ingredients

- **Additional layer of embedding**
  \[\rightarrow \text{PSP in consequent of Conditional}\]
• Additional layer of embedding
  \[\rightarrow\text{PSP in consequent of Conditional}\]

• not again / again not manipulation
Design Ingredients

- **Additional layer of embedding**
  \[ \rightarrow \text{PSP in consequent of Conditional} \]

- **not again / again not** manipulation

- Presupposition always resolvable \[ \rightarrow \text{no infelicitous conditions} \]
Design Ingredients

- **Additional layer of embedding**
  \[\text{→ PSP in consequent of Conditional}\]

- **not again / again not** manipulation

- Presupposition always resolvable \(\text{→ no infelicitous conditions}\)

- **Additional variation:** location of support for PSP:
  - **globally** in a preceding sentence, or
  - **locally** in the **antecedent** of the *if*-clause
Tina war letzte Woche \{(I) \emptyset / (II) \textit{nicht}\} Schlittschuhlaufen. Wenn sie gestern \{(I) \textit{nicht} / (II) \emptyset\} Schlittschuhlaufen war, dann...
Context

*Tina war letzte Woche {(I) \(\emptyset\) / (II) *nicht*} Schlittschuhlaufen. Wenn sie
Tina was last week *not* ice-skating. If she
*gestern* {(I) *nicht* / (II) \(\emptyset\)} Schlittschuhlaufen war, dann...
yesterday *not* ice-skating was, then...

Target

...geht sie heute bestimmt {(NW) *nicht wieder* / (WN) *wieder nicht*}
...goes she today *not* again *again* *not*
*Schlittschuhlaufen, auch wenn das Wetter so schön ist.*
*ice-skating, even if the weather so beautiful is.*
### Context

*Tina war letzte Woche (I) (1) \( \emptyset \) / (II) \( \text{nicht} \)\* Schlittschuhlaufen. Wenn sie Tina was last week *not* ice-skating. If she
gestern (I) \( \text{nicht} \) / (II) (1) \( \emptyset \) Schlittschuhlaufen war, dann... yesterday *not* ice-skating was, then...

### Target

...geht sie heute bestimmt (NW) \( \text{nicht wieder} \) / (WN) \( \text{wieder nicht} \) ...goes she today not again again not
Schlittschuhlaufen, auch wenn das Wetter so schön ist. ice-skating, even if the weather so beautiful is.

= 4 conditions:

<table>
<thead>
<tr>
<th></th>
<th>Local</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context I</td>
<td>a: WN</td>
<td>b: NW</td>
</tr>
<tr>
<td>Context II</td>
<td>d: NW</td>
<td>c: WN</td>
</tr>
</tbody>
</table>
**p:** Tina didn’t go ice-skating yesterday

![Diagram showing DRT Predictions: I-WN (local)]
DRT Predictions: I-WN (local)

\( p: \) Tina didn’t go ice-skating yesterday

Path length = 1
c: Tina didn’t go ice-skating last week
c: Tina didn’t go ice-skating last week

\[ x \]
\[ Tina(x) \]
\[ C \]
\[ \sim x \text{ went ice-skating before} \] (2)

\[ \sim x \text{ went ice-skating before} \] (0)
\[ \sim x \text{ went ice-skating today} \]

Path length = 2
c: Tina went ice-skating last week
c: Tina went ice-skating last week

\[ x \quad Tina(x) \quad \sim \quad x \text{ went ice-skating today} \quad \varnothing \]

\[ \Rightarrow \quad x \text{ went ice-skating before} \quad (1) \]

\[ \quad \sim \quad x \text{ went ice-skating before} \quad (0) \]
c: Tina went ice-skating last week
DRT Predictions: I-NW (global)

**c:** Tina went ice-skating last week

\[
x
Tina(x)
C
\_ went ice-skating before \_ (3)
\]

\[
p
\_ went ice-skating before \_ (2)
\Rightarrow
\_ went ice-skating before \_ (1)
\sim \_ went ice-skating today
\_ went ice-skating before \_ (0)
\]

Path length = 3
\[\mathbf{p}: \ \text{Tina went ice-skating last week}\]
p: Tina went ice-skating last week
\[ p: \text{Tina went ice-skating last week} \]

Path length = 2
Predictions of a DRT analysis - Summary

\[ \text{LOCAL} \]

I \quad a = 1 \ (A_2-B) \quad < \quad b = 3 \ (A_1-C) \\
A \quad \land \\
II \quad d = 2 \ (A_1-B) \quad = \quad c = 2 \ (A_2-C) \\

\[ \rightarrow \text{Context} \ast \text{Location interaction} \ (+ \text{main effect of Location}) \]

\[ x, \ \text{Tina}(x) \]
\[ c, \ x \text{ went ice-skating before} (C) \]
\[ p, \ x \text{ went ice-skating before} (B) \]
\[ \Rightarrow \]
\[ x \text{ went ice-skating before} (A_2) \]
\[ \sim \ x \text{ went ice-skating today} \]
\[ x \text{ went ice-skating before} (A_1) \]
Dynamic Semantics

Context change potentials and PSP definedness conditions in conditionals:

**CCP of an if-clause**

\[ c + \text{If } p, q = c - ((c + p) - ((c + p) + q)) \]

[defined iff \((c + p) + \text{PSP}_q = (c + p)\)]

Note: PSPs of the consequent evaluated relative to original context updated with the antecedent. → No way to determine location of support for PSP! Therefore: No processing prediction based on semantics alone w.r.t. relative processing effort.
Dynamic Semantics

Context change potentials and PSP definedness conditions in conditionals:

**CCP of an if-clause**

\[
c + \text{If } p, q = c - ((c + p) - ((c + p) + q))
\]

[defined iff \((c + p) + \text{PSP}_q = (c + p)\)]

**Note:** PSPs of the consequent evaluated relative to original context updated with the antecedent
Dynamic Semantics

Context change potentials and PSP definedness conditions in conditionals:

**CCP of an if-clause**

\[ c^+ \text{ If } p, q = c - ((c + p) - ((c + p) + q)) \]

[defined iff \( (c + p) + \text{PSP}_q = (c + p) \)]

**Note:** PSPs of the consequent evaluated relative to original context updated with the antecedent

→ No way to determine location of support for PSP!

**Therefore:** No processing prediction based on semantics alone w.r.t. relative processing effort
A Processing Hypothesis

(independent from dynamic account)

- **Again** is an anaphoric trigger
A Processing Hypothesis

(independent from dynamic account)

- **Again** is an anaphoric trigger
- Processing parallel to other anaphora

Plausible hypothesis: Closer antecedent preferred and easier (here: local context) → Count distance in clauses

<table>
<thead>
<tr>
<th>Location</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A Processing Hypothesis

(independent from dynamic account)

- **Again** is an anaphoric trigger

- Processing parallel to other anaphora

- Plausible hypothesis: Closer antecedent preferred and easier (here: *local context*)
  → Count *distance in clauses*
A Processing Hypothesis

- **Again** is an anaphoric trigger
- Processing parallel to other anaphora
- Plausible hypothesis: Closer antecedent preferred and easier (here: local context) → Count *distance in clauses*

\[
\begin{array}{ccc}
\text{LOCAL} & < & \text{GLOBAL} \\
\text{I} & a = 1 & < \\
\text{=} & b = 2 \\
\text{II} & d = 1 & < \\
\end{array}
\]

→ main effect of Location
Potential predictions of a dynamic semantics analysis

One way of squeezing a potential prediction out of the dynamic account:

**Added complexity for negated PSP**

- $PSP_q = \neg r : \ c + \neg r = c? \approx c - (c + r) = c?$
- $PSP_q = r : \ c + r = c?$
Potential predictions of a dynamic semantics analysis

One way of squeezing a potential prediction out of the dynamic account:

**Added complexity for negated PSP**

- $PSP_q = \neg r : \quad c + \neg r = c? \quad \approx \quad c - (c + r) = c? \quad c + r = c?$
- $PSP_q = r :$

**Negated PSP in materials**

$r = Tina had been ice-skating before$

**WN:** $PSP_q = \neg r$

**NW:** $PSP_q = r$
Predictions of a dynamic semantics analysis

Additionally, negation in antecedent might play further role:

Assume:

\( q: \) Tina was ice-skating yesterday. \hspace{1cm} \( r: \) Tina had been ice-skating before.

**Context I**

\[
\begin{align*}
\text{WN: } (c' + \neg q) + \neg PSP_r &= c' + \neg q \\
\text{NW: } (c' + \neg q) + PSP_r &= c' + \neg q
\end{align*}
\]

**Context II**

\[
\begin{align*}
\text{WN: } (c' + q) + \neg PSP_r &= c' + q \\
\text{NW: } (c' + q) + PSP_r &= c' + q
\end{align*}
\]
Predictions of a dynamic semantics analysis

Additionally, negation in antecedent might play further role:

Assume:

\( q: \) Tina was ice-skating yesterday.

\( r: \) Tina had been ice-skating before.

**Context I:**

\[
\begin{align*}
WN &: (c' + \neg q) + \neg PSP_r = c' + \neg q \\
NW &: (c' + \neg q) + PSP_r = c' + \neg q
\end{align*}
\]

**Context II**

\[
\begin{align*}
WN &: (c' + q) + \neg PSP_r = c' + q \\
NW &: (c' + q) + PSP_r = c' + q
\end{align*}
\]

→ Context * Location interaction (BUT different from DRT: \( a > b, \ d < c \))
Prediction Summary

DRT

Processing

Dynamic (Negation)
DRT

Processing

Dynamic (Negation)

And the winner is...
### Results - Reading times on verb

<table>
<thead>
<tr>
<th>Verb - Total Time</th>
<th>Context</th>
<th>Total Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I II</td>
<td>location</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>global</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>local</td>
<td>450</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verb - Reg. Path</th>
<th>Context</th>
<th>Reg. Path (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I II</td>
<td>location</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>global</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>local</td>
<td>400</td>
</tr>
</tbody>
</table>

- Sum of all fixations on verb
- Sum of all fixations from first looking at verb to first moving on to the right

Parallel Results for Rereading time and for wieder nicht region

**Sig. interaction**

**Main effect of Location (and Context)**

Simple effects:

- \( a < b \), but not \( d < c \) (Reg Path)

\[ 35 / 40 \]
Results - Reading times on verb

**Verb - Total Time**

<table>
<thead>
<tr>
<th>Context</th>
<th>Total Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>350</td>
</tr>
<tr>
<td>II</td>
<td>400</td>
</tr>
<tr>
<td>location</td>
<td>global</td>
</tr>
<tr>
<td>global</td>
<td>450</td>
</tr>
</tbody>
</table>

**Verb - Reg. Path**

<table>
<thead>
<tr>
<th>Context</th>
<th>Reg. Path (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>300</td>
</tr>
<tr>
<td>II</td>
<td>400</td>
</tr>
<tr>
<td>location</td>
<td>global</td>
</tr>
<tr>
<td>global</td>
<td>350</td>
</tr>
</tbody>
</table>

**Sum of all fixations on verb**

**Sum of all fixations from first looking at verb to first moving on to the right**

Parallel Results for Rereading time and for **wieder nicht** region
Results - Reading times on verb

**Verb - Total Time**

<table>
<thead>
<tr>
<th>Context</th>
<th>Total Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>350</td>
</tr>
<tr>
<td>II</td>
<td>400</td>
</tr>
<tr>
<td>I</td>
<td>450</td>
</tr>
</tbody>
</table>

**Verb - Reg. Path**

<table>
<thead>
<tr>
<th>Context</th>
<th>Reg. Path (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>300</td>
</tr>
<tr>
<td>II</td>
<td>350</td>
</tr>
<tr>
<td>I</td>
<td>400</td>
</tr>
</tbody>
</table>

Sum of all fixations on verb

Parallel Results for Rereading time and for *wieder nicht* region

- **Sig. interaction**
- **Main effect of Location** (and Context)

Simple effects:
- \( a < b \), but not \( d < c \)
- \( a < d \) (Reg Path)
Further Analyses

- Main effect of Firstword (NW > WN) in Firstword × Location analysis, predicted only by DRT (not shown here)
Further Analyses

- Main effect of Firstword (NW > WN) in Firstword × Location analysis, predicted only by DRT (not shown here)

- Analysis based on **DRT Projection Path Length**
  - equally good as Context × Location interaction analysis
  - much better than analysis based on Location alone (corresponds to processing hypothesis)
Conclusion

- Strong support for representational complexity of PSP projection at the processing level

- DRT Projection Path length is a surprisingly good predictor of processing effort as reflected in reading times

- Potential anaphora processing effects based on clause-distance apparently absent
Open Issues & Further Questions

- Relation to Global < Local finding by Chemla & Bott 2012?

- Do non-anaphoric triggers behave the same way?

- Do pronouns behave the same way?

- Can any other PSP theories capture this data?

- Are there other independent processing interpretations?
References II


