Alignment, Reanalysis & (Re-)encoding

Matt Wagers
University of California, Santa Cruz
Department of Linguistics

X-PPL 2022 ⬤ September 12-13, 2022
University of Zurich, Department of Comparative Language Science
Investigations to date on verb-initial languages

- **Austronesian**
  - **Chamorro**
    Wagers, Borja & Chung, 2022; Chung & Wagers, 2021, Wagers, Borja & Chung 2018; Wagers, Borja & Chung 2015
  - **Tagalog**
    Tanaka 2016; Sauppe 2016; Pizarro-Guevara 2014; Pizarro-Guevara & Wagers 2020; Bondoc et al. 2019; Garcia et al. 2019
  - **Polynesian**
    Niuean: Longenbaugh & Polinsky 2016; Tollan & Heller, 2018
    Tongan: Ono et al. 2019, Otaki et al. 2021
  - **Formosan**
    Seediq: Sato et al. 2018, Ono et al. 2020, Yano et al. 2019

- **Oto-Manguean**
  - **Zapotec** (today)

- **Mayan**
  - **Kaqchikel** Kiyama et al. 2013; Koizumi et al. 2014; Yasunaga et al. 2015; Koizumi & Imamura 2016; Koizumi & Kim, 2016; et al.
  - **Tseltal** Norcliffe et al. 2015
  - **Chol, Q’anjob’al** Clemens et al. 2015
Have there been any consistent lessons?

- **Production.** Verb-initial clauses appear to be challenging to produce, compared to alternatives with an initial NP —

  - Perhaps because they require early processing of event representations (Norcliffe et al. 2015 for Tseltal; Sauppe 2016 for Tagalog)

- In VOS clauses, there is a conflict between linearization (O > S) and the accessibility of agents (Ag > Pat) (Koizumi et al. for Kaqchikel; Bondoc et al., and Garcia et al. for Tagalog)

- **Comprehension.** Less to say yet specifically about verb-initiality.

  - Comprehension/production asymmetry? SVO is easier to produce, but VOS is easier to comprehend in Kaqchikel; the same may be true about VSO v. VOS in Tagalog
What could be special about verb-initial RC processing?

1. **N - V - N** will often be ambiguous

2. Early verbs = early argument structure constraints

3. **V-initial languages** are often constrained by prominence hierarchies that regulate post-verbal argument realization (Minkoff, 2000; cf. Clemens & Coon, 2018)
The N - V - N configuration in V-initial languages and encoding interference

Can we find evidence for encoding interference in N - V - N configurations, of the sort familiar from N - N - V configurations?

1. Defining encoding interference in N - N - V orders:
   - When and why? New evidence from English

2. Evidence from N - V - N orders
   - Zapotec: gender/noun class
   - Chamorro: DP type or size
Part 1
Encoding interference
N - N - V
The reporter the politician the commentator met trusts said the president won’t resign.
The **reporter** the **politician** the **commentator** met trusts **said** the president won’t resign.
... nested constructions should become difficult to understand even when they are, in principle, within the capacity of a finite device, since available memory (i.e., number of states) is clearly quite limited for real-time analytic operations ... from these observations we are led to conclude that sentences of natural languages containing nested dependences or self-embedding beyond a certain point should be impossible for (unaided) native speakers to understand.


The reporter the politician the commentator met trusts said the president won’t resign.
The reporter the politician the commentator met trusts said the president won’t resign.

The reporter everyone I met trusts said the president won’t resign.
Memory interference during language processing
Gordon, Hendrick, & Johnson (2001) et seq

**Experiment 1**

**ORC** The banker that the barber praised climbed the mountain.

**SRC** The banker that praised the barber climbed the mountain.

**Experiment 2**

**ORC** The banker that you praised ...

**SRC** The banker that praised you ...

**Experiment 3**

**ORC** The banker that Ben praised ...

**SRC** The banker that praised Ben ...

**RC × DP Match interactions**

Reduced/eliminated ORC>SRC penalty when DPs mismatch
The parsing and semantic interpretation of a sentence *require* that intermediate representations be held in memory and addressed during comprehension.

Object-extracted constructions impose greater demands of this sort than do subject-extracted constructions because *they require that two NPs be stored and subsequently accessed while subject-extracted constructions do not.*

The different functions of those two NPs *are specified by the order* in which they appear in the sentence.

Memory for order information is impaired when items to be remembered are similar *because the similarity of the items causes interference in retrieving the order information* (Lewandowsky & Murdock, 1989; Murdock & Vom Saal, 1967; Nairne, 1990)

Given the classes of NPs that we have contrasted (descriptions, names, and pronouns), possible sources of similarity-based interference exist on both syntactic and semantic levels of representation. Possible syntactic features of NPs that could contribute to similarity include gender, number, case and person. Other syntactic correlates that distinguish names and pronouns from descriptions could also provide a basic of similarity[^fn].

[^fn]: For example, on one syntactic analysis, a description has two distinct morphemes for the specifier (determiner) position and the common noun position, whereas proper names and pronouns only have a single morpheme for these two syntactic classes.


---

**CASE**

**ANIMACY**

**PERSON**

Memory interference during language processing
Villata, Tabor, & Franck (2018); Italian gender

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Example of item in the four experimental conditions of Experiment 1.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental conditions</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Masculine object</strong></td>
<td></td>
</tr>
<tr>
<td>Match (MM)</td>
<td>Il/ballerino/che/il/cameriere/ha/sorpreso/beveva/un/cocktail/alcolico&lt;br&gt;The/dancer-MASC/that/the/waiter-MASC/has/surprised-Ø/drank/a/cocktail/with alcohol</td>
</tr>
<tr>
<td>Mismatch (MF)</td>
<td>Il/ballerino/che/la/cameriera/ha/sorpreso/beveva/un/cocktail/alcolico&lt;br&gt;The/dancer-MASC/that/the/waiter-FEM/has/surprised-Ø/drank/a/cocktail/with alcohol</td>
</tr>
<tr>
<td><strong>Feminine object</strong></td>
<td></td>
</tr>
<tr>
<td>Match (FF)</td>
<td>La/ballerina/che/la/cameriera/ha/sorpreso/beveva/un/cocktail/alcolico&lt;br&gt;The/dancer-FEM/that/the/waiter-FEM/has/surprised-Ø/drank/a/cocktail/with alcohol</td>
</tr>
<tr>
<td>Mismatch (FM)</td>
<td>La/ballerina/che/Il/cameriere/ha/sorpreso/beveva/un/cocktail/alcolico&lt;br&gt;The/dancer-FEM/that/the/waiter-MASC/has/surprised-Ø/drank/a/cocktail/with alcohol</td>
</tr>
</tbody>
</table>
Memory interference during language processing
Villata, Tabor, & Franck (2018); Italian gender

**FIGURE 1** | Distribution of reading times (in ms) in the four experimental conditions for the different regions of Experiment 1 (correct trials only).

Region 7 (*surprised*). Results attested to a significant effect of gender match ($\beta = 0.031$, $SE = 0.014$, $t = 2.253$, $p = 0.025$), with faster reading times for mismatch conditions ($M = 1197$ ms) than match conditions ($M = 1316$ ms). No other effect was significant ($t_s < 1$).

Region 8 (*drank*). No effect was significant ($t_s < 1$).

Region 5 (*waiter*). Results attested to a marginally significant effect of the gender of the object ($\beta = -0.020$, $SE = 0.010$, $t = -1.921$, $p = 0.068$), attesting to longer reading times at the second noun phrase region for feminine objects ($M = 763$ ms) than for masculine objects ($M = 728$ ms). Further models attested that this difference was entirely driven by the condition with two feminine noun phrases, which had marginally significant longer reading times as compared to the condition with two masculine noun phrases ($\beta = -0.053$, $SE = 0.028$, $t = -1.901$, $p = 0.057$), while all other conditions were on a par.

No other effect was significant ($t_s < 1$).
Where do similarity effects come from?

**INTERFERENCE FROM ENCODING AND RETRIEVAL**

Two “memory-based” mechanisms: **encoding** and **retrieval**

**Retrieval**

\[
P(M_i | Q_j) = \frac{s(Q_j, M_i)}{\sum_i^N s(Q_j, M_i)}
\]

← Match between the **CUE** and the **MEMORY**

← **Selectiveness** of CUE for the MEMORY

Nairne (1990, 2007)

*Arnett & Wagers (2017)*

cf. *Van Dyke & Lewis (2003)*

Et seq.

*S-COMP*

the explorer who believed that the monster was prowling the ruins went insane ...

the explorer who believed the monster to be prowling the ruins went insane ...

ECM

retrieval interference

**Optimal:**

A strong, unique cue
Memory interference during language processing
Villata, Tabor, & Franck (2018); Italian gender

No plausible gender-related cue in these sentences

Region 7 (surprised). Results attested to a significant effect of gender match ($\beta = 0.031$, $SE = 0.014$, $t = 2.253$, $p = 0.025$), with faster reading times for mismatch conditions ($M = 1197$ ms) than match conditions ($M = 1316$ ms). No other effect was significant ($t_s < 1$).

Region 8 (drank). No effect was significant ($t_s < 1$).

Region 5 (waiter). Results attested to a marginally significant effect of the gender of the object ($\beta = -0.020$, $SE = 0.010$, $t = -1.921$, $p = 0.068$), attesting to longer reading times at the second noun phrase region for feminine objects ($M = 763$ ms) than for masculine objects ($M = 728$ ms). Further models attested that this difference was entirely driven by the condition with two feminine noun phrases, which had marginally significant longer reading times as compared to the condition with two masculine noun phrases ($\beta = -0.053$, $SE = 0.028$, $t = -1.901$, $p = 0.057$), while all other conditions were on a par.

No other effect was significant ($t_s < 1$).

FIGURE 1 | Distribution of reading times (in ms) in the four experimental conditions for the different regions of Experiment 1 (correct trials only).
Where do similarity effects come from?

INTERFERENCE FROM **ENCODING** AND **RETRIEVAL**

**Figure 1.** Recent empirical work investigating incremental structure building in sentence processing can be usefully summarized in terms of distinct effects on the working memory processes of encoding, storage and retrieval. The figure illustrates the three processes with a simple example, showing the encoding of a subject noun-phrase, ‘the toy’, and its later retrieval at the associated verb, ‘arrived’. See the text and Box 1 for more detail about the nature of the encoded and retrieved structures. Abbreviation: SOV, subject-object-verb word order.

**Lewis, Van Dyke, & Vasishth (2006)**
The parsing and semantic interpretation of a sentence require that intermediate representations be held in memory and addressed during comprehension.

Object-extracted constructions impose greater demands of this sort than do subject-extracted constructions because they require that two NPs be stored and subsequently accessed while subject-extracted constructions do not.

The different functions of those two NPs are specified by the order in which they appear in the sentence.

Memory for order information is impaired when items to be remembered are similar because the similarity of the items causes interference in retrieving the order information (Lewandowsky & Murdock, 1989; Murdock & Vom Saal, 1967; Nairne, 1990).

Similarity can help and it can hurt
Ex.: Oberauer, Ferrell, Jarrold, Pasiecznik & Greaves (2012)

• Participants memorized lists of words, with the goal of recalling targets which were either phonologically similar or dissimilar to distractors that followed them.

  • baff daff haff vame rame pame nidd jidd gidd
  • baff jaab maab vame zegg yegg nidd vipe yipe

• Better recall of targets - in the right order - for similar lists! cf. Oberauer, 2009, for a related effect for semantic similarity

• ... but similar lists also led to more intrusions for immediately adjacent distractors
Similarity can help and can hurt
Ex.: Oberauer, Ferrell, Jarrold, Pasiecznik & Greaves (2012)

**SUPERPOSITION EFFECT** (Ferrell & Lewandowsky, 2002)
Y effectively contributes some of its features to the preceding position. If X and Y are similar, this will **strengthen** the binding of content to context: \(<X,1>\)

**FEATURE OVERWRITING** (Nairne, 1990; Oberauer & Kliegl, 2006)
Shared features get “overwritten”, **weakening** the content of X or Y.

Important assumption: Items get associated with preceding positions.
Applying to ORCs ...

Hypothesis: Reanalysis is the culprit, not linear order per se.

\( \text{DP}_1 \) ('banker') is effectively associated with two syntactic positions (S, O). As a consequence, it “loses” its shared features to actual subject, \( \text{DP}_2 \) ('barber').
Encoding interference damages representations
Rich & Wagers (2020)

- Manipulate **Similarity** and **Contiguity** of matrix subject **DP1** and embedded **DP2** in a complex sentence.
- Measure reading times when **DP1** must be integrated with **TP1**

<table>
<thead>
<tr>
<th>DP₁</th>
<th>[ DP₂</th>
<th>TP₂ ]</th>
<th>T₁ V₁ Adv₁</th>
<th>VP₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>the knife that</td>
<td>the sword</td>
<td>HI</td>
<td>was placed near</td>
<td>sharpened</td>
</tr>
<tr>
<td></td>
<td>the stick</td>
<td>MED</td>
<td></td>
<td>had been recently</td>
</tr>
<tr>
<td></td>
<td>the shirt</td>
<td>LO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Similarity of DP1 ~ DP2**
More similar **DP2** degrades **DP1**

**DP1 integration**
(no arg structure cues)

RTs ~ quality of DP1
Encoding interference damages representations
Rich & Wagers (2020)

### DP2 contiguous with DP1

<table>
<thead>
<tr>
<th>DP1</th>
<th>[ DP2 ]</th>
<th>TP2</th>
<th>T1 V1 Adv1</th>
<th>VP1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>the knife</strong> that</td>
<td>the <em>sword</em> <strong>HI</strong></td>
<td>was placed near</td>
<td><strong>had been recently</strong></td>
<td>sharpened</td>
</tr>
<tr>
<td></td>
<td>the <em>stick</em> <strong>MED</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>the <em>shirt</em> <strong>LO</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DP2 discontiguous with DP1

<table>
<thead>
<tr>
<th>DP1</th>
<th>[ T2 V2 P2 ]</th>
<th>DP2 ]</th>
<th>T1 V1 Adv1</th>
<th>VP1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>the knife</strong> that</td>
<td>_ was placed near</td>
<td>the <em>sword</em> <strong>HI</strong></td>
<td><strong>had been recently</strong></td>
<td>sharpened</td>
</tr>
<tr>
<td></td>
<td></td>
<td>the <em>stick</em> <strong>MED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>the <em>shirt</em> <strong>LO</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Encoding interference damages representations
Rich & Wagers (2020)

Contiguous encoding
Discontiguous

Similarity
(by LSA cos θ)

HI Similarity: knife ~ sword
LO Similarity: knife ~ shirt

UCSC
N_SUBJ = 64

Prolific
N_SUBJ = 48

Data collected during COVID-19 pandemic
How two DPs interact during sentence processing is determined by their similarity.

When DPs are similar and dynamically associated to the same position, this can lead to enhancement of the “winning” binding but degradation of one of the DPs.

Rich & Wagers (2020) document the downstream effects of the degradation.

No general theory (yet) of which features matter for similarity.

Some formal features do, like gender & number; others don’t (person).

DP “size” also seems to matter. More on that later …

BUT, so far, encoding interference has been shown in N - N - V configurations, when multiple nouns proceed the verb.

Is there encoding interference in N - V - N configurations?

In principle, possible if there is reanalysis (or the attachments are competitive).
Part 2
Encoding interference
N - V - N
RC processing
In verb-initial languages
SLZ in a nutshell

1. **Rigidly VSO:**
   V-N-N is unambiguous

2. **Movement creates ambiguity:**
   N-V-N: gap in **SUBJ** or **OBJ** position

3. There are **resumptive pronouns** (RPs)
   - which look like regular pronouns:
   - ... **SUBJ** pronouns obligatorily cliticize on verb
   - ... **OBJ** pronouns cannot cliticize across NP subject
   - therefore, **can potentially disambiguate**
1: Rigid VSO word order

(1) Tsyill

\[\text{pinch}.\text{CONT}\]

\[\text{Verb}\]

\[\text{Subject}\]

\[\text{Object}\]

\[\text{bene'}\text{ nu'ulhe}=\text{nh}\]

\[\text{CL woman}=\text{DEF}\]

\[\text{bene'}\text{ xyage'}=\text{nh}\]

\[\text{CL man}=\text{DEF}\]

‘The woman is pinching the man.’

NOT ‘The man is pinching the woman.’
2: Movement creates ambiguity

(2) Shlhe’eyd=a’ bene’ nu’ulhe=nh...

‘I see the woman that __ is pinching the man.’

OR ‘I see the woman that the man is pinching __.’
2: Movement creates ambiguity

(3) Bene’ nu’ulhe=nh tsyill bene’ xyage’=nh.

‘THE WOMAN is pinching the man.’

OR ‘The man is pinching THE WOMAN.’
3: Pronouns

Resumptive pronouns (RPs) can eliminate ambiguity.

Subject RPs must be clitics, and object RPs cannot cliticize across a subject DP.

\begin{itemize}
\item \texttt{Shlhe\textquoteleft eyd=a’ bene’ nu’ulhe=nh tsyill=e’ bene’ xyage’=nh.}
\item \texttt{see.CONT=1SG CL woman=DEF pinch.CONT=3EL CL man=DEF}
\item ‘I see the woman that she is pinching the man.’
\item ‘I see the woman that the man is pinching her.’
\end{itemize}
How do SLZ comprehenders parse RCs?

- Picture-matching experiments to probe the comprehension of RCs
- N = 105 speakers, living in Santiago Laxopa; auditory presentation
- Sentence types: ambiguous (gap), subject RPs and object RPs
How do SLZ comprehenders parse RCs?

- Picture-matching experiments to probe the comprehension of RCs
- N = 105 speakers, living in Santiago Laxopa; auditory presentation
- Sentence types: ambiguous (gap), subject RPs and object RPs

**Diagram:**
- Bar chart showing % Subject RC Interpretations for Ambiguous Subject RP, accurate subject RP comprehension, weak subject bias, and object RP comprehension at chance.
Why are object RPs so hard?

Suggestive observation from Foreman & Munro (2007):
In Macuilianguis Zapotec (MacZ), object RPs – and only object RPs – are unacceptable in MacZ — a typologically remarkable claim; cf. Keenan & Comrie, 1977

Plumb (2017) adds to this by showing that, in a historical variety, there are 0 attested object RPs (Colonial Valley Zapotec, CVZ; historical, 16th-19th C. corpus)

Plumb (2017), adapted from Table 1, “Resumptive pronoun attestation in CVZ”
Why are object RPs so hard?

Foreman & Munro (2007):
Object RPs – and only object RPs – are unacceptable in Macuiltianguis Zapotec (MacZ) (this is a typologically remarkable claim; cf. Keenan & Comrie, 1977)

A parsing constraint is proposed to account for this: immediately post-verbal NPs are parsed as subjects if they satisfy the verb’s selectional requirements.

We will call it $V\prec\text{SUBJ}$

Thus, in MacZ, there is a kind of constructional competition:

... NP-only RCs receive a default ORC interpretation

... and subject RPs are frequently used to achieve SRCs
What is happening moment-by-moment??

Foreman & Munro’s \( V < \text{SUBJ} \) parsing principle for MacZ is not strictly *incompatible* with there being an alternative principle — \( \text{PARSESUBJ} \) — to interpret RC fillers as subjects.

It will cause conflict whenever the post-verbal subject is a full DP. And our weak subject bias initially suggests \( \text{PARSESUBJ} \) is *slightly favored* in that competition.

```
DP - [\( \text{RC} \) V - DP]
```

Any evidence for an early \( \text{PARSESUBJ} \) principle?
Recall: bad performance on object RPs in our first experiment

- Conjecture: we used DPs that were insufficiently distinct, which has been shown to affect ORC parsing (cf. Gordon et al. 2001, Villata & Franck, 2019)

- $X_1 [\ V\ X_2 \ RP\ ]$

  by hypothesis $X_1$ & $X_2$ compete for the same SUBJ position, and this simultaneous co-activation creates an opportunity for superposition (enhancing; Ferrell & Lewandowsky, 2002) & feature overwriting (destructive) (Oberaeur & Kliegl 2006)

- $X_1 [\ V\ Y_2 \ RP\ ]$

  A grammatically active index that can discriminate $X_1$ & $Y_2$ will facilitate reanalysis

More generally

It is sometimes claimed that V-initial lgs are more directly constrained by animacy hierarchies (Minkoff, 2000; cf. Clemens & Coon 2018)

It's possible equal-animacy effects are more deleterious in non-canonical sentences (cf. Kubo et al. 2015).
Animacy-based gender

<table>
<thead>
<tr>
<th>Clitic</th>
<th>Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>3ELDER</td>
<td>=(n)e'</td>
</tr>
<tr>
<td>3HUMAN</td>
<td>=ba'</td>
</tr>
<tr>
<td>3ANIMAL</td>
<td>=(e)b</td>
</tr>
<tr>
<td>3INANIMATE</td>
<td>=(e)nh</td>
</tr>
</tbody>
</table>
Eye-tracking while listening

Santiago Laxopa, Oaxaca, Summer 2019

SUBJ = EL

SUBJ = HU

These DPs are different genders, reflected by different classifiers & different pronouns

-íl/-illo ‘call’
Baseline: incrementality in V-S-O clauses

How much information is necessary to discriminate between interpretations?

86% (±4%)
Baseline: incrementality in V-S-O clauses

Zapotec speakers can direct their attention to the correct picture with just the information provided by a verb + NP1.
Incrementality in relative clauses (with gaps)

How much information is necessary to discriminate between interpretations?

NP1

Udan fotografian tse

bi'i nu'ule'n

shlill

bene' gule'n
gan dzak Ini.

young girl
call
old person

V

NP2

52% (±5%)

Different from Exp 1.
No bias either way!
Incrementality in relative clauses (with gaps)

How much information is necessary to discriminate between interpretations?
Incrementality in relative clauses (with object RP)

How much information is necessary to discriminate between interpretations?

69% (± 5%)

Much more accurate than E1!
Incrementality in relative clauses (with object RP)

Speakers **switch** their attention from the **subject** picture to the **object** picture when they hear an RP.
Incrementality in relative clauses in 3 experiments

Exp. 1 (n = 31): Elder and Human arguments
Exp. 2 (n = 34): Human and Animal arguments
Exp. 3 (n = 30): Human and Inanimate arguments

Emergence of Parse Subject in All Experiments

Ambiguous RC

Object RP

Sasaki et al., 2021
We find direct evidence for **PARSESUBJ** in momentary record, i.e., looks to pictures.

- Early looks to **subject gap** picture before **NP2**.
- Cross-over pattern in **object RP** sentences consistent with reanalysis (cf. Pickering, Traxler & Crocker, 2000)

Evidence for **V<SUBJ** is at best **indirect**

No **cumulative** preference for subject gaps (52%)
We directly test the idea that DP match affects the ease of reanalysis.

2 x 2 design: {Match, Mismatch} x {Gap, RP}

Between-items: 15 items NP1 = HU; 15 items NP1 = IN
Effect of DP Match on ORC+RP comprehension

% NP1 = Subject Interpretations

NP1 = HU

Match Mismatch
Ambig. Gap
Match Mismatch
Obj RP

NP1 = IN

Match Mismatch
Ambig. Gap
Match Mismatch
Obj RP

Distinct DPs ~
greater success
reanalyzing to ORC
Mismatched arguments facilitate reanalysis

Diagram showing the effect of mismatched arguments on reanalysis:
- **Match**:
  - ArgGap
  - ObjRP

- **Mismatch**:
  - ArgGap
  - ObjRP

Variables:
- p_look
- time (ms)

Legend:
- **ctl**
- **object**
- **subject**

LookToN1AsSubj

Graphs illustrate the change in p_look over time for matched and mismatched conditions.
What is happening moment-by-moment??
Chamorro has two head-RC orders

**Head-final**

(5) **Ågang atyu i [ ha papaini i palåo’an ] na biha**

<table>
<thead>
<tr>
<th>call</th>
<th>DEM</th>
<th>D</th>
<th>combing</th>
<th>D</th>
<th>woman</th>
<th>L</th>
<th>old.lady</th>
</tr>
</thead>
</table>

“Call that woman who is combing the old lady”   SRC
“Call that woman who the old lady is combing”   ORC

**Head-initial**

(6) **Ågang atyu na biha i [ ha papaini i palåo’an ]**

<table>
<thead>
<tr>
<th>call</th>
<th>DEM</th>
<th>L</th>
<th>old.lady</th>
<th>D</th>
<th>combing</th>
<th>D</th>
<th>woman</th>
</tr>
</thead>
</table>

“Call the old lady who is combing the woman”   SRC
“Call the old lady who is the woman is combing”   ORC
Chamorro RC parsing as a function of head-RC order

- Picture matching to audio + touch-tracking  
  (cf., mouse-tracking, Freeman & Ambady, 2010)

- Developed in OpenSesame [http://osdoc.cogsci.nl/](http://osdoc.cogsci.nl/)  
  (Mathôt et al., 2012)

- and deployed on Google Nexus 10 tablets

Wagers, Chung & Borja (2018) *Cognition*
Head-initial relative clause

... na biha i [ ha papaini i palåo’an __ ]

... old lady who _ is combing the woman
Head-initial relative clause

... *na biha i [ ha papaini i palåo’an __ ]*

... old lady who the woman is combing __
Cumulatively, interpretations depend on head-RC order

Subject gap responses

- **Exp 1 (DP)**: Head-initial (black) vs. Head-final (blue)
- **Exp 2 (DP)**: Head-initial (black) vs. Head-final (blue)

But, the earliest interpretations are subject gap interpretations!

Evidence that $\mathbf{V} < \mathbf{SUBJ}$ doesn’t precede $\mathbf{PARSE} \mathbf{SUBJ}$ in head-final RCs.
What is happening moment-by-moment

Inserts an easily defeasible subject gap

Rarely triggers reanalysis

Is success of reanalysis is a function of similarity?

Head-initial RC

Head-final RC

DP - [RC V - DP] - DP
Chamorro has two head-RC orders

Head-final

(5) Ågang atyu i [ ha papaini i palåo’an ] na biha
   call DEM D combing D woman L old.lady
   “Call that old lady who is combing the woman”   SRC
   “Call that old lady who the woman is combing”   ORC

Head-initial

(6) Ågang atyu na biha i [ ha papaini i palåo’an ]
   call DEM L old.lady D combing D woman
   “Call that old lady who is combing the woman”   SRC
   “Call that old lady who is the woman is combing” ORC

Null-headed RCs

(7) Ågang atyu i [ ha papaini i palåo’an ]
   call DEM D combing D woman
   “Call that one who is combing the woman”   SRC
   “Call that one who the woman is combing”   ORC
Subject gap interpretations depend on head-RC order

Subject gap responses

Exp 1 (DP)
Neither **Chamorro** nor **Zapotec** show an across-the-board cumulative preference for subject gaps.

Both **Chamorro** and **Zapotec** nonetheless show evidence of the momentary effects of **PARSESUBJ**, a rule that inserts subject gaps early.

Arguably, **Chamorro** and **Zapotec** have a competing constraint (**V≺SUBJ**) that wants to identify the first post-verbal constituent as a subject. Cf. Bondoc et al. 2019 for Tagalog

In both languages, the **PARSESUBJ** interpretation gets entrenched in **N-V-N** constructions in circumstances of **encoding interference**

In **Zapotec**, the similarity relationship is defined by gender/animacy. In **Chamorro** it is DP type or size. Cf. Pizarro-Guevara 2020 for Tagalog.
Conclusion

Encoding interference arises in both \textbf{N - N - V} and in \textbf{N - V - N} configurations.

Factors like gender/animacy and DP type/size count toward encoding interference in \textbf{N - V - N} just like \textbf{N - N - V}.

This occurs despite the fact that the \textbf{N - V - N} configuration arguably provides clearer positional cues to the order of the two nouns.

It’s not linear order, then, but the \textbf{process of reanalysis} which I’ve argued unifies the two configurations.

If this is correct, the reanalysis in \textbf{N - V - N} is “unforced”: it doesn’t have to happen to attain a grammatical parse. I’ve argued two competing principles, which are activated at different time points, prompt the reanalysis.
Duxklhenu’!

- **Zapotec**
  - Raul Díaz Robles, and 2 other speakers
  - Residents of Santiago Laxopa
    - Director Evaristo López Velázquez
    - Santiago Laxopa President Celestino Robles Ramirez
  - **z/lab**: Fe Silva Robles, Maziar Toosarvandani, Kelsey Sasaki, Jed Pizarro-Guevara, Steven Foley, Brianda Caldera, Azusena Orozco, Jack Duff, Delaney Gomez-Jackson
- **RPs**: Jim McCloskey, Sandy Chung, Ivy Sichel,
- **r/lab** at UC Santa Cruz, audiences at Michigan, MAPLL-TCP-TL 2019, CUNY 2020 and IJPCP 2021

- **NSF BCS #2019804** to UCSC (Toosarvandani, PI; Sichel & Wagers, Co-PI)

- UCSC Academic Senate **Committee on Research** and Vice Chancellor for Research
  - **The Humanities Institute**, UC Santa Cruz
  - **Roque Reyes Mendoza**, illustrator
Dångkulu na Si Yu’us Ma’åsi’!

Luta
- Tita A. Hocog
- Antonio C. Atalig Memorial Library
- Sentrun Manåmku’
- Denise Tanya King
- Rita H. Inos Rota High School
- Office of the Mayor & Mayor Efraim M. Atalig
- Marvin Tamangided & Sinapalo School
- Magdalena S.N. Mesngon & Department of Community and Cultural Affairs
- Julita A. Calvo

Saipan
- Roman Tudela
- Indigenous Affairs Office
- Joeten-Kiyu Library
- Lady Diann Torres Foundation
- Rita Chong
- Historic Preservation Office
- Jessica Tomokane
- CNMI Legislature
- Representative Lee Pan T. Guerrero
- Senator Justo S. Quitugua
- Len Sablan
- Roy D. Rechebei†
- Mrs. Paulette T. Sablan & San Vicente Elementary
- Dr. Ignacia T. Demapan & Kagman Elementary
- Cindy P. Reyes & the CCLPC
- Marianas Public Land Trust

Manuel F. Borja

Chamorro Dictionary
Working Groups

NMI Humanities Council

Nicole Goux, illustrator

http://chamorro.sites.ucsc.edu
National Science Foundation BCS #1251429 to MW & SC