Young speakers in the bottleneck

knowledge and use of morphology in Chamorro

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Sentence Processing in Multilingual and Other Less Commonly Studied Populations
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Figure 1. Map of the Mariana Islands. Inset shows the position of the Mariana Islands in relation to Asia and the western Pacific. From Smith, Cooper-Nurse & Gawel (2008)
Commonwealth of the Northern Mariana Islands

English-only: ~17%

Source: 2010 US Census

From Smith, Cooper-Nurse & Gawel (2008)

All inhabitants

Philippine languages (33%)
Chamorro (24%)
Other Pacific languages (10%)
Chinese (7%)
Korean (6%)
Commonwealth of the Northern Mariana Islands

Language Preference Among Ethnic Chamorros

- English-only < 0.5%

- English-only: ~17%

- Chamorro-only < 0.5%

- Chamorro-only (24%)

- Philippine languages (33%)

- Other Pacific languages (10%)

- Chinese (7%)

- Korean (6%)
Speaker age
By language each speaker uses at home

Chamorro

5 to 11
12 to 17
18 to 20
21 to 24
25 to 29
30 to 34
35 to 44
45 to 54
55 to 64
>65

0
0.1
0.2
0.3
0.4

English-only

0
0.1
0.2
0.3
0.4

Source: 2010 US Census
Percentage of speakers in age group
By language each speaker uses at home

Source: 2010 US Census
Attitudes about change

Chamorro observers evaluating language health often draw evidence from the local music industry.

The Chamorro music industry, which has helped to sustain the fluency and the positive language attitudes of older Chamorros has begun to decline slightly in recent years.... when young Chamorros branch out into new musical genres, the lack of their fluency in Chamorro leads the result of their creativity energies to be largely in English. (Miguel Lujan Bevacqua, 2006)
Our research

Since 2011, we have conducted 6 studies on Chamorro sentence processing, each asking how morphology constrains incremental interpretation.

Approximately 420 unique participants have been involved in our research, amounting to nearly 5% of (eligible) Chamorro speakers in the CNMI.

Could we leverage our data to ask questions about how younger speakers’ knowledge and use of Chamorro might be different from older speakers’?
Today

- Grammar of relative clauses
- Factors affecting RC disambiguation
- Younger speakers’ use of complex morphology as a cue to disambiguation
Synopsis

- In the domain investigated, younger speakers show little evidence of having morphological or syntactic knowledge that is divergent from their older counterparts.

- But they do show a heightened sensitivity to processing bottlenecks.
Language features

1. *Verb-initial canonical word order*

2. Flexible modifier order

3. Rich verbal morphology
1) Verb-initial word order

(1) **Mañaibuk** i palåo’an lemmai
    
    cook       woman       breadfruit

    “The woman **cooked** breadfruit in coconut milk”

- word order is otherwise flexible
2) Flexible modifier order

- Modifiers can occur before or after the head noun

(2)  Atan  i agaga’  na kareta
     look.at  red  L  car
     “Look at the red car.”

(3)  Atan  i karetan  agaga’
     look.at  car.L  red
     “Look at the red car.”
2) Flexible modifier order

- .... Including relative clause modifiers

(4) Ågang i palåo’an [ ni mañaibuk lemmai ]
call woman REL cook breadfruit
“Call the woman **who cooked breadfruit**”

(5) Ågang i [ mañaibuk lemmai ] na palåo’an
call cook breadfruit L woman
“Call the woman **who cooked breadfruit**”
2) Flexible modifier order

- Additionally: relative clauses may be headless

(6) Ågang i [ mañaibuk lemmai ] ∅
call cook breadfruit
“Call the one who cooked breadfruit”
3) Rich morphology

- Transitive RCs are systematically ambiguous

(7) Atan atyu i [ ha kadididak i biha ] na påtgun.

look.at DEM tickle.PROG old L child

“Look at the child who __ is tickling the old lady”
“Look at the child who the old lady is tickling __”
3) Rich morphology

- “Wh-Agreement” morphology disambiguates

(8) Atan atyu i [kumadididak i biha] na påtgun.

look.at DEM tickle.PROG old L child

<um>: Subject Wh-Agreement
3) Rich morphology

- “Wh-Agreement” morphology disambiguates

(9) Atan atyu i [kinadidadak-ña i biha] na påtgun.
    look.at DEM  tickle.PROG  old  L  child

<in> + -PossAgr: Object Wh-Agreement
3) Rich morphology

- Many ways to inflect the same root to directly encode filler-gap grammatical role via wh-agreement or voice

hu kadidak, un kadidak ... ... 
makadidak
kinadidak
mangadidak
kumadidak
kinadidak-ku, kinadidak-mu ... ... ... ...
## Comparison to English

<table>
<thead>
<tr>
<th></th>
<th>Chamorro</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Word order</strong></td>
<td>V-S-O flexible</td>
<td>S-V-O less flexible</td>
</tr>
<tr>
<td><strong>Modifiers</strong></td>
<td>D-N-RC</td>
<td>D-N-RC</td>
</tr>
<tr>
<td></td>
<td>D-RC-N</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D-RC-∅</td>
<td></td>
</tr>
<tr>
<td><strong>Morphology</strong></td>
<td>directly identifies gap in RCs</td>
<td>word order provides partial cue to gap</td>
</tr>
</tbody>
</table>
Two experiments (2013, 2014)

1. How does head-modifier order affect interpretation of ambiguous RCs?

2. How effective are unambiguous morphological cues to RC interpretation?

Wagers, Borja & Chung, in prep
Method

- 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
paini  ‘comb’
Chonnik i floris guatu gi atyu …
Push the flower over to that …
Postnominal relative clause

... na biha i ha papaini i palåo’an

... old lady who ___ is combing the woman
Ambiguous RCs

Subject interpretations (%)

<table>
<thead>
<tr>
<th></th>
<th>Prenominal</th>
<th>Postnominal</th>
<th>Headless</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td>Ambiguous RCs</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Wagers, Borja & Chung, in prep
Why does {RC, N} order matter?

**postnominal**

\[
D - N - [_{RC} V \ldots] =_{\emptyset} e = \text{Subj}
\]

An early analysis links the visible RC-external argument to the subject position, simultaneously satisfying its need for a thematic role and the verb’s need for a subject.

Wagers, Borja & Chung, in prep
Why does \{RC, N\} order matter?

**prenominal**

\[
\begin{array}{l}
D - \left[_{RC} V \ldots \ ?N \right] \\
\quad = \text{Subj} \\
\quad e \quad = \emptyset
\end{array}
\]

An early, hypothetical analysis links the unseen RC-external argument to the subject position.

\[
\begin{array}{l}
D - \left[_{RC} V \; DP \ldots \ ?N \right] \\
\quad = \text{Subj} \\
\quad e \quad = \emptyset
\end{array}
\]

It gives way under competition to a stronger analysis, which links the **visible** internal argument to that position.

Wagers, Borja & Chung, in prep
Earlier subject analyses in prenominal RCs

Wagers, Borja & Chung, in prep
Two experiments (2013, 2014)

1. How does head-modifier order affect interpretation of ambiguous RCs?

2. How effective are unambiguous morphological cues to RC interpretation?

Wagers, Borja & Chung, in prep
Unambiguous RCs

Error rate (%)

Object Wh-Agr

Subject Wh-Agr

Prenominal

Postnominal

Headless

Wagers, Borja & Chung, in prep
Speaker characteristics

Age x Sex Counts

- 18-29
- 30-39
- 40-49
- 50-59
- 60-70

- male
- female
The youngest speakers make the most errors.
But not across the board! Only in certain RC orders.
Error summary

- The youngest speakers can use morphology to correctly disambiguate, **but not in all orders.**

- Across the board, speakers make the fewest errors on *headless relative clauses.*
Conjecture, I

- Younger speakers’ grammars of movement and Wh-Agreement are not divergent from older speakers’.

- But, younger speakers are more sensitive to the processing bottlenecks caused by competition or reanalysis.
Why does \{RC, N\} order matter?

prenominal

\[
D - [_{RC} V \ldots ?N] = \text{Subj} \quad e \quad \theta
\]

An early, hypothetical analysis links the unseen RC-external argument to the subject position.

\[
D - [_{RC} V \; \text{DP} \ldots ?N] = \text{Subj} \quad e \quad \theta
\]

It gives way under competition to a stronger analysis, which links the visible internal argument to that position.

Wagers, Borja & Chung, in prep
Younger speakers experience greater competition in ambiguous, prenominal RCs.

(cf. mouse-tracking, Freeman & Ambady, 2010)
Younger speakers experience greater competition in ambiguous, prenominal RCs.

Touch track length by age, gap & structure

(c.f. mouse-tracking, Freeman & Ambady, 2010)
... and in postnominal RCs with Object Wh-Agreement

Unambiguous WH Agreement verbs

<table>
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<tr>
<th>rc.type</th>
<th>pre</th>
<th>post</th>
<th>headless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object WH</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject WH</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Unambiguous WH Agreement verbs**
- **rc.type**: pre, post, headless
- **Object WH**
- **Subject WH**

- **touch track length** (residual pixels)
- **age (years)**
Reanalysis with Object Wh-Agreement

postnominal

\[
D - N - \left[_{RC} V \ldots \right]
\]

\[
= \emptyset \quad e \quad = \text{Subj}
\]

reanalysis

\[
D - N - \left[_{RC} \text{kinadidak-ña} \ldots \right]
\]

\[
= \emptyset \quad = \text{Obj} \quad \text{Subj}
\]

Wagers, Borja & Chung, in prep
Summary

- The youngest speakers can use morphology to correctly disambiguate, but not in all orders.

- Across the board, speakers make the fewest errors on headless relative clauses.

- Touch-tracking measures give evidence of more pronounced competition for younger speakers between 2 interpretations/pictures.
Conjecture, II

- Younger speakers’ grammars of movement and Wh-Agreement are not divergent from older speakers’

- Younger speakers are most sensitive to competition from their English grammar, leading to worse performance on more English-like structures
3) Rich morphology

- Transitive RCs are systematically ambiguous

(7) Atan atyu i [ ha kadididak i biha ] na påtgun.
look.at DEM tickle.PROG old L child

“Look at the child who __ is tickling the old lady”
“Look at the child who the old lady is tickling __”
4) Radical pro drop

- ... but, pro cannot be an object if the subject is an animate full DP

(7) Atan atyu i [ ha kadididak pro ] na påtgun.
    look.at DEM tickle.PROG L child

“Look at the child who __ is tickling her”
“Look at the child who she is tickling __”
The youngest speakers make very few errors!

Person–Animacy Hierarchy Errors

![Graph showing error rate against age (years) for different rc.types: post and pre.]

- Error rate on the y-axis, ranging from 0.00 to 1.00.
- Age (years) on the x-axis, ranging from 30 to 60.
- Two types of data points: post (black) and pre (orange).

The graph illustrates that the error rate decreases as age increases, with the youngest speakers (e.g., 30 years) making very few errors compared to older speakers.
Summary, II

- Younger speakers do comparatively well at enforcing a decidedly un-English-like constraint

- … in the same competitive environments that gave them problems before
Conclusions

- N-RC order affects how ambiguous RCs are interpreted
- It also affects how easily RCs are processed with disambiguating morphology
- Younger speakers can process complex object Wh-Agreement verb forms with very few errors
- But they are more sensitive to RC type than older speakers
Conclusions

- Younger speakers are more sensitive to RC type than older speakers
- … in particular, the number or ordering of DP arguments
- Our data suggest that either:
  - they are more sensitive to competition between analyses;
  - OR they are most errorful when processing uniquely Chamorro morphology in English-like syntactic environments;
Dångkulu na Si Yu’us Ma’åsi’!

**Luta**
- Tita A. Hocog
- Office of Mayor Melchior T. Mendiola
- Bureau of Motor Vehicles
- Department of Commerce
- Dept. of Community and Cultural Affairs
- Municipal Council
- Police Department
- Port Authority
- Sinapalo School

**Saipan**
- Arts Council
- Café at the Park
- Chamorro-Carolinian Cultural Center
- CCLPC
- Department of Commerce
- Frank Tomokane
- Garapan Elementary School
- Ignacia T. Demapan
- Inetnun Åmut yan Kutturan Natibu
- Joeten-Kiyu Library
  - Rosalyn Ajoste
- Office of Congressman Antonio R. Agulto
  - Lupe T. Pangelinan
- Office of Vocational Rehabilitation
  - KKMP
  - Gary Schwartz and Gordon Marciano
- Marianas Public Land Trust
- NMI Humanities Council
  - Alejandro Agulto
  - Elvin Quituguia
- National Science Foundation BCS #1251429 to MW & SC

**Tinian**
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- Florine M. Hofschneider
- Lorna Cruz

**Chamorro Dictionary Working Groups**
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**NMI Humanities Council**
- Alejandro Agulto
- Elvin Quituguia
Thank you ~ Si Yu’us Ma’åsi’

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