A Case of “Elsewhere Reversal” in Iranian Armenian Verbs

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Outline

Description of the Change
- Armenian varieties
- Armenian verbal morphology
- The “Elsewhere Reversal”

Accounting for the Change
- Indirect facilitation by a phonological change
- Support from Armenian variety typology
- A quantitative acquisition-based analysis
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The Armenian Language(s)

- A branch of Indo-European spoken indigenously in the southern Caucasus and eastern Anatolia
- A large diaspora in former Ottoman, Soviet, and Persian territories as well as the USA
- Two primary branches: Western and Eastern
- Our focus is Tehrani Iranian Armenian spoken in Tehran and Los Angeles
  Eastern, similar to Standard Armenian
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- Two primary branches: **Western** and **Eastern**
- Our focus is **Tehrani Iranian Armenian** spoken in Tehran and Los Angeles
  Eastern, similar to **Standard Armenian**

**Standard Eastern Armenian** is conservative in the relevant paradigm, so we use it as a proxy for pre-modern Iranian Armenian
Armenian Verbs

- Distinguishes perfectivity in the past tense
- Two inflectional classes by theme vowel: A-Class, E-Class. **E-Class is the largest**

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Vocab Items for Perfect

- `ASP[IPFV]T[PST] ↔ -Ø-i-`
An Iranian Innovation

- Regular E-Class perfects have an ending -$a-$ instead of -$c’i-$
- They pattern like the E-Class irregulars of conservative varieties

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Vocab Items for Perfect

- $\text{ASP[Pfv]} \leftrightarrow \emptyset-a- \text{/ LIST} $
- $-c’i- \text{/ ELSEWHERE}$

A case of analogical extension

A morphological pattern has spread from a smaller irregular class to a larger regular class!
An ‘Elsewhere Reversal’

The conditioned and default realizations seem to have flip-flopped!

- \(-c’-i\)- was the default, now it’s limited to A-Class
- \(-Ø-a\)- was limited to irregulars, now it’s the default

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Vocab Items for Perfect

- c’-i- / ELSEWHERE

- ASP[PfV] T[Pst] ↔ -c’-i- / Th[=a]____
- Ø-a- / ELSEWHERE
Two Additional Observations

Some regular E-Class verbs already had -a- perfects

- Observed in Western as well as Eastern Armenian
- They coexist with -ec’i- perfects (sometimes only in the 3rd person singular)
- Tend to be high-frequency verbs (‘do,’ ‘bring,’ ‘give,’ ‘say,’...)

Outside of Iranian Armenian, -a- perfects are more common in

- Intransitive verbs
- Verbs with monosyllabic roots

1 Martirosyan 2009
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There are actually two changes here...

1. **A Phonological Change**
   - **Hiatus glide insertion** > **Deletion**
   - **Conservative** > **Iranian**
   - /ei/ > [eji]
   - /ei/ -> [i]

2. **A Morphological Change**
   - **The perfect Elsewhere Reversal**
   - **Conservative** → **Iranian**
   - -ec’i- → -a-

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### Proposal: Indirect Causation

1. The phono change made a novel alternative morpho generalization available to learners
2. A speaker adopting this novel generalization could spread -a- to regular E-Class verbs via normal over-regularization

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Two Options after the Phonological Change

Conservative Generalization

- ASP[PFV] ↔ Θ / LIST
- ASP[PFV] ↔ -c’-
- ASP[IPFV] ↔ Θ
- T[PST] ↔ -a- / LIST
- T[PST] ↔ -i-

Predicts ergec’in

Innovative Generalization

- ASP[PFV] ↔ -c’- / TH[=a]
- ASP[PFV] ↔ Θ
- ASP[IPFV] ↔ Θ
- T[PST] ↔ -a- / √-ASP[PFV]
- T[PST] ↔ -i-

Predicts ergan

There are many ways to implement this. The idea is:
When there is no (overt) TH, perfect = -a-, imperfect = -i-.
Predictions

If the phonological change set up the Elsewhere Reversal, then

● A-Class should retain -ac’i- perfects because its imperfect retains [aji]
● If an Armenian variety has the Elsewhere Reversal, it must also have /ei/>[i]
● If an Armenian variety has /ei/>[i], it may or may not have have the reversal
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<td>-ein</td>
<td>-ec’in</td>
<td>(Standard Eastern)</td>
</tr>
<tr>
<td>-in</td>
<td>-ec’in</td>
<td>10</td>
</tr>
<tr>
<td>-in</td>
<td>-(ec’)*in</td>
<td>3</td>
</tr>
<tr>
<td>-in</td>
<td>-an</td>
<td>1 (Tehrani Iranian)</td>
</tr>
<tr>
<td>-ein</td>
<td>-an or -in</td>
<td>unattested</td>
</tr>
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- /ei/ > [ejil], no reversal
- /ei/ > [i], no reversal
- /ei/ > [i], optional reversal
- /ei/ > [i], complete reversal
- /ei/ > [ejil], reversal
The Actuation Problem

Under what conditions was the novel grammar innovated?

- The Actuation Problem.\(^1\) We can never know exactly for sure
  …But we can approach a solution asymptotically

\(^1\) Weinreich, Labov, & Herzog 1968
The Actuation Problem

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Helps to have a precise definition of actuation\(^2\)…

Actuation = Innovation + uptake into the speech community
(The hand-off from an individual-level process to a population-level one)

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\(^1\) Weinreich, Labov, & Herzog 1968, \(^2\) Labov, Yaeger, & Steiner 1972
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...And a model of innovation

Adopting a learning model provides insight into under what conditions the novel Iranian Armenian grammar could have been learned

\(^1\) Weinreich, Labov, & Herzog 1968, \(^1\) Labov, Yaeger, & Steiner 1972
The Tolerance Principle (Yang 2016)

- A concrete model for the acquisition of linguistic generalization
- An evaluation metric over linguistic hypotheses
- Developed in the context of the Past Tense Debate
  But has since been applied across levels of the grammar

Serves as our innovation model

- The TP provides a model for learner over-regularization
- Over-regularization is the individual-level analogue to diachronic analogy
The Tolerance Principle (Yang 2016)

How many exceptions is “too many” exceptions?
Given a hypothesized generalization operating over some class, quantitatively define the number of exceptions below which the generalization is tenable

\[ N = \text{number of types that should obey the generalization} \]
\[ e = \text{number of types that do not obey the generalization} \]
\[ \theta = \text{max # of exceptions that can be tolerated} \]

Exceptions are tolerable if \( e < \theta \)
\[ \theta = \frac{N}{\ln N} \]
$N$ and $e$ Vary over Individual Development

- $N$ and $e$ are properties of each individual
- $N$ is the number of class members a child has learned so far
- $N$ and $e$ grow as the learner’s vocabulary grows

Can learn generalizations over small $N$ not possible over large $N$
Visualization of the Tolerance Principle

$N =$ types it should apply to
$e =$ types that are exceptions
$\theta =$ tolerance threshold

$e$ falls in $[0, N]$ and may be less than or greater than $\theta$
Visualization of the Tolerance Principle

$N$ = types it should apply to  
e = types that are exceptions  
$\theta$ = tolerance threshold

If $e$ is below $\theta$,
acquire pattern as rule
Visualization of the Tolerance Principle

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- \( N \) grows over an individual’s development, \( \theta \) grows more slowly
Visualization of the Tolerance Principle

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- If $\theta$ grows faster than $e$, a pattern may fall into productivity
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- If $e$ grows faster than $\theta$, a pattern may fall out of productivity
Acquisition in the Past

- Children in the past must have acquired language in the same way that modern children do
  a straightforward application of uniformitarianism
- We can reason about acquisition in the past in the same way we do now

1 Labov 1972 as applied to linguistics, Walkden 2019
Acquisition in the Past

- Children in the past must have acquired language in the same way that modern children do
  a straightforward application of uniformitarianism\(^1\)
- We can reason about acquisition in the past in the same way we do now

Can non-child-directed speech corpora be substituted for child-directed speech to study the relevant problem?
Yes, for the purposes of lexical acquisition\(^2\)

\(^1\) Labov 1972 as applied to linguistics, Walkden 2019, \(^2\) Kodner 2019
Child Lexical Knowledge

- Learners’ vocabularies grow over the course of development
- There is significant individual variation, but consistent trends
- Only on the order of 10^2 for English and German learners by around age 3
- Observed across many languages, ≤ half of these are verbs
- Children have the foundations for language-specific grammars by this point

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<th>Language</th>
<th>Estimated</th>
<th>Vocab</th>
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<tr>
<td>English 2;10-3;0^1</td>
<td>525-1,116</td>
<td></td>
<td></td>
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<tr>
<td>German 2;6^4</td>
<td>μ = 429, σ &gt; 100</td>
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Methodology

Estimate learner vocabularies in increasing increments

- Verbs extracted/annotated from an Eastern Armenian frequency dictionary\(^1\)
- Vocabularies estimated by taking the top \(V\) for \(V=50, 60, ..., 100, 200, ..., 600\)

\(^1\) Ղազարյան 1982
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Explore feasible incrementation pathways

- What novel generalizations (if any) can be tolerated at each \( V \) size?
- These are feasible incrementation pathways for the Elsewhere Reversal as new cohorts successively extend over-generalizations

\(^{1}\) Ղազարյան 1982
Data Summary (Std East)

- E-Class accounts for most verbs
- Irregular, monosyllabic, and intrans. constitute large subsets of E-Class

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<tr>
<th>V</th>
<th>E-Class All</th>
<th>Std E-(a)-</th>
<th>E-Class Irreg</th>
<th>E-Class 1(\sigma)</th>
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<td>33</td>
<td>8</td>
<td>15</td>
<td>26</td>
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<tr>
<td>60</td>
<td>41</td>
<td>10</td>
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<td>11</td>
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<td>100</td>
<td>72</td>
<td>12</td>
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Data Summary (Std East)

- E-Class accounts for most verbs
- Irregular, monosyllabic, and intrans. constitute large subsets of E-Class

We take irregular E-Class verbs with -\(a\)- perfects in Standard as the initial state (blue column) and ignore optional -\(a\)- verbs (conservative assumption)

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<td>200</td>
<td>161</td>
<td>13</td>
<td>54</td>
<td>106</td>
<td>64</td>
</tr>
<tr>
<td>300</td>
<td>243</td>
<td>16</td>
<td>79</td>
<td>144</td>
<td>97</td>
</tr>
<tr>
<td>400</td>
<td>332</td>
<td>17</td>
<td>112</td>
<td>176</td>
<td>144</td>
</tr>
<tr>
<td>500</td>
<td>416</td>
<td>17</td>
<td>143</td>
<td>217</td>
<td>189</td>
</tr>
<tr>
<td>600</td>
<td>508</td>
<td>19</td>
<td>175</td>
<td>250</td>
<td>229</td>
</tr>
</tbody>
</table>
1. Initial Over-Generalization

Extend \(-\sigma\)- immediately to all E-Class?

\[ N = |E\text{-Class} \subseteq V| \quad e = |\subseteq E\text{-class with }-ec'i- \text{ perfect in Standard}| \]
1. Initial Over-Generalization

Extend $-\alpha-$ immediately to all E-Class? **Impossible.**

$N = |E\text{-Class} \subset V|$  
$e = |\subset E\text{-class with } -ec'j- \text{ perfect in Standard}|$

<table>
<thead>
<tr>
<th>$V$</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>200</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N (e)$ Tolerable?</td>
<td>33 (25)</td>
<td>41 (31)</td>
<td>47 (37)</td>
<td>56 (44)</td>
<td>63 (51)</td>
<td>72 (60)</td>
<td>161 (146)</td>
<td>...</td>
</tr>
</tbody>
</table>

$\times$
1. Initial Over-Generalization

Extend \(-\alpha\) immediately to all E-Class? **Impossible.**

\[ N = |E-Class \subset V| \quad e = |\subset E\text{-class with } -ec'i- \text{ perfect in Standard}| \]

<table>
<thead>
<tr>
<th>(V)</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>200</th>
</tr>
</thead>
<tbody>
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<td>33 (25)</td>
<td>41 (31)</td>
<td>47 (37)</td>
<td>56 (44)</td>
<td>63 (51)</td>
<td>72 (60)</td>
<td>161 (146)</td>
</tr>
<tr>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

Extend \(-\alpha\) to all Irregular E-Class? **Possible at \(V < 100\)**

\[ N = |Irreg\ E-Class \subset V| \quad e = |\subset Irreg\ E\text{-class with } -ec'i- \text{ perfect in Standard}| \]

<table>
<thead>
<tr>
<th>(V)</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N(e)) Tolerable?</td>
<td>15 (7)</td>
<td>17 (7)</td>
<td>18 (8)</td>
<td>23 (11)</td>
<td>24 (12)</td>
<td>28 (16)</td>
<td>54 (39)</td>
</tr>
<tr>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

\(? = \text{within 1 of } \theta\)
1. Initial Over-Generalization

Extend -α- immediately to all E-Class Intransitives? Only \( V < 70 \)

\[
N = |\text{E-Class intrans} \subset V| \quad e = |\text{E-class intrans with -ec'i- perf in Std}| \]

<table>
<thead>
<tr>
<th>( V )</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N (e) ) Tolerable?</td>
<td>33 (25)</td>
<td>41 (31)</td>
<td>✔️</td>
<td>47 (37)</td>
<td>✔️</td>
<td>56 (44)</td>
<td>✔️</td>
</tr>
</tbody>
</table>

Extend -α- to all Irregular E-Class Intransitives? \( V < 200 \)

\[
N = |\text{Irreg E-Class intrans} \subset V| \quad e = |\text{Irreg E-class intrans with -ec'i- perf in Std}| \]

<table>
<thead>
<tr>
<th>( V )</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N (e) ) Tolerable?</td>
<td>15 (7)</td>
<td>✔️</td>
<td>17 (7)</td>
<td>✔️</td>
<td>18 (8)</td>
<td>✔️</td>
<td>23 (11)</td>
</tr>
</tbody>
</table>
2. If -α- Spread to all Irregular E-Class, then...

Further extend -α- to all E-Class Monosyllables? \( V < 70 \)

<table>
<thead>
<tr>
<th>( V )</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>200</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N (e) )</td>
<td>26 (12) ✔</td>
<td>32 (16) ?</td>
<td>36 (20) ✗</td>
<td>42 (23) ✗</td>
<td>46 (26) ✗</td>
<td>49 (27) ✗</td>
<td>106 (64) ✗</td>
<td>144 (91) ✗</td>
</tr>
</tbody>
</table>

Further extend -α- to all E-Class Intransitives? \( V < 200 \)

<table>
<thead>
<tr>
<th>( V )</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>200</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N (e) )</td>
<td>10 (5) ✔</td>
<td>11 (5) ✔</td>
<td>16 (9) ?</td>
<td>20 (9) ✔</td>
<td>23 (11) ✔</td>
<td>28 (14) ?</td>
<td>64 (30) ✗</td>
<td>97 (41) ✗</td>
</tr>
</tbody>
</table>

Further extend -α- to all E-Class 1σ Intransitives? \( V < 400 \)

<table>
<thead>
<tr>
<th>( V )</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>200</th>
<th>300</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N (e) )</td>
<td>10 (5) ✔</td>
<td>11 (5) ✔</td>
<td>16 (9) ?</td>
<td>20 (9) ✔</td>
<td>23 (11) ✔</td>
<td>23 (11) ✔</td>
<td>28 (14) ?</td>
<td>28 (14) ?</td>
</tr>
</tbody>
</table>

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3. If -α- Spread to all Irreg and 1σ E-Class, then…

Further extend -α- to all E-Class? \( V < 400 \)

Further extend -α- to all E-Class Intransitives? All \( V \)

This process was repeated iteratively to uncover feasible incrementation pathways
Feasible Pathways for Analogical Extension

If \( V = 100 \) is used as the min \(|V|\) needed for incrementation:

- Several pathways for incrementation to the Elsewhere Reversal

Conservative Eastern (Irregulars-only)  Elsewhere Reversal  Attested Iranian (all E-Class)
Feasible Pathways for Analogical Extension

If $V=100$ is used as the min $|V|$ needed for incrementation:

- Several pathways for incrementation to the Elsewhere Reversal

![Diagram showing pathways from $V=100$ to Irregular Intrans, Irreg 1σ Intrans, Irregular 1σ, and Attested Iranian (all E-Class).]}
Feasible Pathways for Analogical Extension

If $V=100$ is used as the min $|V|$ needed for incrementation:

- Several pathways for incrementation to the Elsewhere Reversal

\[\begin{align*}
\text{Irregular Intrans} &\quad 1\sigma \text{ Intrans} \\
\text{Irreg } 1\sigma \text{ Intrans} &\quad \text{Irregular } 1\sigma \\
\text{Irregular Intrans} &\quad \text{Irregular}
\end{align*}\]
Feasible Pathways for Analogical Extension

If $V=100$ is used as the min $|V|$ needed for incrementation:

- Several pathways for incrementation to the Elsewhere Reversal
Feasible Pathways for Analogical Extension

If $\nu=100$ is used as the min $|\nu|$ needed for incrementation:

- Several pathways for incrementation to the Elsewhere Reversal
Conclusions

Analogical Extension: Just Fortuitous Analogical Leveling

- Analogical change is the population-level diachronic extension of individual learner over-generalization
- Leveling and extension share an identical mechanism
  Extension is just quantitatively less likely to be actuated
Conclusions

Analogical Extension: Just Fortuitous Analogical Leveling

- Analogical change is the population-level diachronic extension of individual learner over-generalization
- **Leveling and extension share an identical mechanism**
  Extension is just quantitatively less likely to be actuated

The Elsewhere Reversal: An epiphenomenon

- Elsewhere reversal is a description of the change based on a particular theoretical analysis, not a mechanism of change
- Similar ontological status to phonological rule reordering itself probably an epiphenomenon
Conclusions

Phonological Change: A Sufficient but not Necessary Condition

- A phonological change is implicated in permitting this morphological change. But only indirectly, through learner innovation.
- Change is a contingent process. Acquisition and social factors come into play. This change did not have to happen just because it could happen.
- Sufficient but necessary condition is backed up by a typological survey.
Conclusions

Phonological Change: A Sufficient but not Necessary Condition
● A phonological change is implicated in permitting this morphological change
  But only indirectly, through learner innovation
● Change is a contingent process. Acquisition and social factors come into play
  This change did not have to happen just because it could happen
● Sufficient but necessary condition is backed up by a typological survey

Precise Predictions: A Directed Search for Armenian Varieties
● The quantitative learning approach here makes precise predictions
● We now have a lead for what to look for in related Eastern Armenian varieties
  What did the grammars mean when they described “optional” -c’-?
The End.
Questions?

Thank You!
- PLC Organizing Committee and Reviewers
- UCLA Armenian Workshop Participants