**Navajo case study, error analysis**:

**From Reichard, 1951:**

* *“Speakers often fail to distinguish dual and plural, using the same forms for both.”*

We have the exact same case with the model output:

gold:

y-i-ghááh **woo-h-kai**  V;REAL;PFV/PRF;2;PL

hypo:

y-i-ghááh **woo'-áázh** <- valid 2nd person duoplural, but 2nd person plural is target

* *“The greatest difficulty of analysis is due to the large number of overlapping forms and to the many functions performed by a single prefix of the type CV (e.g. yi- is a 3rd person object and agent, progressive, momentary, present and perfective aspects, etc.)”.*

[Prefix errors](#_pmnq8n90186a)

[Stem errors](#_dxh2p7kroc2v)

**Error types in prefixes:**

**Er**

##### **Prefix errors (lemma/hypothesis - lemma/gold)**

y-i-l-ní da-ji-**l**-ní V;REAL;PFV/PRF;4;PL

y-i-l-ní da-**bi**-ji-ní V;REAL;PFV/PRF;4;PL

Lemma: y- (3rd person object prefix) + -Ø- (3rd person subject prefix) + -l- (classifier-transitivity) + -ní (neuter imperfective stem of root -NIID, “to say”).

Gold: da- (plural marker, three or more subjects) + bi (3rd person, object prefix) + ji (“one”, (fourth person, subject prefix) + -ní (neuter imperfective stem of root -NIID, “to say”).

Error type: missing 3rd person object prefix; inserts -l- classifier

[https://en.wiktionary.org/wiki/yilní](https://en.wiktionary.org/wiki/yiln%C3%AD)

yi-ghá'-dí-l-dlaad bi-ghá-dazhdi'-**ní(perfective)-l(classifier)-**dláád V;REAL;PFV/PRF;4;PL

yi-ghá'-dí-l-dlaad bi-ghá-dazh'de-es-dláád V;REAL;PFV/PRF;4;PL

Lemma: b- (3rd person indirect object prefix) + -ghá- (“through” ) + -'a- (unspecified person object prefix) + -di- (“fire”) + -?´- (ni-modal 3rd person subject prefix) + -l- (classifier, causative) + -dlaad (imperfective stem of root -DLÁÁD, “to rip”).

Gold: bi- (“his, its” (third person, object prefix)) + -ghá- (“through” ) + da (plural marker, three or more subjects) + dazde (da-pl.; dji-4 subj.) + -dlaad (imperfective stem of root -DLÁÁD, “to rip”)

[https://en.wiktionary.org/wiki/yighá'díldlaad](https://en.wiktionary.org/wiki/yigh%C3%A1'd%C3%ADldlaad)

y-é-ná-l-niih y-éé-da-**ad(perfective?)**-l-nih V;REAL;PROSP;3;PL

y-é-ná-l-niih y-éé-da-**d-oo**-l-nih V;REAL;PROSP;3;PL

Lemma: b- (3rd person indirect object prefix) + -é- (“about” ) + -ná- (“back”, reversionary) + -Ø- (3rd person subject prefix) + -l- (classifier) + -niih (imperfective stem of root -NII', “to know about”).

Gold: y- (3rd person indirect object prefix) + éé- (“about” ) + da (plural marker, three or more subjects) + d- (future) + -oo- (combining form with yi- progressive in 3rd person form prefix) + -l- (classifier) + -nih (stem of root -NII', “to know about”).

[https://en.wiktionary.org/wiki/yénálniih](https://en.wiktionary.org/wiki/y%C3%A9n%C3%A1lniih)

né-í-l-tsááh n-da-**so**o-l-tsááh V;REAL;PFV/PRF;2;PL

né-í-l-tsááh n-da-o-l-tsááh V;REAL;PFV/PRF;2;PL

Lemma: ná- (“back”, reversionary) + -y- (3rd person object prefix) + -Ø- (3rd person subject prefix) + -l- (classifier) + -tsááh (imperfective stem of root -TSEII, “to be dry”).

Gold: ná- (“back”, reversionary) + da (plural marker, three or more subjects) + -o- (2nd person) + -l- (classifier) + -tsááh (imperfective stem of root -TSEII, “to be dry”).

[https://en.wiktionary.org/wiki/néíltsááh](https://en.wiktionary.org/wiki/n%C3%A9%C3%ADlts%C3%A1%C3%A1h)

na-y-ii-l-niih na-**a**(indefinite object prefix)-sh-niih V;REAL;IPFV/PROG;1;SG

na-y-ii-l-niih na-ha-sh-niih V;REAL;IPFV/PROG;1;SG

Lemma: na- (atelic, circuital) + -y- (3rd person object prefix) + -hi- (seriative) + -Ø- (3rd person subject prefix) + -l- (classifier) + -niih (imperfective stem of root -NII', “to act with the hand”).

Gold: na- (atelic, circuital) + ha - (space object prefix) + sh - (1 SG subject prefix) + -niih (imperfective stem of root -NII', “to act with the hand”).

<https://en.wiktionary.org/wiki/nayiilniih>

yi-i-ji´i´h yi-i-ji´i´' V;REAL;PFV/PRF;1;SG

yi-i-ji´i´h yi-i-**sh**(singular subject prefix)-ji´i´' V;REAL;PFV/PRF;1;SG

Lemma: yi- (transitional) + -Ø- (3rd person subject prefix) + -d- (classifier) + -zhi´i´h (transitional imperfective stem of root -ZHI´I´', “to be black”).

Gold: yi- (transitional) + **sh -** (1 SG subject prefix) + ji´i´' (stem)

[https://en.wiktionary.org/wiki/yiiji´i´h](https://en.wiktionary.org/wiki/yiiji%C2%B4i%C2%B4h)

**y-oo-d-la´ da-oo-d-la´ V;REAL;PFV/PRF;3;PL**

**y-oo-d-la´ da-y-oo-d-la´ V;REAL;PFV/PRF;3;PL**

Lemma: y- (3rd person object prefix) + -oo- (meaning unclear, combining form of yini- in the 3rd person) + -d- (classifier) + -la´ (neuter imperfective stem of root -LAAD, “to believe”).

Gold: da (plural marker, three or more subjects) + y- (3rd person object prefix) + -oo- (meaning unclear, combining form of yini- in the 3rd person) + -d- (classifier) + -la´ (neuter imperfective stem of root -LAAD, “to believe”).

[https://en.wiktionary.org/wiki/yoodla´](https://en.wiktionary.org/wiki/yoodla%C2%B4)

á-t'é á-t'ée d-oo V;REAL;PROSP;2;DU/PL

á-t'é á-**n-óh**-t'ée d-oo V;REAL;PROSP;2;DU/PL

Lemma: 'á- (comparative) + -Ø- (ni-modal 3rd person subject prefix) + -Ø- (classifier) + -t'é (imperfective stem of root -T'E', “to be”)

Gold: 'á- (comparative) + **n (you) + óh (2 DU/PL) +** -t'é (imperfective stem of root -T'E', “to be”) + d (future) + -oo- (combining form with yi- progressive in 3rd person form prefix)

[https://en.wiktionary.org/wiki/át'é](https://en.wiktionary.org/wiki/%C3%A1t'%C3%A9)

á-din á-ní-**s**-din V;REAL;PFV/PRF;1;SG

á-din á-ní-sh-din V;REAL;PFV/PRF;1;SG

Lemma: 'á- (thematic) + -Ø- (ni-modal 3rd person subject prefix) + -Ø- (classifier) + -din (neuter imperfective stem of root -DIID, “to disappear”)

Gold: 'á- (thematic) + [ní](https://en.wiktionary.org/wiki/-n%C3%AD#Navajo) - perfective + sh- (1 SG) + -din (neuter imperfective stem of root -DIID, “to disappear”)

[https://en.wiktionary.org/wiki/ádin](https://en.wiktionary.org/wiki/%C3%A1din)

y-i-'aash **yi**-d-oo-'ash V;REAL;PROSP;3;SG/DU/PL

y-i'-aash d-oo-'ash V;REAL;PROSP;3;SG/DU/PL

Lemma: y- (peg element) + -Ø- (3rd person subject prefix) + -Ø- (classifier) + -'aash (imperfective stem of root -'ÁÁZH, “to go, to walk — 2 actors”).

Gold: d- (future) + -oo- (combining form with yi- progressive in 3rd person form prefix) + -'ash ( stem of root -'ÁÁZH, “to go, to walk — 2 actors”).

<https://en.wiktionary.org/wiki/yi'aash>

y-oo-z-nah ná-y-oo-sh-nah V;REAL;ITER;1;SG

y-oo-z-nah ná-y-oo-**sh'**-nah V;REAL;ITER;1;SG

Lemma: yi- (thematic) + -oo- (combining form of an unidentified yi- prefix) + -Ø- (3rd person subject prefix) + -Ø- (classifier) + -nééh (imperfective stem of root -NAH, “to forget”).

Gold: ná ([for](https://en.wiktionary.org/wiki/for) [you](https://en.wiktionary.org/wiki/you), for [your](https://en.wiktionary.org/wiki/your) [sake](https://en.wiktionary.org/wiki/sake)) + yi- (thematic) + -oo- (combining form of an unidentified yi- prefix)+

sh' (1 SG) + -nééh (imperfective stem of root -NAH, “to forget”).

<https://en.wiktionary.org/wiki/yooznah>

yi-ba-d-oo-ghááh bi-ba-n-dá-sh-ááh V;REAL;ITER;1;SG

yi-ba-d-oo-ghááh bi-ba-n-d**í**-sh-**d**-ááh V;REAL;ITER;1;SG

Lemma: b- (3rd person indirect object prefix) + -ba- (“use up, exhaust” ) + -di- (thematic)

-Ø- (classifier) + -ááh (imperfective stem of root -YÁ, “to go — 1 actor”)

-Ø- (classifier) + -'aash (imperfective stem of root -'ÁÁZH, “to go — 2 actors”)

-d- (classifier) + -kááh (imperfective stem of root -KAI, “to go — 3 actors”)

Gold: bi- (3rd person object prefix) + -ba- (“use up, exhaust” ) + n - (from na-’about’) + dí (ITER) + sh (1 SG) + d (classifier) + -ááh (imperfective stem of root -YÁ, “to go — 1 actor”)

[https://en.wiktionary.org/wiki/yibadooghááh](https://en.wiktionary.org/wiki/yibadoogh%C3%A1%C3%A1h)

na-aghá ni-ni-it-'ash V;REAL;ITER;1;DU/PL

na-aghá ni-né-i-it-'ash V;REAL;ITER;1;DU/PL

Lemma: na- (atelic, circuital) + -Ø- (3rd person subject prefix) +

-Ø- (classifier) + -á (continuative imperfective stem of root -YÁ, “to go, to walk — 1 actor”)

-Ø- (classifier) + -'aash (continuative imperfective stem of root -'ÁÁZH, “to go, to walk — 2 actors”)

-d- (classifier) + -kai (continuative imperfective stem of root -KAI, “to go, to walk — 3 actors”)

Gold: ni- + né- + i- + it (id, we two) + -'aash (continuative imperfective stem of root -'ÁÁZH, “to go, to walk — 2 actors”)

[https://en.wiktionary.org/wiki/naaghá](https://en.wiktionary.org/wiki/naagh%C3%A1)

##### **Stem errors ?**

y-a´-a´'-dí-l-gééd ba´-a´-dí-í'-ní-**sh-gon** V;REAL;PFV/PRF;2;SG

y-a´-a´'-dí-l-gééd ba´-a´'-dí-í-ní-l-geed V;REAL;PFV/PRF;2;SG

Lemma: b- (3rd person indirect object prefix) + -a´- (“passing by, alongside”) + -ná- (“back”, reversionary) + -'a- (unspecified person object prefix) + -di- (“relinquish”) + -Ø- (3rd person subject prefix)+ -l- (classifier) + -gééd (imperfective stem of root -GEED, “to stick”).

Gold: b- (3rd person indirect object prefix) + -a´- (“passing by, alongside”) + -di- (“relinquish”) + Í

ní- (perfective) + -l- (classifier) + -geed ( stem of root -GEED, “to stick”).

[https://en.wiktionary.org/wiki/ya´a´'dílgééd](https://en.wiktionary.org/wiki/ya%C2%B4a%C2%B4'd%C3%ADlg%C3%A9%C3%A9d)

na-agh-á n**o**-o-oh-**ka'**  V;OPT;2;PL

na-agh-á na-o-oh-kááh V;OPT;2;PL

Lemma: na- (atelic, circuital) + -Ø- (3rd person subject prefix) +

-Ø- (classifier) + -á (continuative imperfective stem of root -YÁ, “to go, to walk — 1 actor”)

-Ø- (classifier) + -'aash (continuative imperfective stem of root -'ÁÁZH, “to go, to walk — 2 actors”)

-d- (classifier) + -kai (continuative imperfective stem of root -KAI, “to go, to walk — 3 actors”)

Gold: na- (atelic, circuital) + o (optative) + oh (2nd PL) + -kááh (stem)

[https://en.wiktionary.org/wiki/naaghá](https://en.wiktionary.org/wiki/naagh%C3%A1)

ni-daah **ji-sdaan** V;REAL;PFV/PRF;2;DU/PL

ni-daah si-n-oo-ké V;REAL;PFV/PRF;2;DU/PL

Lemma: ni- (terminative) + -Ø- (3rd person subject prefix) + -Ø- (classifier) + -daah (imperfective stem of root -DÁ, “to sit — 1 actor”)

[ni-](https://en.wiktionary.org/wiki/ni-#Navajo) (terminative) + [-Ø-](https://en.wiktionary.org/wiki/-%C3%98-#Navajo) (3rd person subject prefix) + [-Ø-](https://en.wiktionary.org/wiki/-%C3%98-#Navajo) (classifier) + [-daah](https://en.wiktionary.org/w/index.php?title=-daah&action=edit&redlink=1) (imperfective stem of root [-DÁ](https://en.wiktionary.org/w/index.php?title=-D%C3%81&action=edit&redlink=1), “to sit — 1 actor”)

[ni-](https://en.wiktionary.org/wiki/ni-#Navajo) (terminative) + [-Ø-](https://en.wiktionary.org/wiki/-%C3%98-#Navajo) (3rd person subject prefix) + [-Ø-](https://en.wiktionary.org/wiki/-%C3%98-#Navajo) (classifier) + [-keeh](https://en.wiktionary.org/w/index.php?title=-keeh&action=edit&redlink=1) (imperfective stem of root [-KÉ](https://en.wiktionary.org/w/index.php?title=-K%C3%89&action=edit&redlink=1), “to sit — 2 actors”)

[di-](https://en.wiktionary.org/wiki/di-#Navajo) (thematic) + -[ni-](https://en.wiktionary.org/wiki/ni-#Navajo) (terminative) + [-Ø-](https://en.wiktionary.org/wiki/-%C3%98-#Navajo) (3rd person subject prefix) + [-Ø-](https://en.wiktionary.org/wiki/-%C3%98-#Navajo) (classifier) + [-bįįh](https://en.wiktionary.org/w/index.php?title=-b%C4%AF%C4%AFh&action=edit&redlink=1) (imperfective stem of root [-BIN](https://en.wiktionary.org/w/index.php?title=-BIN&action=edit&redlink=1), “to sit — 3 actors”)

Gold: si - (perfective) + n + oo (2nd DU/PL) + [-keeh](https://en.wiktionary.org/w/index.php?title=-keeh&action=edit&redlink=1) (imperfective stem of root [-KÉ](https://en.wiktionary.org/w/index.php?title=-K%C3%89&action=edit&redlink=1), “to sit — 2 actors”)

<https://en.wiktionary.org/wiki/nidaah>

y-i-ghááh woo'**-**áázh V;REAL;PFV/PRF;2;PL

y-i-ghááh woo-h-kai V;REAL;PFV/PRF;2;PL

**woo'-áázh - valid second person duoplural !**

**woo-h-kai - target: second person plural !**

Lemma: y- (peg element) + -Ø- (3rd person subject prefix) +

-Ø- (classifier) + -ááh (imperfective stem of root -YÁ, “to go — 1 actor”)

-Ø- (classifier) + -'aash (imperfective stem of root -'ÁÁZH, “to go — 2 actors”)

-d- (classifier) + -kááh (imperfective stem of root -KAI, “to go — 3 actors”)

[https://en.wiktionary.org/wiki/yighááh](https://en.wiktionary.org/wiki/yigh%C3%A1%C3%A1h)

Resources:

Gladys A. Reichard. Navajo Grammar. <https://ia600308.us.archive.org/21/items/rosettaproject_nav_book-1/rosettaproject_nav_book-1.pdf>

David Eddington and Jordan Lachler. A Computational Analysis of Navajo Verb Stems. <https://pdfs.semanticscholar.org/77c6/43717312d0cb4069ff3d04da8b34de21f967.pdf>

<https://en.wikipedia.org/wiki/Navajo_grammar#Classifiers_(transitivity_prefixes)>

<https://en.wiktionary.org/w/index.php?title=Category:Navajo_terms_with_usage_examples&from=N>

<http://linguistics.byu.edu/faculty/eddingtond/navajo>