

Reciprocity in Fieldwork and Theory

Sarah E. Murray
Cornell University

Abstract

Empirical findings from fieldwork inform our theories of natural language semantics: what is cross-linguistically possible, what current theories can and cannot account for, what type of representations we need, and so on. Formally precise analyses can also inform our fieldwork, making predictions that need to be tested in the field and providing novel questions to ask. This interrelationship of fieldwork and theory can be mutually beneficial, symbiotic, producing novel avenues for both fieldwork and analysis. This paper discusses an example of such interplay from the author's fieldwork on the semantics of the reflexive/reciprocal construction in Cheyenne (Plains Algonquian). New data led to a novel analysis in terms of underspecification, which in turn led to novel discoveries about the possible interpretations of the Cheyenne reflexive/reciprocal marker (Murray 2007, 2008).

1 Introduction

Since 2006, during the summers I have worked with members of the Cheyenne community on the Northern Cheyenne Indian Reservation in Montana. We have worked together on a variety of Cheyenne language projects, including several semantics projects, with topics ranging from reflexivity and reciprocity to evidentials and the marking of illocutionary mood. In this paper, I discuss several of the methods that I use in my semantic fieldwork, from eliciting judgments of felicity and truth based on explicit contexts from existing texts, constructed discourses, or images, to observing language use and attempting to learn the language myself.

In particular, I discuss an example from my fieldwork on reflexives and reciprocals in Cheyenne. Cheyenne uses a single verbal suffix, *-ahte*, to express both reflexivity and reciprocity, as in (1).

- (1) *Ka'ěškóne-ho é-vóom-áhtse-o'o.*
child-PL.AN 3-see-*ahte*-3PL.AN
'The children saw each other.' / 'The children saw themselves.'

The suffix *-ahte* is compatible with both plural subjects and singular subjects, and further additions to the sentence can specify a reflexive or a reciprocal interpretation. Given this data from Cheyenne, I developed an analysis of *-ahte* where this

marker is underspecified, not ambiguous (Murray 2007, 2008). This formal analysis made strong predictions about other possible interpretations of Cheyenne sentences with *-ahte*. Specifically, the analysis predicted that for subjects involving three or more individuals, sentences with *-ahte* will allow a mixed construal: one that is partly reflexive and partly reciprocal, as in Figure 1c.

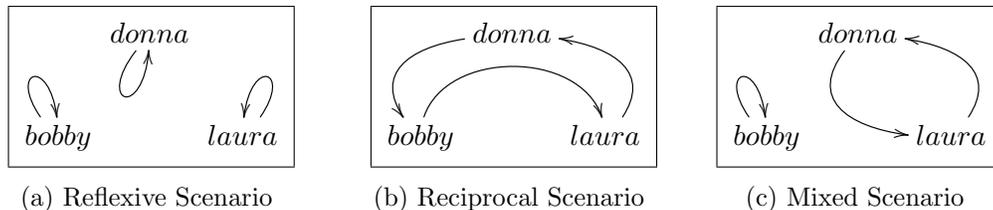


Figure 1: Simple Reflexive, Reciprocal, and Mixed Scenarios

At the time of developing this analysis, I did not know if this was true or false for Cheyenne, and it had not been discussed for other languages with “ambiguous” markers of reflexivity and reciprocity. To test these predictions of the analysis, I developed various tasks for subsequent fieldwork. They involved Cheyenne sentences with *-ahte* in a variety of scenarios, including mixed scenarios. Results from these tasks show that mixed construals are available in Cheyenne. This provides strong evidence that Cheyenne *-ahte* is underspecified for reflexivity and reciprocity, not ambiguous. In fact, this turns out to be a robust pattern cross-linguistically for what had been thought to be ambiguous forms (Murray 2007, 2008, Cable 2012). Without the strong predictions from the formal analysis, I most likely would never have asked about these possible interpretations.

In addition to discussing this example from my own fieldwork, this paper has two general goals. First, to illustrate that formal semantic training is valuable training for fieldwork. Formal analyses, and their predictions, are one useful tool for fieldworkers to be equipped with. In addition, semantic training can help in documenting understudied languages, as the systematic investigation of the semantic properties of a language should be part of the complete description of the language. Second, I want to emphasize that there can be a reciprocal, mutually beneficial relationship between fieldwork and theory (see also Rice 2006, Cover and Tonhauser 2013, Gillon 2013, McKenzie 2013, a.o.). Empirical findings from fieldwork inform our theories of natural language semantics and formally precise analyses can inform our fieldwork, making predictions that need to be tested in the field and providing novel questions to ask.

The next section of this paper gives a brief background on the Cheyenne language and the methodology used in the fieldwork discussed in this paper. Section 3 discusses the marking of reciprocity and reflexivity in Cheyenne, contrasting it with English. The underspecification analysis is discussed in Section 4. I briefly intro-

duce the framework and then discuss the analysis of Cheyenne in detail, including the predicted mixed construal. Section 5 enumerates the ways that I tested these predictions during my fieldwork and the results. Section 6 is the conclusion.

2 Background on Cheyenne and Methodology

Cheyenne is a Plains Algonquian language spoken in Montana and Oklahoma. It is an endangered language, with around 1,000 native speakers of Cheyenne in Montana, most of whom are over 50 (Fisher et al. 2006). Though most children are not learning the language, there are several ongoing language revitalization efforts, including language classes in the local schools and summer language camps for kids.

The data presented in this paper are primarily from my own fieldwork, building on a Cheyenne Grammar (Leman 2012), texts (Leman 1980, 1987), a dictionary (Fisher et al. 2006), and a study of Cheyenne word order (Leman 1999). In my fieldwork, I use a variety of methods, drawing on Newman and Ratliff 2001 and Matthewson 2004, among others. These methods include observation of language use and textual studies, including reading, reformatting, glossing, and (re)translating texts.¹ Much of my fieldwork involves direct elicitations, often based on modified texts or constructed mini-discourses and stories. A particularly useful strategy, I have found, is to build on naturally occurring examples by modifying the context or the target sentence, and then eliciting judgments of felicity and truth. This can be useful because texts provide grammatical, felicitous examples in a context, which can be a practical place to start exploring a phenomenon. I am also learning the language, through my own study and language classes, as well as volunteering at a summer language immersion camp for kids. Learning the language has of course helped me in constructing examples, but also in understanding the interaction of various components of the language.

In elicitation sessions, I work on an individual basis with several consultants, all of whom are native speakers of Cheyenne. I work on the same material with several different people, presenting tasks in different orders, separated by other material. When possible, tasks are confirmed with each consultant after an interval of at least several days. Elicitation tasks include acceptability judgements about and corrections of various kinds of examples in a given context as well as thinking of contexts in which certain examples could be used. I use both naturally occurring and constructed examples in constructed contexts or (modified) textual contexts.

In this paper, I primarily discuss direct elicitations involving truth-value judgments or felicity judgments of constructed examples in constructed contexts. How-

¹Many existing Cheyenne texts are translated on a word-for-word basis with the English directly below the Cheyenne (e.g., Leman 1987). In collaboration with language teachers, I have been reformatting texts by separating the Cheyenne and English, formatting the Cheyenne into natural paragraphs, and giving free translations in addition to interlinear glosses at the end.

ever, the constructed examples and contexts draw on uses found in Cheyenne texts and the dictionary. In truth-value judgement tasks, I ask my consultants if a sentence is true in an explicit context, provided in English or Cheyenne, sometimes supplemented by an image or drawing. For felicity judgment tasks, I construct short discourses or dialogues in Cheyenne and ask if they are acceptable, either in a context or out of the blue. Typically sentences that are acceptable in a context are both felicitous and true. However, sentences may be unacceptable in a context because they are infelicitous or because they are false. These are importantly different and truth-value judgment tasks can help tease them apart. Tasks used in semantic fieldwork draw on those used in language acquisition research (see, e.g., Crain and Thornton 1998, Eisele and Lust 1996). The use of these types of tasks in semantic fieldwork is discussed in detail in Matthewson 2004.

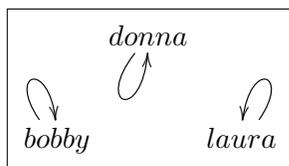
3 Cheyenne Reflexives and Reciprocals

In some languages, including English, reflexivity and reciprocity are expressed by means of distinct forms: *themselves* is a reflexive construction, as in (2), while *each other* is reciprocal, as in (3).

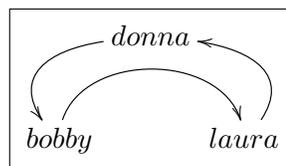
(2) *The children saw themselves.*

(3) *The children saw each other.*

The English reflexive sentence (2) is true if each of the children saw himself/herself. The English reciprocal sentence (3) is true if each child saw at least one other child, and each child was seen by at least one other child. This reciprocal interpretation is called weak reciprocity.² For example, assume that there are three children, one boy (*bobby*) and two girls (*laura* and *donna*). Figure 2 below depicts possible reflexive and reciprocal scenarios for these three children, with lines indicating what relations hold between the children.



(a) Reflexive Scenario



(b) (Weak) Reciprocal Scenario

Figure 2: Simple Reflexive and Reciprocal Scenarios

²Other reciprocal interpretations are possible for (3), including strong reciprocity, where each child saw every other child (see, e.g., Langendoen 1978, Dalrymple et al. 1998).

The English reflexive sentence (2) is true in the reflexive scenario, Figure 2a, but not in the reciprocal scenario, Figure 2b. The English reciprocal sentence (3) is true in the reciprocal scenario, Figure 2b, but not in the reflexive scenario, Figure 2a. That is, the English constructions in (2) and (3) are specified for a reflexive meaning or a reciprocal meaning, respectively, and do not overlap.³ However, the meanings do have something important in common: they both require that the subject set (who performs the action, where the arrow originates from) and the object set (who undergoes the action, where the arrow points) be the same set. For example, in both scenarios in Figure 2, each child sees some child, and each child is seen.

In contrast to English, many languages, including Spanish, French, and German, use a single form to express both reflexivity and reciprocity (Maslova 2008, Langendoen and Magloire 2003). Cheyenne is another such language. The verbal suffix *-ahte* (phonologically realized as *-ahtse* or *-estse*) can express both reflexivity and reciprocity (Leman 2012, Murray 2007, 2008). That is, sentences with this suffix can be true in reflexive scenarios (e.g., Figure 2a) as well as in reciprocal scenarios (e.g., Figure 2b). For example, Cheyenne (4), which has a plural subject, allows both a reflexive interpretation, translated as English (5), and a reciprocal interpretation, translated as English (6).

- (4) [Several children were playing in the woods and got into some poison ivy. Not long after, they were covered in itchy bumps.]
Ka'èškóne-ho é-axeen-áhtse-o'o. (Murray 2008)
 child-PL.AN 3-scratch-*ahte*-3PL.AN
- (5) *The children scratched themselves.* reflexive construal of (4)
- (6) *The children scratched each other.* reciprocal construal of (4)

Cheyenne (4) can be true if each child scratched himself, as in the reflexive scenario in Figure 2a, or if each child was scratched and scratched at least one other child, as the reciprocal scenario in Figure 2b. This was established through truth-value judgment tasks with contexts described in English as well as with diagrams such as the ones in Figure 2. In addition, several texts show the availability of each interpretation of *-ahte*.⁴

Cheyenne *-ahte* is also compatible with singular subjects, as illustrated in (7). (In Cheyenne, singular agreement is the unmarked default on the noun and verb.)

³Though there can be a collective interpretation of plural reflexives, e.g., *The students helped themselves*, with the interpretation that the students as a group act to help that group.

⁴See, e.g., *The Bear, the Coyote, and the Skunk* by Jeanette Howlingcrane in Leman 2012 for a reciprocal interpretation of *-ahte* with a plural subject and *Your Head is Covered* (anonymous) in Leman 1987 for a reflexive interpretation of *-ahte* with a plural subject. For an example with a singular subject, see *I'm Beading Moccasins* by Jeanette Howlingcrane in Leman 2012.

- (7) *Hetané-ka'ěškóne é-axeen-**ahte**.* (Murray 2008)
 man-child 3-scratch-*ahte*
 ‘The boy scratched himself.’ reflexive construal only

Cheyenne (7) only has a reflexive interpretation. This is unsurprising, as there are no individuals that the singular subject could bear the verbal relation to besides himself. In a satisfactory analysis of the Cheyenne data, the reflexive interpretation of (7) should follow from its having a singular subject.

A reciprocal construal with a plural subject can also be specified with the addition of a modifier *nonámé'tó'e*, as in (8).

- (8) *He'é-ka'ěškóne-ho noná-mé'tó'e é-axeen-**áhte**-o'ó.* (Murray 2008)
 woman-child-PL.AN noná-other 3-scratch-*ahte*-3PL.AN
 ‘The girls scratched each other.’ reciprocal construal only

With the addition of the modifier *nonámé'tó'e*, Cheyenne (8) is true only in reciprocal scenarios, as in Figure 2b. This modifier can also be used without the reflexive/reciprocal suffix with a meaning of ‘one by one’ or ‘in turns’. It is related to the Cheyenne word *mé'tó'e*, which means ‘in turn’ or ‘in exchange’ (Fisher et al. 2006).

In summary, the Cheyenne reflexive/reciprocal suffix *-ahte* can have both reflexive and reciprocal interpretations. These meanings share a requirement that the same set of individuals perform and undergo the verbal action, but they differ in what relation is required to hold between the individuals (reflexive or reciprocal). The reflexive interpretation and the reciprocal interpretation can each be specified, given certain changes or additions to the sentence.

This data suggests a unified analysis of the Cheyenne reflexive/reciprocal morpheme, one where it is underspecified, not ambiguous. Because there is only one morpheme, a unified analysis, if possible, is preferred. Given the overlap in meaning between reflexive and reciprocal interpretations, it does not seem like a true ambiguity (e.g., English *bank*). Furthermore, many languages express reflexivity and reciprocity with a single form.

Given these facts, I set out to give a unified analysis of Cheyenne *-ahte*, appealing to underspecification. In general terms, the Cheyenne reflexive/reciprocal suffix *-ahte* requires that the subject and object be the same set of individuals. For (4), the truth conditions are that each child scratched some child and each child was scratched. However, it does not require any particular relation to hold between these individuals. Thus, it is underspecified for reflexivity or reciprocity. These relations can be further specified with additions or changes to the sentence. In the next section, I discuss a formal analysis of Cheyenne reflexives and reciprocals following this general line. I chose to implement the analysis in a particular framework that provided a simple way of formalizing this analysis, but it made strong, novel predictions.

4 Underspecification Analysis

A unified analysis of the Cheyenne reflexive/reciprocal suffix *-ahte* can be given by appealing to underspecification: the suffix only requires that the subject set and the object set are the same. There is no specification of a reflexive relation or a reciprocal relation between the individuals in the set, as there is for English *themselves* and *each other*.

The framework Dynamic Plural Logic (van den Berg 1996) allows a straightforward and simple analysis of this phenomena because of the way it represents plurality. In Dynamic Plural Logic, there are two kinds of values for variables: global values and dependent values. Dependent values are individuals while global values are sets of individuals. Using this framework, Cheyenne *-ahte* can be analyzed as requiring only global identity, identity of the subject (x) and object (y) at the set level. In Dynamic Plural Logic, this is written as in (9) below.

(9) Proposed translation: *-ahte* \rightsquigarrow $+ [y = x]$ (Murray 2007, 2008)

In this section, I give a brief overview of Dynamic Plural Logic and then discuss in detail the analysis of Cheyenne given in (9), including the use with singular and plural subjects, the reciprocal-only interpretation with *nonámé'tó'e*, and the connection with English reflexives and reciprocals (adapted from Murray 2007, 2008). The proposed analysis can account for all of the data discussed in Section 3, but makes a novel prediction: that sentences with Cheyenne *-ahte* can be true in a **mixed scenario**, one that is partly reflexive and partly reciprocal.

The crucial point made in this section is that formalizing an underspecification analysis led to a novel prediction. This prediction led to new questions to ask during fieldwork, questions I would not have asked otherwise, and led to new discoveries about the meaning of this construction in Cheyenne. Thus, formal semantic training helped to uncover a pattern that may have otherwise gone undocumented. What was essential was distinguishing between an ambiguity analysis and underspecification analysis, and working out the predictions of the analyses. The remainder of this section discusses the details of the analysis in Dynamic Plural Logic and how this predicted the mixed construal. However, other underspecification analyses are possible (e.g., Cable 2012) and, while they may differ in other important ways, also predict mixed construals. Those not interested in working through the details of how the predictions were made could skip directly to section Section 5, where the testing of these predictions and the results are discussed in detail.

4.1 Overview of the Framework: Dynamic Plural Logic

Dynamic Plural Logic (van den Berg 1996; henceforth DPIL) is an extension of Dynamic Predicate Logic (Groenendijk and Stokhof 1991) developed to model pluralities and the dependencies between them. As in Dynamic Predicate Logic, a

formula in DPIL denotes a relation between information states. In Dynamic Predicate Logic, an information state is an assignment function. In DPIL, an information state is a **set** of assignment functions, each of which assigns at most one individual to each variable. Such **plural information states** as a whole assign a set to each variable, the collection of values assigned to that variable by the individual functions in that information state.

For example, consider the sets $\{a, b\}$, $\{c, d\}$, and $\{e\}$ assigned to the variables x , y , and z , respectively. In the extension of Dynamic Predicate Logic to pluralities in Kamp and Reyle 1993, $\{a, b\}$ would be assigned to x , $\{c, d\}$ to y , and $\{e\}$ to z by a single assignment function that assigns sets to each variable: $g = \{\langle x, \{a, b\}\rangle, \langle y, \{c, d\}\rangle, \langle z, \{e\}\rangle\}$. This information state is represented as the first matrix in (10), below.

In DPIL, these same values would be assigned to these variables by a set of assignment functions, each of which assigns only a single individual to each variable. One such information state is $G = \{\{\langle x, a\rangle, \langle y, c\rangle, \langle z, e\rangle\}, \{\langle x, b\rangle, \langle y, d\rangle, \langle z, e\rangle\}\}$. This information state can also be written as $G = \{g_1, g_2\}$ where $g_1 = \{\langle x, a\rangle, \langle y, c\rangle, \langle z, e\rangle\}$ and $g_2 = \{\langle x, b\rangle, \langle y, d\rangle, \langle z, e\rangle\}$. This information state is represented as the second matrix in (10), below.

(10) Information states: assignment function vs. set of assignment functions

	x	y	z
g	$\{a, b\}$	$\{c, d\}$	$\{e\}$

Dynamic Predicate Logic

G	x	y	z
g_1	a	c	e
g_2	b	d	e

DPIL

Information states in DPIL allow a distinction between *global values* (columns) and *dependent values* (rows). The global value of a variable is the set of values assigned to that variable by the entire information state. For example, the global value of y in (10) is $G(y) = \{c, d\}$. A dependent value of a variable is a subset of its global value, assigned to that variable by a *sub-state* – the information state restricted to a particular value for another variable. For example, there are two x sub-states in (10), G where $x = a$, written $G|_{x=a}$, and G where $x = b$, written $G|_{x=b}$. Thus, there are two x -dependent y -values: $G|_{x=a}(y) = \{c\}$ and $G|_{x=b}(y) = \{d\}$. DPIL information states can assign the same global values to variables but differ on their dependent values, as illustrated in the information states in (11), below.

(11) Same global values, different dependent values

G	x	y	z
g_1	a	c	e
g_2	b	d	e

G'	x	y	z
g'_1	a	d	e
g'_2	b	c	e

G''	x	y	z
g''_1	a	c	e
g''_2	b	d	e
g''_3	b	c	e

The three information states in (11) agree on the global values for x , y , and z : they each assign $\{a, b\}$ to x , $\{c, d\}$ to y , and $\{e\}$ to z . However, the information states assign different dependent values to the variables. Each of the information states in (11) has two x sub-states, $G|_{x=a}$ and $G|_{x=b}$, but what these sub-states are differs from state to state. For example, the $x = b$ sub-states assign different values to y in each information state in (11): $G|_{x=b}(y) = \{d\}$ while $G'|_{x=b}(y) = \{c\}$ and $G''|_{x=b}(y) = \{c, d\}$.

These different dependent values represent different dependencies between the variables. In G , b is related to d while in G' , b is related to c . G'' encodes the same relation between b and d as G as well as an additional relation between b and c . Thinking ahead to the analysis of reflexivity and reciprocity, these dependencies, or rows, can be thought of as requirements on the verbal relation of the sentence. (For example, state G might require that b saw d , state G' would require that b saw c , and state G'' would require both.)

The plural information states of DPIL can represent dependencies between variables – relations between individual members of pluralities – as well as global values. This distinction is crucial to the analysis of Cheyenne and English reflexives and reciprocals given in the next section: Cheyenne *-ahte* requires only global identity, while English forms also specify certain dependencies between the variables.

4.2 Analysis of Cheyenne Reflexives and Reciprocals

In DPIL, Cheyenne *-ahte* can be analyzed as requiring only global identity – identity at the column level – with no requirements on the row relations. The proposed translation is given in (12) below.⁵

$$(12) \text{ -ahte} \quad \rightsquigarrow \quad +[y = x] \quad = (9)$$

This analysis allows sentences with Cheyenne *-ahte* and plural subjects, such as (13), to be true in both reflexive and reciprocal scenarios.

- (13) [Several children were playing in the woods and got into some poison ivy.
Not long after, they were covered in itchy bumps.]

$$\begin{array}{l} Ka'ěškóne-ho \quad é-axeen-áhtse-o'ó. \\ \text{child-PL.AN} \quad 3\text{-scratch-ahte-3PL.AN} \end{array} \quad = (4)$$

- (i) ‘The children scratched **themselves**.’ reflexive construal of (13)
(ii) ‘The children scratched **each other**.’ reciprocal construal of (13)

The entire Cheyenne sentence (13) can be translated into DPIL as (14) below, where $C = \text{child}$, $PL = \text{plural}$, and $S = \text{scratch}$. The ϵ_x introduces variable assignments to the variable x (column), which one can think of as a discourse referent for x . The

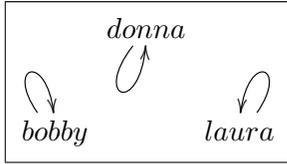
⁵ The plus in $+[y = x]$ makes this requirement a presupposition (see Murray 2007, 2008).

δ_x is the distributivity operator over x , which requires each condition in its scope to hold for each x at the individual (row) level. (See Murray 2007, 2008 for a full DPIL fragment, with definitions and detailed explanations).

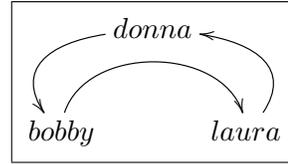
$$(14) \quad \epsilon_x \wedge \delta_x(Cx) \wedge PLx \wedge \delta_x(\epsilon_y) \wedge \delta_x(Sxy) \wedge +[y = x]$$

The first three conjuncts are contributed by the plural noun, the fourth and fifth by the verb, and the sixth by the Cheyenne reflexive/reciprocal suffix. This requires that the subject denote a plural set of children, each member of which scratched some child and was scratched by some child, allowing (13) to be true in both reflexive and reciprocal scenarios.

For example, again assume there are three children, *bobby*, *donna*, and *laura*. Cheyenne (13) can be true in either a reflexive scenario like the one depicted in Figure 3a or in a reciprocal scenario like the one depicted in Figure 3b.



(a) Reflexive Scenario



(b) (Weak) Reciprocal Scenario

Figure 3: Simple Reflexive and Reciprocal Scenarios

These facts are captured by the analysis of Cheyenne *-ahte* given in (12) because all that (12) requires is that the subject (x) and object (y) sets are identical. This is true in both Figure 3a and Figure 3b, where the subject and object sets are both $\{b, d, l\}$, the set of *bobby*, *donna*, and *laura*. Likewise, several possible information states could make (14) true. For example, consider the information states in (15). The requirement imposed by *-ahte*, $+[y = x]$, is true of each: $G_1(x) = G_1(y) = \{b, d, l\} = G_2(x) = G_2(y)$. These information states correspond to the scenarios illustrated in Figure 3.

(15) Possible information states for (14)

G_1	x	y
g_{1_1}	<i>b</i>	<i>b</i>
g_{1_2}	<i>d</i>	<i>d</i>
g_{1_3}	<i>l</i>	<i>l</i>
(a) reflexive		

G_2	x	y
g_{2_1}	<i>b</i>	<i>l</i>
g_{2_3}	<i>l</i>	<i>d</i>
g_{2_3}	<i>d</i>	<i>b</i>
(b) reciprocal		

The analysis of Cheyenne (13) in (14) introduces x values (ϵ_x) for a plural set of individuals (PLx), each of which are children ($\delta_x(Cx)$), introduces y values ($\delta_x(\epsilon_y)$) that

are identical on a global level ($+ [y = x]$), and requires that each child x scratched at least one y ($\delta_x(\text{Sxy})$). In a model with three children, *bobby*, *donna*, and *laura*, we get information states like those in (15): (15a) requires that each child scratched herself/himself and (15b) requires that *bobby* scratched *laura*, *laura* scratched *donna*, and *donna* scratched *bobby*. Many information states other than those in (15) could make (14) true, but crucially (14) provides a unified analysis of Cheyenne (13) that allows it to be true in both reflexive and reciprocal scenarios.

With the addition of Cheyenne *nonámé'tó'e*, only a reciprocal construal is allowed, as in (16).

- (16) *Ka'ěškóne-ho noná-mé'tó'e é-axeen-áhtse-o'o.*
 child-PL.AN noná-other 3-scratch-ah-te-3PL.AN
 ‘The children scratched each other.’ reciprocal construal only

This modifier can be analyzed as adding a requirement about the dependencies between the individuals in the sets: it requires that each individual be related to at least one other individual, written in DPIL as $+ [\delta_y(y \odot x)]$. This requirement can be added to the translation of (13), given in (14), to produce the translation of (16), given in (17).

- (17) $\epsilon_x \wedge \delta_x(\text{Cx}) \wedge \text{PLx} \wedge \delta_x(\epsilon_y) \wedge + [\delta_y(y \odot x)] \wedge \delta_x(\text{Sxy}) \wedge + [y = x]$

This addition would rule out the information state G_1 in (15a). Only information states like G_2 would satisfy this new requirement: each individual has to scratch at least one other individual, yielding the reciprocal only interpretation.

The meaning contributed by Cheyenne *nonámé'tó'e* is a component of the meaning of English *each other*. Following this analysis, this English reciprocal marker can be analyzed as the combination of Cheyenne *-ah-te* and *nonámé'tó'e*, translated into DPIL as $+ [y = x] \wedge + [\delta_y(y \odot x)]$. English *themselves* can be analyzed as the combination of Cheyenne *-ah-te*, a plural requirement, and a requirement that each individual is related at least to itself, translated as $+ [\text{PLy}] \wedge + [y = x] \wedge + [\delta_y(y \odot x)]$. (English *himself* would be similar, but with a singular requirement.) That is, English *each other* is lexically specified for a reciprocal meaning, English *themselves* is lexically specified for a reflexive meaning, and Cheyenne *-ah-te* is underspecified for reflexivity or reciprocity.

With singular subjects, as in as in (18), Cheyenne *-ah-te* only has a reflexive interpretation.

- (18) *Ka'ěškóne é-axeen-áhtse.*
 child 3-scratch-ah-te
 ‘The child scratched himself.’ reflexive construal only

The analysis so far predicts this: because the subject is a single individual, the object must be that same single individual. This results in the reflexive only interpretation with singular subjects. The translation of Cheyenne (18) is given in (19).

$$(19) \ \varepsilon_x \wedge \delta_x(\mathbf{Cx}) \wedge \mathbf{SGx} \wedge \delta_x(\varepsilon_y) \wedge \delta_x(\mathbf{Sxy}) \wedge +[\mathbf{y} = \mathbf{x}]$$

The only change between the translations of Cheyenne (13), with a plural subject, and Cheyenne (18), with a singular subject, is the third conjunct, which now requires the subject to be singular (\mathbf{SGx}). This only allows assignments with identical singleton sets assigned to x and y , as in (20), where $G_3(x) = G_3(y) = \{b\}$.

(20) Possible information states for (19)

G_3	x	y
g_{3_1}	b	b

This underspecification analysis correctly predicts all of the data discussed in Section 3: both reflexive and reciprocal construals with plural subjects, only a reflexive construal with a singular subject, and only a reciprocal construal with the addition of *nonámé'tó'e*.

However, the analysis makes a novel prediction: for plural subjects of three or more individuals, in addition to a reflexive and a reciprocal construal, a **mixed construal** is predicted. A mixed construal is one that is partially reflexive and partially reciprocal. For example, if there are three children, *bobby*, *donna*, and *laura*, and the global values of x and y are the three children $\{b, d, l\}$, as in (15), then another possible information state for Cheyenne (13), repeated below as (22), will be (c) in (21). In (21c), just as in (21a) and (21b), the global values for x and y are identical: $G_4(x) = G_4(y) = \{b, d, l\}$.

(21) Novel prediction: a mixed construal

G_1	x	y	
g_{1_1}	b	b	
g_{1_2}	d	d	
g_{1_3}	l	l	
(a) reflexive			
G_2	x	y	
g_{2_1}	b	l	
g_{2_2}	l	d	
g_{2_3}	d	b	
(b) reciprocal			
G_4	x	y	
g_{4_1}	b	b	reflexive
g_{4_2}	d	l	reciprocal
g_{4_3}	l	d	
(c) mixed			

Thus, Cheyenne (22) is predicted to have three kinds of construals: a reflexive construal, a reciprocal construal, and a mixed construal – one that is partly reflexive and partly reciprocal. Such an interpretation is hard to translate into English, but an attempt is given in (22iii).

(22) [Three children were playing in the woods and got into some poison ivy. Not long after, they were covered in itchy bumps.]

$$\begin{array}{l} \text{Ka'ěškóne-ho} \quad \acute{e}\text{-axeen-}\mathbf{\acute{a}htse}\text{-o'ó.} \\ \text{child-PL.AN} \quad 3\text{-scratch-}\mathbf{ahte}\text{-3PL.AN} \end{array} = (4)$$

- (i) ‘The children scratched **themselves**.’ reflexive construal of (22)
- (ii) ‘The children scratched **each other**.’ reciprocal construal of (22)
- (iii) ‘The children were scratching.’ mixed construal of (22)

These three construals are illustrated in Figure 4. For the mixed construal, the reciprocal relation holds of some sub-group (here *donna* and *laura*) while the reflexive relation holds of the rest (here *bobby*).

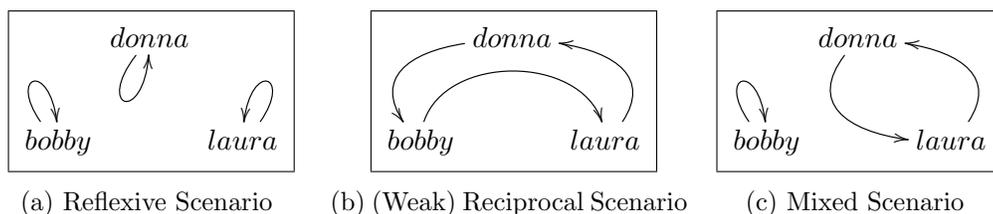


Figure 4: Simple Reflexive, Reciprocal, and Mixed Scenarios

This prediction of the proposed underspecification analysis of Cheyenne *-ahte* is unavoidable: the properties of DPIL that allow a simple, unified analysis of the reflexive and reciprocal construals of Cheyenne predict that a mixed construal should be possible. In fact, any underspecification analysis with similar properties would make the same prediction.

Prior to formalizing this underspecification analysis of Cheyenne, I had never thought to ask if Cheyenne sentences like (22) were true in mixed scenarios like Figure 4c. Coming from an English perspective, with constructions specified for reflexivity and reciprocity, mixed scenarios are somewhat strange. Such an interpretation is certainly not predicted, or possible, if we think that Cheyenne *-ahte* is ambiguous between English-like reflexive and reciprocal interpretations. Thus, at the time of formalizing the analysis, I did not know if Cheyenne (22) was true or false in a situation like Figure 4c. If not for the strong predictions made by this formal analysis, I might never have asked. Contra e.g., Evans and Levinson 2009, abstracting to a formal analysis can free us from a language bias, allowing us to examine patterns in typologically diverse languages from neutral ground: “From the theoretical point of view all languages have equal status” (Bittner 2008).

5 Testing the Predictions and Results

After realizing that an underspecification analysis of Cheyenne predicted that sentences like (22) were true in mixed scenarios, as in Figure 4c, I had to devise ways to test this prediction during my next fieldwork trip. Several Cheyenne texts (e.g., Leman 1980, 1987) have instances of *-ahte* that are clearly reflexive and ones that

are clearly reciprocal (see note 4). These textual examples were how I first became aware of this property of Cheyenne, but no textual examples illustrate a mixed interpretation. This absence of evidence does not aid in determining whether construals are allowed – semantic elicitation is needed.

To test whether or not mixed interpretations are available in Cheyenne, I developed three direct elicitation tasks, drawing on Matthewson 2004: (i) judgements of sentences like Cheyenne (22) in situations described in English, (ii) judgements of sentences like (22) with drawings of various situations, and (iii) constructing short texts that spell out the mixed construal of sentences like (22). The first two of these tasks are truth-value judgement tasks. The third task is combination of a truth value judgment and a felicity judgment task: I constructed short discourses in Cheyenne that spelled out the mixed construal and asked if they were acceptable, and if so, if they were true or false.

For the first task, I gave the contexts in English. All of my consultants speak English fluently, and, though I am learning, I am not yet fluent in Cheyenne. In addition, it is easier to ensure a reflexive or reciprocal interpretation in English, since the English forms *themselves* and *each other* are specified for reflexivity and reciprocity. All of the examples I constructed for this task were roughly of the form given in (23). For the purpose of this paper, I'll use the same verb throughout, though I tested with a variety of verbs.

In (23), I provided a context that specified a reflexive interpretation for the whole group of children. Sentence (22), repeated in each example below, was judged by my consultants to be true in this context.

- (23) **Reflexive** [Three children were playing in the woods and got into some poison ivy. Not long after, they were covered in itchy bumps. All of the children got the poison ivy on their legs, so they each scratched their own legs.]

Ka'ěškóne-ho é-axeen-áhtse-o'o. = (22)
 child-PL.AN 3-scratch-ah-te-3PL.AN

'The children scratched **themselves**.' Judgement: True

In (24) I gave a scenario that specified a reciprocal scenario. Sentence (22) was judged true in this scenario as well.

- (24) **Reciprocal** [Three children were playing in the woods and got into some poison ivy. Not long after, they were covered in itchy bumps. All of the children got the poison ivy on their backs, so they couldn't scratch it themselves. Each child scratched another's back.]

Ka'ěškóne-ho é-axeen-áhtse-o'o. = (22)
 child-PL.AN 3-scratch-ah-te-3PL.AN

'The children scratched **each other**.' Judgement: True

To make sure that identity of subject and object was required, I tried examples where only part of the group was scratching, as in (25), and where the children were being scratched by other people, as in (26). Sentence (22) was judged false in both of these scenarios.

- (25) **Neither** [Three children, a boy and two girls, were playing in the woods and got into some poison ivy. Not long after, the boy had itchy bumps all over his legs. He scratched his own legs while the girls checked themselves for bumps.]

Ka'ěškóne-ho é-axeen-áhtse-o'o. = (22)

child-PL.AN 3-scratch-*ahte*-3PL.AN

‘The children scratched **themselves/each other.**’ Judgement: False

- (26) **Neither** [Three children were playing in the woods and got into some poison ivy. Not long after, they were covered in itchy bumps. All of the children got the poison ivy on their backs, so they couldn’t scratch it themselves. The children ran home and had their parents scratch their backs for them.]

Ka'ěškóne-ho é-axeen-áhtse-o'o. = (22)

child-PL.AN 3-scratch-*ahte*-3PL.AN

‘The children scratched **themselves/each other.**’ Judgement: False

So far these judgements support the analysis given in Section 4: Cheyenne (22) is true in both reflexive and reciprocal scenarios, and requires the subject and object set to be the same. But what about the mixed construal? I constructed a parallel scenario where part of the group of children were scratching each other and one member of the group scratched himself, given in (26). Sentence (22) was judged true in this scenario.

- (27) **Mixed** [Three children, a boy and two girls, were playing in the woods and got into some poison ivy. Not long after, they were covered in itchy bumps. The boy had bumps all over his legs and the girls had bumps all over their backs. The boy scratched his own legs and each girl scratched the other’s back.]

Ka'ěškóne-ho é-axeen-áhtse-o'o. = (22)

child-PL.AN 3-scratch-*ahte*-3PL.AN

‘The children were scratching.’ Judgement: True

I also tried variants of these tasks giving specific names to each child, and the results were the same.

The second task was judgements of sentences like Cheyenne (22) given pictures that I drew. The drawings presented scenarios parallel to the ones described above in English, and they produced parallel results. These were very useful for helping to make clear the different relations. For the most part, they looked similar to the

illustrations in Figure 4. However, I drew these all on the fly, realizing only once I was in the field how useful pictures could be. Since then (2006-7), more attention has come to using pictures and story boards in elicitations (see, e.g., the Totem Field Storyboards (<http://totemfieldstoryboards.org/>) and Burton and Matthewson 2013). In subsequent elicitations, I have used maps and images to aid in elicitation, though they must also be supplemented with some verbal contextual information.

For the third task, I constructed short Cheyenne discourses like (28), which elaborate on the relations between the individuals, spelling out the mixed construal. In (28), the first sentence, (28i), is Cheyenne (22). The second sentence, (28ii), is a conjunction of Cheyenne (7) ‘the boy scratched himself’ and Cheyenne (8) ‘the girls scratched each other’.

(28) **Mixed** [Three children, a boy and two girls, were playing in the woods and got into some poison ivy. Not long after, they were covered in itchy bumps. The boy had bumps all over his legs and the girls had bumps all over their backs. The boy scratched his own legs and each girl scratched the other’s back.]

- i. *Ka'èškóne-ho é-axeen-áhtse-o'o.* = (22)
 child-PL.AN 3-scratch.AN-*ahte*-3PL.AN
- ii. *Hetané-ka'èškóne é-axeen-áhtse naa*
 man-child 3-scratch.AN-*ahte* and
he'é-ka'èškóne-ho noná-mé'tó'e é-axeen-áhtse-o'o.
 woman-child-PL.AN noná-NON.ID 3-scratch.AN-*ahte*-3PL.AN

Judgment: Felicitous and True

The mixed elaboration in Cheyenne (28ii) specifies a reflexive relation for the subgroup of the boy and a reciprocal relation for the subgroup of the girls. This continuation of Cheyenne (28i) is felicitous – it is a good elaboration. In addition, (28) is true in the context provided. That would not be possible if Cheyenne (28i) were ambiguous between a reflexive and a reciprocal, as in (29).

- (29) a. # *The children scratched **themselves**. The boy scratched **himself** and the girls scratched **each other**.*
 b. # *The children scratched **each other**. The boy scratched **himself** and the girls scratched **each other**.*

Thus, it is difficult to translate the Cheyenne discourse (28) into English. The least awkward translation is (30), where Cheyenne (28i) is rendered as (30i), without any object:

- (30) i. *The children **were scratching**.*
 ii. *The boy scratched **himself** and the girls scratched **each other**.*

In summary, results from various tasks show that mixed construals are allowed in Cheyenne. Supporting evidence comes from each of the three tasks: sentences like Cheyenne (22) were judged true in mixed scenarios (both visual and described) and the mixed elaboration in (28) is grammatical, felicitous, and true in mixed scenarios. This provides strong evidence that Cheyenne *-ahte* is underspecified for reflexivity and reciprocity, not ambiguous. Mixed elaborations are unavailable with English reflexives and reciprocals, so Cheyenne cannot just be ambiguous between these two meanings.

6 Conclusions

In making a case for the indispensable role of direct elicitation methods in semantic fieldwork, while (re)emphasizing the importance of texts, Matthewson 2004 says “As pointed out by Mithun (2001) and many others, it is only by collecting spontaneous speech that the researcher can be exposed to phenomena that are outside the boundaries of his/her prior knowledge or imagination” (p. 376). I strongly believe that collecting spontaneous speech and texts are invaluable tools for fieldwork, for learning and studying a language. However, as demonstrated by this paper, theoretical analyses can be another such tool. By formalizing analyses, we make strong predictions that can also expose us to phenomena outside the boundaries of our prior knowledge and imagination.

Mixed construals are available for Cheyenne *-ahte*. This is a fact that, coming from an English perspective, might never have been discovered. The underspecification analysis of this construction discussed in Section 4 accounts for both singular and plural antecedents and the variety of construals, and made the strong prediction of a mixed construal. In fact, there being a mixed construal was a consequence of the analysis, unavoidable. As it turns out, the prediction was borne out by the Cheyenne data, but it might have been otherwise. If the prediction had been falsified, it would have been evidence for an ambiguity analysis, but it would still have revealed something new about Cheyenne.

To my knowledge, before Murray 2007, no one had explored the possibility of mixed construals for any other languages with “ambiguous reflexive/reciprocal” markers. However, many such languages exist. After working on the Cheyenne mixed elaboration discourse in (28), I conducted an informal survey of other languages that express reflexivity and reciprocity with a single form. I found that mixed construals are available in many other languages: examples like Cheyenne (28) are also possible in Polish (M. Bittner, p.c.), Romanian (A. Brasoveanu, p.c.), French (V. Déprez, p.c.), Spanish (C. Fasola, p.c.), and German (J. Tonhauser, p.c.). So this pattern of mixed construals seems cross-linguistically quite robust, though not before documented, and has been the topic of subsequent study (Cable 2012).

Two general conclusions are supported by the example discussed in this paper. First, formal semantic training is valuable for fieldwork. Formally precise analyses make predictions that must be tested in the field. These predictions might be things we as fieldworkers would not otherwise ask. Coming from my English-speaking perspective, I might never have thought up such a scenario as (28), and perhaps this is not the type of scenario we would ever find in naturally occurring data. As Rice 2006 says, “enriched coverage comes about because linguistic theory forces one to ask questions that likely would not have been asked otherwise”.

Second, there is a symbiotic relationship between fieldwork and theory. (Semantic) fieldwork provides novel and varied data that pushes the limits of our current theories, and making our (semantic) analyses formally precise can provide new lines of inquiry for fieldwork.

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