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MODELING DEPENCY IN GERMANIC PRETERITE-PRESENT VERBS USING DATR

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Dr. Rusty Barrett, Director of Graduate Studies

MODELING DEPONENCY IN GERMANIC PRETERITE-PRESENT VERBS USING DATR

Thesis

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Arts in
Linguistic Theory and Typology in the College of Arts
and Sciences at the University of Kentucky

By

Marie Bourgerie Hunter

Lexington, Kentucky

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Linguistics

Lexington, Kentucky

2017

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ABSTRACT OF THESIS

MODELING DEPONENCY IN GERMANIC PRETERITE-PRESENT VERBS USING DATR

In certain Germanic languages, there is a group of verbs called preterite-present verbs that are often viewed as irregular, but in fact behave very predictably. They exhibit a morphological phenomenon called deponency, often in conjunction with another morphological phenomenon called heteroclisis. I examine the preterite-present verbs of three different languages: Old Norse, Modern Icelandic, and Modern German. Initially, I approach them from a historical perspective and then seek to reconcile their morphology with the modern perspective. A criteria is established for a canonical preterite-present verb, and then using a lexical programming language called DATR, I create code that generates the appropriate paradigms while also illustrating the morphological relationships between verb tenses and inflection classes, among other things. DATR is a programming language used specifically for language models.

KEYWORDS: morphology, preterite-present, proto-germanic, deponency, DATR

Marie Bourgerie Hunter

8/3/2017

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To my boys,
Husband and son
Ian and Ollie Pop
(I love you both so much I sometimes feel I may burst)

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Table of Contents

Acknowledgments.....	iii
List of Tables.....	vii
List of Figures	viii
Chapter 1 – Introduction	1
Chapter 2 – Theory and Literature Review.....	5
2.1 – Preterite-Present Verbs	5
2.1.1 – General description.....	5
2.1.2 Classification Criteria.....	10
2.1.3 – Where do they come from?.....	11
Grimm’s Theory:	11
Perfect origin theory:.....	12
Other theories:.....	13
2.1.4 – Semantics	13
2.2 – Deponency	17
2.3 – Brief DATR Introduction.....	19
Chapter 3 – Languages, verbs, and their general properties	23
3.1 – Old Norse.....	23
3.1.2 – Strong and Weak verbs	23
3.1.3 – Preterite-present.....	25
3.2 – Modern Icelandic.....	26
3.2.1 – Verbs.....	26
3.3 – Modern German.....	28
Chapter 4 – Methodology.....	32
Understanding Basic DATR	32
Chapter 5 – Results.....	37
Chapter 6 – Analysis and Conclusions	73
6.1 – Innovations in DATR and insights from this DATR theory	75
Deponency	78
Things the model did not do well.....	78
Abbreviations	80
Bibliography:	81

Vita..... 83

List of Tables

Table 1 - 'skulu'	2
Table 2– PGmc Preterite-present verbs (Birkmann, 1987; Bammesberger, 1995)	4
Table 3 - Glosses (Bammesberger, 1995; Birkmann, 1987: 66-84).....	6
Table 4 - brenna	8
Table 5 - skulu	9
Table 6 - fella.....	9
Table 7 - Glosses, broken down by language.....	14
Table 8 - Old English skulan	16
Table 9 - Latin verb regere with a normal inflectional pattern.....	17
Table 10 - Latin verb sequī with a deponent inflectional pattern, seen by the empty passive cells	17
Table 11 - munu, icelandic	18
Table 12 - Non-paramaterized hierarchy (Tiberius, 2002, 702).....	21
Table 13 - líta, Old Norse	24
Table 14 - fara, Old Norse	24
Table 15 - Strong verb suffixes in Old Norse.....	25
Table 16 - Old Norse strong verb suffixes (Byock, 2013)	25
Table 17 - Old Norse weak verb suffixes.....	25
Table 18 - Verb suffixes in Icelandic (Einarsson, 1945).....	27
Table 19 - bíta, Icelandic	27
Table 20 - vita, icelandic.....	27
Table 21 - German verb suffixes	29
Table 22 - biegen, German strong	30
Table 23 - mögen, German pret-pres	30

List of Figures

Figure 1 - Germanic Languages (Harbert, 2007, 8)	3
Figure 2 - Russian nouns (Hippisley 2012, 30)	33

Chapter 1 – Introduction

In Old Norse, the verb *skulu* ‘shall’ – which comes from the same root as modern English ‘shall/should’ and has an unusual conjugation pattern (Table 1). The present tense mimics the past tense of a strong verb, and the past tense resembles the weak past tense in the indicative¹. This is often written off as an irregularity, but it is actually part of a much larger, systematic pattern. *Skulu* is part of a class of verbs named ‘preterite-presents’ and they occur throughout the Germanic languages. It is a small group; at the Proto-Germanic level, fourteen stems are reconstructible, and two others are introduced in a later time period. In Old Norse this combination (a morphological phenomenon called deponency—I discuss it in more depth in chapter 2.2) between the strong and the weak verb is very predictable; in other languages, particularly more modern languages, verbs in the class don’t line up with this pattern as neatly. Neat or not, the inflections can all be accounted for cross-linguistically in a single theory using the programming language called DATR (that was specially designed for representing lexical patterns).

SKULU 'WILL (OBLIGATION, INTENTION)'		
	pres	past
1SG	<i>skal</i>	<i>skylda</i>
2SG	<i>skalt</i>	<i>skyldir</i>
3SG	<i>skal</i>	<i>skyldi</i>

¹ This thesis addresses the indicative only because preterite-present verbs behave regularly in other categories.

1PL	<i>skulum</i>	<i>skyldum</i>
2PL	<i>skuluð</i>	<i>skylduð</i>
3PL	<i>skulu</i>	<i>skyldu</i>

Table 1 - 'skulu' – Old English

The languages I account for in the DATR theory are Old Norse, Icelandic, and Modern German. These languages were chosen strategically as a pilot study to see how feasible a larger scale project would be. Old Norse contains preterite-present verbs that are prototypical or canonical with this theory, and represents a state of North Germanic dating to about 900 years ago. Icelandic grammar is directly descended from Old Norse so there is a direct historical comparison between these two languages. There are a lot of similarities while at the same time showing some signs of the preterite-present class being infiltrated by other factors. Modern German is from a different branch entirely, being a West Germanic language (see Figure 1 below). Which verbs stayed in the language over time, the suffixes, the location of the ablauts within the paradigm, and the ablauts themselves – these factors are similar between Modern Icelandic and Old Norse but predictably vary much more when comparing the previous languages to Modern German.²

² Some languages were eliminated based solely on the lack of data and complete paradigms. This was the case with Gothic, which is the best documented West Germanic language and has a lot of interesting patterns, but it has an extremely limited surviving data set.

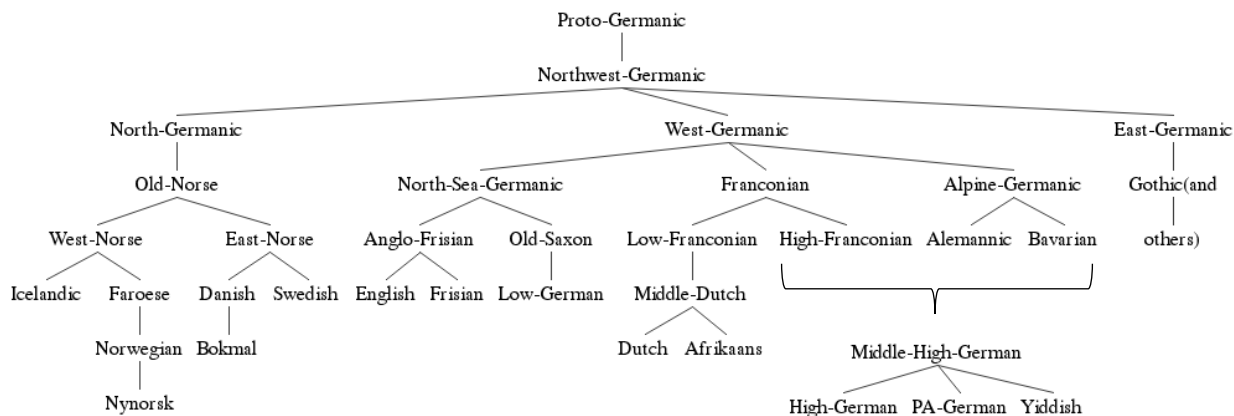


Figure 1 -- Germanic Languages (Harbert 2007, 8)

Not all Germanic languages have maintained the preterite-present class – Old English had the pattern, but Modern English does so only vestigially. Modern English has dropped most of the paradigm, selecting only a present and a past tense to maintain (‘will’ / ‘would’), and other languages, such as Danish, have done similarly. While the former preterite-present verbs in these languages have interesting features that merit discussion and study, I’m focusing on languages that have full or mostly-full paradigms.

Proto-GMC	Old Norse	Modern Icelandic	Modern German	Modern English
* <i>witan</i>	<i>vita</i>	<i>vita</i>	<i>wissen</i>	<i>wise</i>
* <i>munan</i>	<i>muna, munu</i>	<i>muna, munu</i>		
* <i>(ga)durzan</i>				
* <i>kunnan</i>	<i>kunna</i>	<i>kunna</i>	<i>können</i>	<i>can</i>
* <i>dugan</i>				
* <i>magan</i>	<i>mega</i>	<i>mega</i>	<i>mögen, vermögen</i>	<i>may</i>
* <i>aigan</i>	<i>eiga</i>	<i>eiga</i>		
* <i>ōgan</i>				
* <i>lais</i>				
* <i>þurban</i>	<i>þurfa</i>	<i>þurfa</i>	<i>dürfen, bedürfen</i>	
* <i>binah, ganah</i>				
* <i>unnah</i>	<i>unna</i>	<i>unna</i>		
* <i>mōtan</i>			<i>müssen</i>	<i>must</i>
* <i>skulan</i>	<i>skulu</i>	<i>skulu</i>	<i>sollen</i>	<i>shall</i>
	<i>knega</i>			
			<i>wollen</i>	<i>will</i>

Table 2– PGmc Preterite-present verbs (Birkmann 1987; Bammesberger 1995)

Chapter 2 – Theory and Literature Review

2.1 – Preterite-Present Verbs

2.1.1 – General description

Preterite-present verbs are a class of verbs among Germanic languages that are often seen as irregular but are a clear class of verbs identified by several primary features: the ablaut stems, the suffixes, and the content-form mismatch in the previous categories. Historically, there are fourteen verbs in this category in Proto-Germanic; the following table contains all of the reconstructed infinitive forms, the reconstructed stem alternants, and the glosses.

PGmc infinitive	<i>*witan</i>	<i>*munan</i>	<i>*(ga)durzan</i>	<i>*kunnan</i>	<i>*dugan</i>	<i>*magan/mugan</i>	<i>*aigan</i>
Stem alternants	<i>*wait/wit</i>	<i>*man/mun</i>	<i>*dars/durz</i>	<i>*kann/kunn</i>	<i>*daug/dug</i>	<i>*mag/mag</i> <i>*mag/mug</i>	<i>*aih/aig</i>
gloss	'know'	'remember' 'want'	'dare'	'know,' 'be able to'	'be suitable, good for'	'can, be able to'	'have,' 'must'
PGmc infinitive	<i>*ōgan</i>	<i>lais (got.)</i>	<i>*þurban</i>	<i>binah/ganah (got.)</i>	<i>*unnan</i>	<i>*mōtan</i>	<i>*skulan</i>
Stem alternants	<i>*ōg/ōg</i>	<i>*lais/liz</i>	<i>*þarf/þurf</i>	<i>*nah/nug</i>	<i>*ann/unn</i>	<i>*mōt/mōt</i>	<i>*skal/skul</i>
gloss	'be afraid'	'know'	'need, be necessary'	'permitted, allow' 'suffice'	'love'	'have to ', 'be able to', 'be allowed'	'have to'

Table 3 - Glosses (Bammesberger 1995; Birkmann 1987: 66-84)³

³ The primary preterite-present resource that was used in this thesis was Birkmann (1987) – where there is conflict within the literature, I generally yield to Birkmann – his book is the most comprehensive account of the preterite-present verb class.

One goal is to establish a set of canonical characteristics for preterite-present verbs – Proto-Germanic and Old Norse represent the canonical pattern in most literature and in my theory and deviations make a language increasingly noncanonical. It's helpful to have guidelines – when does a verb stop being a preterite-present verb? Is a verb forever in this class if it was one of the original fourteen verbs? Or are the morphological features of the verbs the only thing that's important and thus more verbs could hypothetically be added under the right historical conditions? This paper is based on the latter premise, that the features of the verb determine whether it is a part of this group or not.

There is a single known instance of a verb being added to the class that was not present in Proto-Germanic. In Gothic, it appeared as 'wiljan' just as a modal verb but later took on preterite-present characteristics in Old High German (Birkmann 1987, 116-118). This is addressed further in the semantics discussions and its implications.

Though languages are being analyzed from multiple time periods in this pilot study, the analysis is still synchronic, examining a single snapshot of each grammar. Because of this, some factors and variables might be hidden.

Preterite-present verbs seem to be borrowing the strong-preterite stems and endings and using them in the present – this is mismatch enough, but it is also paired with a weak preterite in the past tense, with preterite and past being interchangeable in this paper.

This isn't a bad place to start, but things are not quite so canonical or simple, even in the Proto-Germanic, and from a historical perspective it's even less so. Some languages like Old Norse are canonical and match the strong verb conjugations exactly, but most require additional information to finish the paradigm, (as will be seen in the DATR theory that I develop here). Additionally, even in a canonical case, strong inflection classes complicate things so that not every present-preterite lines up with a strong inflection class that it is borrowing from, due to ablauts (but these pret-pres verbs still retain general properties of strong verbs). However, in all cases there is a robust tie between the past tense of strong verbs and the present tense of preterite-present verbs – and this is where the action happens.

In the tables below, highlighting represents parts that borrow and come together to form the preterite-present.

BRENNA 'BURN' – STRONG CLASS, 3

	present	past
1SG	<i>brenn</i>	<i>brann</i>
2SG	<i>brenn-r</i>	<i>brann-t</i>
3SG	<i>brenn-r</i>	<i>brann</i>
1PL	<i>brenn-um</i>	<i>brunn-um</i>
2PL	<i>brenn-ið</i>	<i>brunn-uð</i>
3PL	<i>brenn-a</i>	<i>brunn-u</i>

Table 4 - *brenna* – Old Norse (Byock 2013)

SKULU 'SHALL' — PRETERITE-PRESENT

	present	past
1SG	<i>skal</i>	<i>skyld-a</i>
2SG	<i>skal-t</i>	<i>skyld-ir</i>
3SG	<i>skal</i>	<i>skyld-i</i>
1PL	<i>skul-um</i>	<i>skyld-um</i>
2PL	<i>skul-uð</i>	<i>skyld-uð</i>
3PL	<i>skul-u</i>	<i>skyld-u</i>

Table 5 – skulu – Old Norse (Byock 2013)

FELLA 'FELL' – WEAK CLASS 1

	present	past
1SG	<i>fell-i</i>	<i>felld-a</i>
2SG	<i>fell-ir</i>	<i>felld-ir</i>
3SG	<i>fell-ir</i>	<i>felld-i</i>
1PL	<i>fell-um</i>	<i>felld-um</i>
2PL	<i>fell-ið</i>	<i>felld-uð</i>
3PL	<i>fell-a</i>	<i>felld-u</i>

Table 6 – fella – Old Norse (Byock 2013)

In most preterite-present verbs, there is an ablaut change between the present singular and the present plural. In many cases, the past indicative also uses a different stem – this stem is predictable. The ablaut alternations can be put into several categories or even formal classes, though I am not adhering to a specific class system. The four ablaut patterns represented are: *ai/i*, *au/u*, *a/u*, and *a/i*. These also correspond with patterns present in strong verbs in Proto-Germanic and others.

2.1.2 Classification Criteria

In total, there are three or four preterite-present verbs in Proto-Germanic that do not have ablaut alternation, depending on the reconstruction: *mōt/mōt*, *ōg/ōg*, *aih/aig*, and *mag/mag* (Birkmann reconstructs *mag/mag* as *mag/mug*.) I initially stated that the ablaut alternation was a criterion for a canonical present-preterite, and this is true – but at this early stage at least three verbs lack an ablaut alternation, so this can't be the sole criterion that determines whether or not a verb is a present-preterite (though it is definitely a notable feature.)

The next criterion is that of the preterite-present suffixes. In a comparison of mostly historic languages, including: Old Norwegian, Old Swedish, Gothic, Old High German, Old Saxon, Middle High German, Faroese, Old Danish, Old Frisian, Old English, Old Norse, Modern German, and Modern Icelandic, some patterns are clear. The endings on the present singular stay roughly the same: present 1/3 singular both equal the stem and no suffix, and the present 2 singular is the stem with a -t or -st suffix. The plural varies more than this, though there are some similarities between languages. The present 1 plural = stem + <um> or <un> most commonly; occasionally, an <o> appears instead of a <u>. The present 2 plural is equal to stem [+dental] most often, but sometimes alternates with an -in suffix, as in Old Swedish and Old Danish. Present pl 3 has three major endings: -un, -u, and -a.

The final criterion involves the content-form mismatch. Content-form mismatch refers to when the content of a paradigm is not what the form suggests that it should be; in this case, we are getting verb forms expressing the present tense whose morphology is like that of strong preterites together with verb forms

expressing the preterite whose morphology is that of weak preterites. This is a morphological phenomenon called deponency and it is the primary criterion for determining if a verb falls into this category. Deponency is described in detail in Chapter 2.2.

As mentioned previously, there is variance from these criteria, especially in modern languages. My DATR theory will account for all of these variations within Old Norse, Icelandic, and Modern German.

2.1.3 – Where do they come from?

It's important to address the historical context of preterite-present verbs and why some of these verbs are the way they are, and to do that, the question should be at least briefly answered: where do these verbs come from? There are a couple of theories. Randall and Jones provide a historical overview from a modern perspective of the most prominent theories to date (2015).

Grimm's Theory:

This theory is also referred to as the 'Strong Verb Origin Theory' by Tanaka (2011), and was put forth in 1848 by Jakob Grimm. Grimm coined the term 'praeteritopraesentia' and his very detailed work is the first attempt at reconstructing the preterite-present verbs. The claim is that all preterite-present verbs were originally strong verb preterites in PIE "where the preterite regains the sense of the present, and the original present is for the most part lost" (Randall & Jones 2015, 139).

Grimm himself notes multiple issues with this theory. As I mentioned previously, some of the ablaut grades line up with the Germanic strong verbs, but

others do not. The preterite-presents that do not have ablaut grades also are problematic for this theory. The lack of ablaut alternation is attributed to irregularities within the ablauts but this explanation does not convince many scholars (Randall & Jones 2015, 139). There are also several morphological features that the preterite-present has that strong verbs do not; for example, the preterite-present creates a verbal adjective with a dental whereas strong verbs form “their past participles with the reflex of PGmc *-ana-” (Randall & Jones, 2015, 139). This dental seems intuitive from a synchronic perspective – if we use the explanation that the past tense is formed like a weak verb, it is predictable, but that is not Grimm’s explanation for how the verb came about historically and so cannot be used.

Grimm’s theory is not currently the popular, supported theory in the literature. Tanaka (2011) and Birkmann (1987) – among others -- both have spoken out against it and support countertheories.

Perfect origin theory:

In his book, Birkmann supports the Perfect Origin theory (1987), along with many other scholars. While endorsement can occasionally be found for Grimm’s theory or possible hybrids (see below), Perfect Origin is so widespread it has started to just be accepted as a given in literature (Randall and Jones 2015, 140).

The theory states that the origin of the preterite-present is in the PIE perfect. The Perfect Origin is removing a step and stating that the strong verbs developed parallel to the preterite-present class (Randall & Jones, 2015, 140).

Perfect Origin theory has fewer problems than Grimm's, but it is not flawless or undisputed by all scholars.

Other theories:

Most other origin theories are small modifications of either Grimm's or the Perfect origin theory, making small changes to deal with the issues; examples are the theories advanced by Ringe (2007) and Meid (1971). But they are not so far that it puts them in different categories. One notable exception is a theory put forward by Tanaka (2011), where he posits that preterite-present verbs are neologisms introduced after PIE.

As mentioned previously, the DATR theory is a synchronic look at preterite-present verbs. Where possible, I provide historical support, but it is not possible to efficiently model any of the historical theories in this test study; possibly with synchronic data this could change.

2.1.4 – Semantics

Semantics becomes crucial in the development of modern preterite-present verbs as a class. The table below contains the glosses for each verb.

Proto-GMC (Birkmann)	gloss	Old Norse	Modern Icelandic	Modern German	Modern English
<i>*witan</i>	'know'	<i>vita</i>	<i>vita</i>	<i>wissen</i>	
<i>*munan</i>	'remember'	<i>muna</i>	<i>muna</i>		
	'want'	<i>munu</i>	<i>munu</i>		
<i>*(ga)durzan</i>	'dare'				
<i>*kunnan</i>	'know,' 'be able to'	<i>kunna</i>	<i>kunna</i>	<i>können</i>	<i>can</i>

<i>*dugan</i>	'be suitable, good for'				
<i>*magan</i>	'can, be able to'	<i>mega</i>	<i>mega</i>	<i>mögen</i> 'may' <i>vermögen</i> 'can'	<i>may</i>
<i>*aigan</i>	'have,' 'must'	<i>eiga</i>	<i>eiga</i>		
<i>*ōgan</i>	'be afraid'				
<i>*lais</i>	'know'				
<i>*purban</i>	'need, be necessary'	<i>purfa</i>	<i>purfa</i>	<i>dürfen,</i> <i>bedürfen</i>	
<i>*binah & ganah</i>	'be permitted, allowed' 'suffice'				
<i>*unnan</i>	'love'	<i>unna</i>	<i>unna</i>		
<i>*mōtan</i>	'have to', 'be able to' 'be allowed'			<i>müssen</i>	<i>must</i>
<i>*skulan</i>	'have to'	<i>skulu</i> 'become'	<i>skulu</i>	<i>sollen</i>	<i>shall</i>
	'be able, can' 'know'	<i>knega</i>			
	'want'			<i>wollen</i>	<i>will</i>

Table 7 - Glosses, broken down by language (Birkmann 1987)

Among the initial set of preterite-present verbs, the majority have modal definitions; over time, in both German and English, the non-modal verbs fall away. There are various theories about why, how, and when this began to happen (sources, including Lightfoot); they have been well explored elsewhere and are not relevant to repeat here. However, as a result of the majority of the semantics of preterite-presents looking like modal verbs, we have 'wellen' 'wollen' and 'will'

which are likely the only true innovation in the list.⁴ As previously referenced, these verbs are related to the Gothic ‘wiljan,’ which is a modal verb, but its stems and inflectional patterns do not follow the preterite-present pattern (Birkmann 1987, 117); however, in Old High German, the verb has taken on deponency of the preterite-presents, likely because it is a modal and the class of preterite-presents has at this point become associated with modal verbs (Birkmann 1987, 157). Old English does not adopt ‘willa’ as a preterite-present, and Middle English ‘willen’ does not follow the preterite-present pattern either; but modern English ‘will/would’ mimics the vestigial pattern of the other preterite-present modals in English, such as *shall/should*.

This means it is possible to add to the preterite-present group – though it is just the one root, it ended up adopting the preterite-present pattern in multiple languages. However, it happened because it was one of the only modals that was not a part of the group – that path probably won’t be open again without semantic innovation on the part of the preterite-present class or the language. Additionally, the preterite-present verbs are becoming weaker and more scarce, not stronger, so that makes new members less likely.

Preterite-presents in modern English are not included in the DATR theory and are no longer true preterite-presents because they lack the criteria mentioned previously (ablaut, suffixes, and content-form mismatch/deponency), but their

⁴ *knega is a preterite-present verb that only is attested in Old Norse, but there is little information about it; it could have been an innovation just in that region or it could have been present in Proto-Germanic (Birkmann 1987, 249)

history in this class is the reason for the atypical inflection pattern that is in Modern English today. The modals that we have are: *can/could*, *may/might*, *must/-*, *shall/should*, and *will/would*. We also have a subset of verbs sometimes called “quasi-modals,” which have some characteristics of of model verbs but not all of them -- *ought*, *need*, and *dare* are some examples of this and they have roots in preterite-presents as well (see table 7).

OLD ENGLISH SCULAN ‘SHALL/SHOULD’

	present	past
1SG	sceal	scolde
2SG	scealt	scoldest
3SG	sceal	scolde
PLURAL	sculon	scoldon

Table 8 - Old English skulan

For example, the Old English verb *sculan*. Modern English gets *shall* and *should* from 1/3 sg present and 1/3 sg past, respectively. With *shall/should*, the ablaut in the stem shows a small indication of the old preterite-present pattern. Obviously, they do not inflect anymore, and English modals have deviated semantically so they are not always merely present and past tense of each other, but that is how they started out.

2.2 – Deponency

The word *deponency* stems from the Latin *deponere* which means to ‘lay aside’ – a word has laid aside one function in favor of another (Stump 2016, 197).

Latin deponent verbs are often used as the example in these cases.

	NORMAL VERB, 'RULE'	
	active	passive
PRS IND	regit	regitur
PRS INF	regere	regī
PRF IND	rēxit	rēctus est
PTCP PRF	--	rēctus
SUPINE	rēctum	--
PTCP PRS	regēns	--

Table 9 - Latin verb *regere* with a normal inflectional pattern

	DEPONENT VERB 'FOLLOW'	
	active	passive
PRS IND	sequitur	--
PRS INF	sequī	--
PRF IND	secūtus est	--
PTCP PRF	secūtus	--
SUPINE	secūtum	--
PTCP PRS	sequēns	--

Table 10 - Latin verb *sequī* with a deponent inflectional pattern, seen by the empty passive cells

Essentially, the passives are being adopted and used in the active category, and “the normal function is no longer available” (Baerman 2007, 2). Because the passive forms are being used elsewhere, the passive cells in the paradigm are empty.

Deponency does not only occur in Latin however, we just borrow the name from it, and it does not just apply to active and passive mismatch, as can be seen with preterite-present verbs. Fundamentally, deponency is when there is content-form mismatch within the morphology based on inflectional categories (Stump 2016, 197). This leads to many types of deponency – in the case of preterite-present

verbs, the inflectional categories that are experiencing a mismatch are the preterite and the present, and the strong and the weak classes.

With preterite-present verbs, there is an additional interesting wrinkle.

Verbs like Icelandic *skulu* 'shall, will' and Icelandic *munu* 'shall, will, may' exhibit the expected deponent behavior, with the preterite of the strong verb taking the place of the present tense and the past cells in the paradigm remain empty:

MUNU 'SHALL, WILL, MAY' – PRET-PRES

	pres	past
1SG	<i>Mun</i>	--
2SG	<i>Munt</i>	--
3SG	<i>Mun</i>	--
1PL	<i>Munum</i>	--
2PL	<i>Munið</i>	--
3PL	<i>Munu</i>	--

Table 11 - *munu*, *Modern Icelandic*. (Einarsson 1979)

This is typical of deponency; as was seen in table 10, the passive was defunct; the same happens with the past in *munu*. However, most of the preterite-present verbs are not like this; they combine the strong and the weak classes into one paradigm in order to complete it. This is called heteroclisis⁵ and is sometimes paired with deponency to create a fully-productive paradigm. Baerman and Stump both address preterite-present verbs specifically in their discussions on this topic (Baerman 2007, 16-17; Stump 2016, 224-227).

⁵ Heteroclisis is another morphological content-form mismatch that is defined by multiple inflectional classes occurring within one paradigm and acting upon one lexeme (Stump 2016: 184-185).

2.3 – Brief DATR Introduction

DATR is a programming language that was created by Gerald Gazdar and Roger Evans in the mid-80s – in 1991, it was introduced to Greville Corbett who began applying it to morphology and building the framework of Network Morphology around it. (Brown and Hippisley, 2012, xv-xvi) The language has changed very little since its birth. The 1996 paper by Evans and Gazdar, titled “A Language for Lexical Knowledge Representation,” essentially serves as the formal documentation (the online version of the documentation has some supplementation from two other publications by Bill Keller 1995 and 1996 -- <http://www.datr.org.uk/>). It is clear throughout the documentation that the primary users are linguists – however, it isn’t purely used for morphology.

Network Morphology and DATR are linked, and DATR was the inspiration for Network Morphology – but there are still differences and conscious differentiation between the theory and the formalism, and this was not an accident: “First, we wish to focus on the linguistic insights, which are primary, rather than the formalism, which is second... Second, one of the criticisms levelled against some approaches to morphology (such as Word and Paradigm) is that they are too powerful...A key aim of Network Morphology is to identify a set of universal constraining principles of morphology.” (Corbett and Fraser, 1993, 116).

I will not be focusing on Network Morphology, but only using DATR. This allows accessibility to multiple frameworks.

Paradigms can be generated more efficiently in other programming languages commonly used with languages, such as Perl or Python, but the code

would not have the same significance or yield linguistic insight. DATR represents the lexical items as an inheritance hierarchy – the commonalities are pushed to the top, and nodes can be borrowed from to eliminate redundancies and illustrate relationships between different categories that will be morphological in this theory.

Corbett and Fraser's 1993 work, *Network Morphology: a DATR account of Russian nominal inflection*, is a seminal work in the field. It deals largely with syncretism among Russian nouns – canonical deviations such as syncretism are something that are hard to reconcile in morpheme-based approaches and easily dealt with in DATR because of its inheritance structure. Syncretism is another type of content-form mismatch, like deponency.

There is an adaptation of DATR recently developed called KATR, which stands for Kentucky DATR, since it was developed at University of Kentucky – Finkel & Stump explore this through Hebrew morphology, and detail what they view as usability improvements, as the theory is largely the same. Some of these innovations are allowing regular expressions, allows adjustment to Panini precedence when rules are of the same length so that one rule can be given precedence, allowing special characters, allowing nonsubtractive rules, and allowing the set notation of the paradigm signature to be shuffled (2007, 133). The ability to shuffle the set notation was the biggest innovation; in essence it brings the formalism closer to Paradigm Function Morphology which does not order set notation like Network Morphology does.

There has been work done already in the field on multilingual theories – they are not always specifically about DATR, but often about inheritance hierarchies. (Bateman and Sharoff, 1998; Tiberius 2002; Tiberius and Cahill 2000). There are five ways laid out by Tiberius to approach creating a multilingual hierarchy: non-parameterized, parameterized, micro-features, meta-features, and infinitesimal features models. The first two are most relevant to the data in this thesis (Tiberius 2002).

Non-parameterized models are made by taking all your individual languages and “creating a parallel hierarchy containing what the monolingual lexicons have in common.” (Tiberius 2002, 702)

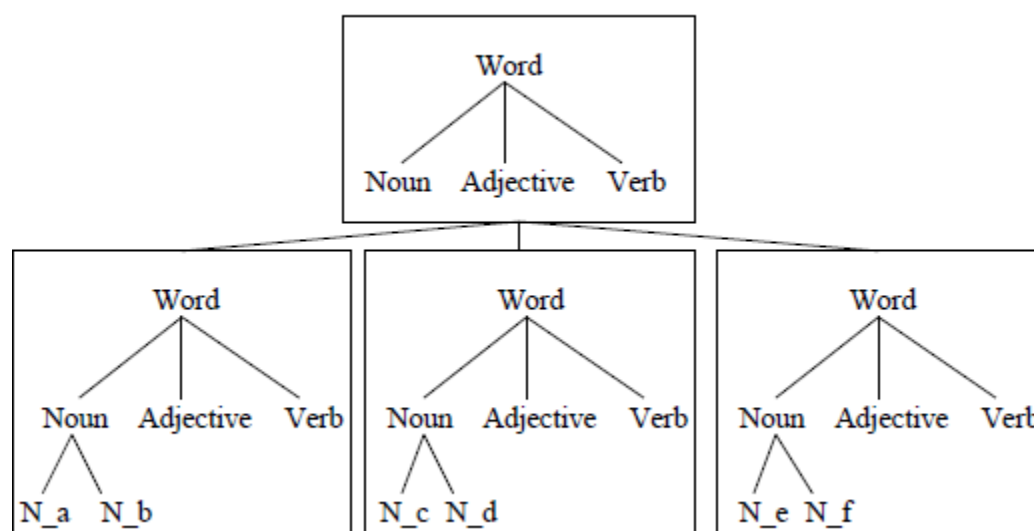


Table 12 - Non-parameterized hierarchy (Tiberius 2002, 702)

Many large-scale and widely-distributed projects have used a non-parameterized model; for example, the PolyLex project (Cahill and Gazdar 1999) among others (Kameyma 1988; Kilgarriff et al. 1999).

In a parameterized model, on the other hand, “all the languages represented in the lexicon are integrated into a single hierarchy and language is used as a parameter to indicate which parts of the lexicon are valid for which languages” (Tiberius 2002, 703).

In some ways I mixed both of these models; language is a parameter in my code, but largely my model is non-parameterized based simply on practicality.

The PolyLex project was programmed using DATR and it was also used by Hippiusley and Gazdar in a hierarchy project with Slavonic color terms (1999).

Chapter 3 – Languages, verbs, and their general properties

3.1 – Old Norse

Old Norse is a North Germanic language. Norse began to be distinct from the language spoken by other Germanic people around 100 CE. Old Norse was divided into three time periods: Primitive Norse, Viking Norse, and Literary Old Norse, Starting with the Viking Norse period, two major subregions are distinguished – West and East Norse, subsuming Old Norwegian and Old Icelandic in the West and Old Swedish and Old Danish in the East. Old Icelandic texts are much more common than other subdialects and serve as the basis for Gordon’s grammar (Gordon 1927: 245).

3.1.2 – Strong and Weak verbs

Formally, Old Norse is described as having seven strong verb classes and four weak verb classes. The variation between strong verb classes is within the stems, and often classified by the ablaut pattern; weak verbs are divided by stem, but not by ablaut. Both strong and weak verbs have the same suffixes across classes.

The ablaut pattern in Old Norse strong verbs occurs between the past singular and the past plural; the present tense has a different vowel as well. An example is *líta* 'look', a member of class I:

LÍTA 'LOOK' - STRONG CLASS I

	pres	past
1SG	<i>lít</i>	<i>leit</i>
2SG	<i>líttr</i>	<i>leizt</i>
3SG	<i>líttr</i>	<i>leit</i>
1PL	<i>lítum</i>	<i>litum</i>
2PL	<i>lituð</i>	<i>lituð</i>

3PL *lítu* *litu*

Table 13 - *líta*, Old Norse (Byock 2013)

Only class VI does not have this ablaut pattern in the past, but instead has it in the present

FARA 'GO, TRAVEL' – STRONG CLASS VI

	pres	past
1SG	<i>fer</i>	<i>fór</i>
2SG	<i>ferr</i>	<i>fórt</i>
3SG	<i>ferr</i>	<i>fór</i>
1PL	<i>förum</i>	<i>fórum</i>
2PL	<i>farið</i>	<i>fóruð</i>
3PL	<i>fara</i>	<i>fóru</i>

Table 14 - *fara*, Old Norse (Byock 2013)

The vowel change in the present 1 plural above is an automatic phonological change; such changes are not addressed in the DATR theory. Ablauts also occur in the present tense in class II, but the alternation remains in the past as well. With most of the classes, ablauts alone suffice to distinguish between them. However, class VII is a mixed bag and the verbs do not match. IV and V have identical ablaut alternations, however, so the difference between them is deeper -- Class IV usually has <l, r, m, n> after the root vowel and class V usually has a single consonant following the root vowel (Byock 2013).

The strong verb suffixes are as follows:

infinitive <3sg present, 3sg past, 3pl past, past participle> 'gloss'

I *líta* <*lítr*, *leit*, *litu*, *litinn*> 'look'

II *bjóða* <*býðr*, *bauð*, *buðu*, *boðinn*> 'offer, invite'

III	verða <verðr, varð, urðu, orðinn>
IV	bera <berr, bar, báru, borinn> ‘carry’
V	gefa <gefr, gaf, gáfu, gefinn> ‘give’
VI	fara <ferr, fór, fóru, farinn> ‘go, travel’
VII	ráða <ræðr, réð, réðu, ráðinn> ‘advise, counsel; rule, govern; decide’

Table 15 - Strong verb suffixes in Old Norse (Byock 2013).

	strong	
	pres	past
1SG	-	-
2SG	r	t
3SG	r	-
1PL	um	um
2PL	ið	uð
3PL	a	u

Table 16 - Old Norse strong verb suffixes (Byock, 2013)

The weak classes do not divide based on stem ablaut or vowels in the stem; because of this, the DATR theory treats them as one class. Weak verbs add a dental suffix to indicate the past tense: *-d-*, *-t-*, or *-ð-*. These are likely phonological derivations of the same underlying *-d-*.

The suffixes are as follows:

	Weak verbs:	
	pres	past
1SG	-	a
2SG	r	ir
3SG	r	i
1PL	um	um
2PL	ið	uð
3PL	a	u

Table 17 - Old Norse weak verb suffixes

3.1.3 – Preterite-present

In Old Norse, the preterite-present verbs are: *vita*, *eiga*, *unna*, *kunna*, *þurfa*, *muna*, *munu*, *skulu*, *mega*, and *knega*. All of these follow the canonical preterite-

present model and have standard deponency; however, there are a few irregularities. The first is not an irregularity with the model, but with the historical data – *knega* only appears in Old Norse, and does not have a complete paradigm. Because of this, I did not include it in the DATR theory.

Eiga and *mega* are irregular in that they do not mimic a specific strong class with their ablaut behavior. They still reflect the general strong pattern.

3.2 – Modern Icelandic

Old Norse is a direct ancestor of Icelandic, and because many of the Old Norse texts we have are written in the Old Icelandic dialect, they are very similar. The strong and weak verbs are remarkably similar in stem shape, with a few differences in suffixes; the preterite-presents show a few interesting deviations from Old Norse and the general preterite-present canonicity.

3.2.1 – Verbs

The strong verbs in Icelandic have identical ablaut variation in the stem to Old Norse and thus do not need to be discussed again. The suffixes vary slightly, and so are shown below.

	strong	weak	pret-pres
PRES 1SG	-	-	-
PRES 2SG	ur	ur	st/t
PRES 3SG	ur	ur	-
PRES 1PL	um	um	um
PRES 2PL	ið	ið	ið
PRES 3PL	a	a	a/u
PAST 1SG	-	i	i
PAST 2SG	st (-zt, -t, -)	ir	ir
PAST 3SG	-	i	i
PAST 1PL	um	um	um
PAST 2PL	uð	uð	uð
PAST 3PL	u	u	u

Table 18 - Verb suffixes in Icelandic (Einarsson, 1945)

The suffixes in the present tense are identical between the strong and the weak verbs, and the plurals are the same everywhere.

An interesting thing is happening here with the preterite-present plural suffixes – with deponency, we expect the strong preterite to be in the present cells, but the present 2 plural and present 3 plural are reverting back to the non-deponent identity, the strong present suffixes, as opposed to the strong past. This discrepancy is highlighted in Table 18 above.

BÍTA 'BITE' – STRONG CLASS 1

	pres	past
1SG	<i>bít</i>	<i>beit</i>
2SG	<i>bítur</i>	<i>beist</i>
3SG	<i>bítur</i>	<i>beit</i>
1PL	<i>bítum</i>	<i>bitum</i>
2PL	<i>bítið</i>	<i>bituð</i>
3PL	<i>bíta</i>	<i>bitu</i>

Table 19 - *bíta*, Modern Icelandic (Einarsson 1987)

VITA 'KNOW' – PRET-PRES

	pres	past
1SG	<i>veit</i>	<i>vissi</i>
2SG	<i>veist</i>	<i>vissir</i>
3SG	<i>veit</i>	<i>vissi</i>
1PL	<i>vitum</i>	<i>vissum</i>
2PL	<i>vitið</i>	<i>vissuð</i>
3PL	<i>vita</i>	<i>vissu</i>

Table 20 - *vita*, Modern Icelandic (Einarsson 1987)

Table 20

The preterite-present verb *vita* aligns with strong class 1, getting both stems and suffixes from it, but reverts back to strong-present endings in past 2 plural and past 3 plural. However, this is only with the suffix; the stem remains borrowed from the strong-past, as we can see by the presence of the ablaut.

As mentioned in section 2.2, Icelandic verbs *munu* and *skulu* drop the heteroclis, so there is no past tense at all. These are the only two verbs dealt with here that do this, and since both verbs were attested in Old Norse as having a fully productive paradigm, the past tense was dropped, not added.

3.3 – Modern German

Modern German is a West Germanic language, and so has followed a different language path than Old Norse and Icelandic. The preterite-present verbs found in modern German are: *dürfen* 'to be allowed, be permitted'; *bedürfen* 'to need, require'; *können* 'can'; *mögen* 'may' 'to like'; *vermögen* 'to be able to, may'; *müssen* 'have to, must'; *sollen* 'should'; *wissen* 'to know, to be aware'; and *wollen* 'want.'

	strong	weak	pret-pres
pres 1sg	e	-	-
pres 2sg	st	st	st
pres 3sg	t	-	-
pres 1pl	en	en	en
pres 2pl	t	t	t
pres 3pl	en	en	en
past 1sg	-	-	-
past 2sg	st	st	st

past 3sg	-	-	-
past 1pl	en	n	n
past 2pl	t	t	t
past 3pl	en	n	n

Table 21 - German verb suffixes (Harris 1914)

In modern German, the suffixes are evening out between the groups. The number and grouping of strong verbs varies within the literature and because the ablauts vary much more within the language, the strong verb classes are not nearly as helpful – they can group the most common patterns, but each class would only include a few dozen completely regular verbs at best, possibly less, depending on how finely the classes are divided up. Additionally, when different grammars each included a slightly different inflectional class system -- I chose to still use a class system for symmetry with the other languages. Most strong verbs fall into ten ablaut classes, if vowel length is not taken into account.⁶ If past participles are not taken into account either (and they are not relevant in this theory), it can be narrowed down to eight classes. This is what I base my classes off of in the DATR theory (Fagan 2009, 80)(Durrell 2002, 234).

Whether classes should be used in the German portion of the DATR is hard to say – it needs vowel overrides in most cases with the preterite-presents so it could be eliminated in the DATR without much difficulty and simultaneously reduce the size of the code. However, there is the other argument that keeping the classes does automatically generate some strong verbs, even if it is a small group of them – it is better than none of them.

⁶ Duden sorts them by frequency phonetically, then orthographically, but this causes a lot of overlap and I am interested in the orthography at this stage (1984, 127)

The weak verb forms the past tense with a *-te-* suffix, placed before the final suffix. I chose to include the <e> as part of the derivational past-tense suffix, despite what other German grammars have done, because the *-te-* shows up in Old Norse and Modern Icelandic as well, so this creates symmetry and the opportunity for borrowing in the DATR.

In modern German, the preterite-present verbs mirror the strong/weak suffixes consistently and as expected. The stems, however, are behaving a little differently.

BIEGEN 'BEND' – STRONG CLASS 2

	pres	past
1SG	<i>biege</i>	<i>bog</i>
2SG	<i>biegst</i>	<i>bogst</i>
3SG	<i>biegt</i>	<i>bog</i>
1PL	<i>biegen</i>	<i>bogen</i>
2PL	<i>biegt</i>	<i>bogt</i>
3PL	<i>biegen</i>	<i>bogen</i>

Table 22 - *biegen*, German strong

MÖGEN 'MAY' 'TO LIKE' – PRET-PRES

	pres	past
1SG	<i>mag</i>	<i>mochte</i>
2SG	<i>magst</i>	<i>mochtest</i>
3SG	<i>mag</i>	<i>mochte</i>
1PL	<i>mögen</i>	<i>mochten</i>
2PL	<i>mögt</i>	<i>mochtet</i>
3PL	<i>mögen</i>	<i>mochten</i>

Table 23 - *mögen*, German pret-pres

The strong verbs do not have the ablaut within the past tense between sg and pl, though it occasionally shows up in the present. This pattern is the same as it was in Old High German (Birkmann 1987, 131).

Chapter 4 – Methodology

Paradigms were collected from various sources, different grammars and linguistic textbooks and grammar websites and verified by speakers of the language when possible. Dr. Kristín M. Jóhannsdóttir consulted on the modern Icelandic and Dr. Mark Richard Lauersdorf consulted on the modern German paradigms.

The DATR theory is validated through a website called “Cats Claw,” which was created by Dr. Raphael Finkel.

Understanding Basic DATR

There is some basic terminology to be aware of. A node is an individual segment of code, introduced in the following way:

Node_name:

Text text == text

Nodes are always capitalized. A leaf node is at the bottom where the lexemes are introduced and any final, lexical specific information added.

A path is in brackets <...> and tells the computer where to put and find information,

The inheritance structure of DATR is based around three major ideas: default inheritance, default inference, default orthogonal multiple inheritance.

	I	II	III	IV
<i>Singular</i>				
NOMINATIVE	zakon	kart-a	rukop'is'	bolot-o
ACCUSATIVE	zakon	kart-u	rukop'is'	bolot-o
GENITIVE	zakon-a	kart-i	rukop'is'-i	bolot-a
DATIVE	zakon-u	kart-e	rukop'is'-i	bolot-u
INSTRUMENTAL	zakon-om	kart-oj	rukop'is'-ju	bolot-om
PREPOSITIONAL ⁵	zakon-e	kart-e	rukop'is'-i	bolot-e
<i>Plural</i>				
NOMINATIVE	zakon-i	kart-i	rukop'is'-i	bolot-a
ACCUSATIVE	zakon-i	kart-i	rukop'is'-i	bolot-a
GENITIVE	zakon-ov	kart	rukop'is'-ej	bolot
DATIVE	zakon-am	kart-am	rukop'is'-am	bolot-am
INSTRUMENTAL	zakon-am`i	kart-am`i	rukop'is'-am`i	bolot-am`i
PREPOSITIONAL	zakon-ax	kart-ax	rukop'is'-ax	bolot-ax

Figure 2 - Russian nouns (Hippisley 2012, 30)

Default inheritance starts with the idea that there are generalizations that can be made at the very top of the hierarchy and applies to all nodes. As can be seen above, certain exponents can be applied across all noun classes, such as the plural dative, instrumental, and prepositional. The plural dative has an –am suffix, the instrumental has the –am`i suffix, and the prepositional carries the –ax suffix. DATR would place a generalization at the top node stating that prepositional plural datives == “stem” am, and likely, this would be made to be inherited by default by all other nodes. This is done with the syntax <> == node – this means that node inherits all the properties of the referenced node.

Default inheritance can be set up at any node, and can be used to express horizontal and vertical relationships within a paradigm (Hippisley 2012, 30-31).

Vertical similarities exist above in class I, between the nominative and the accusative. This could be easily dealt with in the following way

Node_I:

`<nom sg> == "<stem>"`

`<acc sg> == "<nom sg>"`

It's also possible to reference something like this outside of the node – sort of a piecemeal inheritance. Looking at the class IV plural genitive, *bolot*, it has the same lack of a suffix. It might look something like this:

Node_IV:

`<gen pl> == Node_I: "<nom sg>"`.

This has the same effect as `<acc sg> == "<nom sg>"` – they both reference the same point in the code and cell in the paradigm, but from different locations.

While the plural dative, instrumental, and prepositional nouns have the same inflection in all classes, there is some regularity that is not completely across the board. For example, look at the nominative plural. Three out of four of the noun classes share this exponent. Because default rather than mandatory inheritance is used, this can still be set-up as an inherited property that is overridden at class IV. Overrides are permitted and relied upon in this hierarchy, allowing it to easily capture semi-regularity (Hippisley 2012, 33).

In DATR, a node can inherit multiple other nodes:

Node3:

<> == Node1

<> == Node2.

(Evans and Gazdar, 1996, 203)

This feature, orthogonal multiple inheritance or OMI, is an important feature in languages that model lexicons – for example, a transitive verb is a verb but another important aspect is that it requires an NP complement. So, it needs to inherit from nodes reflecting both of those things. (Evans and Gazdar 1996, 203)

This leads to the question, what to do with conflicts? DATR builds in a system to deal with this. The first is the idea that the longest path wins or overrules a shorter path. The next lies with nature of orthogonal relationships; you tend to only inherit a node if all the paths are disjoint, so this falls under the category of “logical consistency” (Evans and Gazdar, 1996, 203-4).

If overlapping must still occur, this is referred to as Prioritized Multiple Inheritance (PMI). It is not encouraged by Evans and Gazdar, who state that there is no linguistic descriptive or analytical advantage for this strategy, and that DATR was designed with orthogonal approaches in mind, not prioritized ones. (Evans and Gazdar 1996, 204)

The following is a statement regarding how to deal with conflicting paths:

“Precedence is given to nodes that come earlier in the ordering, so that the inherited

value for a property comes from the first parent node in the ordering that defines that property, regardless of whether other later nodes also define it (possibly differently)” (Evans and Gazdar 1996).

Multiple inheritance is something that I take advantage of at multiple crucial points in my DATR theory. I will go into more detail about this in my analysis.

Sometimes, to generalize it is as simple as leaving off attributes. For example, in the DATR code for the preterite-presents, the chosen order of attributes is <tense number person> -- this means I could generalize something like:

```
<present pl> == “<stem>” um
```

This would indicate that 1st, 2nd, and 3rd person all have this same pattern, but in one line of code. However, what if I want to generalize this across the present and past tense (which I often do)? I can’t simply leave it off, and I can’t reorder the attributes in DATR. This is where variables come into play. They are indicated with a \$ symbol and need to be declared at the beginning of the document, along with all the possible options that can occur in that variable. So if I put:

```
<$tense pl 1> == “<stem>” um, both present and past tense have this path.
```

It should also be noted that paths can be labelled – sometimes it is as broad as beginning the path with <mor> vs <stem> or sometimes it is more specific like <suffix> or <stem>. I make extensive use of path labelling. This means you can have two nearly identical paths that yield different results.

```
<stem present pl 2> == “<root>”
```

```
<suffix present pl 2> == ið
```


Chapter 5 – Results

#vars \$tense: present past.

#vars \$pastmarker: t d ð.

Verb:

```
<> == <"<verbttype>">
<normal> == "<stem>" "<suffix>"
<pretpres present> == "<stem past>" "<suffix past>"
<pretpres past> == "<stem past>" "<suffix past>".
```

ON_Verb:

```
<> == Verb
<suffix $tense pl 1> == um
<suffix present pl 2> == ið
<suffix present pl 3> == a
<suffix past pl 2> == uð
<suffix past pl 3> == u.
```

German_verb:

```
<> == Verb
<suffix present sg 3> == t
<suffix past sg> ==
<suffix past sg 2> == st
<suffix present sg 2> == st
<suffix $tense pl 1> == en
<suffix $tense pl 2> == t
<suffix $tense pl 3> == en.
```

Icelandic_strong:

```
<> == ON_Verb
```

% inherits directly from Old Norse,

with one override

```
<stem> == "<onset>" "<vowel>" "<coda>"
<suffix present pl 3> == a
<suffix present sg> == ur
<suffix $tense sg 1> ==
<suffix past sg 2> == st
<suffix past sg 3> == .
```

Icelandic_Weak:

```
<> == ON_Verb
<stem> == "<root>"
<stem past> == "<root>" d
% <stem past> == "<root>" ð
```

<suffix past sg> == i
 <suffix past sg 2> == ir
 <suffix present sg> == ur
 <suffix present sg 1> == .

Old_Norse_strong:

<> == ON_Verb
 <stem> == "<onset>" "<vowel>" "<coda>"
 <suffix present sg 1> ==
 <suffix present sg> == r
 <suffix past sg> ==
 <suffix past sg 2> == t.

Old_Norse_weak:

<> == ON_Verb
 <stem> == "<root>"
 <stem past> == "<root>" d
 <suffix present sg 1> == i
 <suffix \$tense sg> == i r
 <suffix past sg 1> == a
 <suffix past sg 3> == i.

German_strong:

<> == German_verb
 <suffix present sg 1> == e
 <stem> == "<onset>" "<vowel>" "<coda>".

German_weak:

<> == German_verb
 <stem> == "<root>"
 <stem past> == "<root>" te
 <suffix present sg 1> == e
 <suffix past pl 1> == n
 <suffix past pl 3> == n.

%%%%%%%%%

Old_Norse_strong1:

<> == Old_Norse_strong
 <vowel present> == í
 <vowel past sg> == ei
 <vowel past pl> == i.

Old_Norse_strong2:

<> == Old_Norse_strong
 <vowel present sg> == ý

```

<vowel present pl> == jó
<vowel past sg> == au
<vowel past pl> == u.

```

```

Old_Norse_strong3:
  <> == Old_Norse_strong
  <vowel present> == e
  <vowel past sg> == a
  <vowel past pl> == u.

```

```

Old_Norse_strong4:
  <> == Old_Norse_strong
  <vowel present> == e
  <vowel past sg> == a
  <vowel past pl> == á.

```

```

Old_Norse_strong5:
  <> == Old_Norse_strong
  <vowel present> == e
  <vowel past sg> == a
  <vowel past pl> == á.

```

```

Old_Norse_strong6:
  <> == Old_Norse_strong
  <vowel present sg> == e
  <vowel present pl> == a
  <vowel past> == ó.

```

```

Old_Norse_strong7:
  <> == Old_Norse_strong.

```

```

Icelandic_strong1:
  <> == Icelandic_strong
  <vowel> == "Old_Norse_strong1".
%%keeping these classes here for clarity

```

```

Icelandic_strong2:
  <> == Icelandic_strong
  <vowel> == "Old_Norse_strong2".

```

```

Icelandic_strong3:
  <> == Icelandic_strong
  <vowel> == "Old_Norse_strong3".

```

```

Icelandic_strong4:
  <> == Icelandic_strong

```

<vowel> == "Old_Norse_strong4".

Icelandic_strong5:

<> == Icelandic_strong
<vowel> == "Old_Norse_strong5".

Icelandic_strong6:

<> == Icelandic_strong
<vowel> == "Old_Norse_strong6".

Icelandic_strong7:

<> == Icelandic_strong.

German_strong1:

<> == German_strong
<vowel present> == ei
<vowel past> == ie.

German_strong2:

<> == German_strong
<vowel present> == ie
<vowel past> == o.

German_strong3:

<> == German_strong
<vowel present> == e
<vowel past> == a.

German_strong4:

<> == German_strong
<vowel present> == i
<vowel past> == a.

German_strong5:

<> == German_strong
<vowel present> == ei
<vowel past> == i.

German_strong6:

<> == German_strong
<vowel present> == a
<vowel past> == u.

German_strong7:

<> == German_strong

<vowel present> == e
 <vowel past> == o.

German_strong8:

<> == German_strong
 <vowel present> == a
 <vowel past> == ie.

%%
 %% %% Preterite Present verbs -- Old Norse

Eiga:

<> == Old_Norse_strong
 <past> == "Eiga_weak"
 <verbttype> == pretpres
 <infinitive> == eiga
 <language> == old norse
 <gloss> == have, must
 <onset> ==
 <coda> == g
 <coda past sg> ==
 <vowel past sg> == á
 <vowel past pl> == ei
 <suffix past sg 2> == tt.

Eiga_weak:

<> == Old_Norse_weak
 <verbttype> == pretpres
 <gloss> == have, must
 <stem> == átt.

Mega:

<> == Old_Norse_strong
 <past> == "Mega_weak"
 <verbttype> == pretpres
 <infinitive> == mega
 <language> == old norse
 <gloss> == can, be able to
 <onset> == m
 <coda> == g
 <coda past sg> ==
 <vowel past sg> == á
 <vowel past pl> == e
 <suffix past sg 2> == tt.

Mega_weak:

<> == Old_Norse_weak
 <verdtype> == pretpres
 <gloss> == can, be able to
 <stem> == m á t t.

Skulu:

<> == Old_Norse_strong3
 <past> == "Skulu_weak"
 <verdtype> == pretpres
 <infinitive> == skulu
 <gloss> == shall
 <language> == old norse
 <onset> == s k
 <coda> == l.

Skulu_weak:

<> == Old_Norse_weak
 <verdtype> == pretpres
 <gloss> == shall
 <root> == s k y l.

Vita:

<> == Old_Norse_strong1
 <past> == "Vita_weak"
 <verdtype> == pretpres
 <infinitive> == vita
 <gloss> == know
 <language> == old norse
 <onset> == v
 <coda> == t
 <stem pres sg 2> == v e i z.

Vita_weak:

<> == Old_Norse_weak
 <verdtype> == pretpres
 <gloss> == know
 <root> == v i s s.

Kunna:

<> == Old_Norse_strong3
 <past> == "Kunna_weak"
 <verdtype> == pretpres
 <infinitive> == kunna
 <gloss> == be able to
 <language> == old norse
 <onset> == k

<coda> == n n.

Kunna_weak:

<> == Old_Norse_weak
 <verbttype> == pretpres
 <gloss> == be able to
 <root> == k u n n.

Muna:

<> == Old_Norse_strong3
 <verbttype> == pretpres
 <language> == old norse
 <infinitive> == muna
 <past> == "Muna_weak"
 <gloss> == remember
 <onset> == m
 <coda> == n.

Muna_weak:

<> == Old_Norse_weak
 <verbttype> == pretpres
 <gloss> == remember
 <root> == m u n.

Munu:

<> == Muna
 <verbttype> == pretpres
 <infinitive> == munu
 <gloss> == will (probability)
 <vowel past sg> == u.

Thurfa:

<> == Old_Norse_strong3
 <verbttype> == pretpres
 <gloss> == need
 <language> == old norse
 <infinitive> == þurfa
 <past> == "Thurfa_weak"
 <onset> == þ
 <coda> == r f.

Thurfa_weak:

<> == Old_Norse_weak
 <verbttype> == pretpres
 <gloss> == need

<root> == Þ u r f.

%% % % % % % % % % % % % % % % % % %
 %%% Strong verbs -- Old Norse

Líta:

<> == Old_Norse_strong1
 <verbttype> == normal
 <gloss> == look
 <infinitive> == líta
 <language> == old norse
 <onset> == l
 <coda> == t.

Bjóða:

<> == Old_Norse_strong2
 <verbttype> == normal
 <gloss> == offer, invite
 <infinitive> == bjóða
 <language> == old norse
 <onset> == b
 <coda> == ð
 <stem past sg 2> == baut.

Verða:

<> == Old_Norse_strong3
 <verbttype> == normal
 <gloss> == become
 <infinitive> == verða
 <language> == old norse
 <onset> == v
 <coda> == r ð
 <stem past pl> == u r ð.

Brenna:

<> == Old_Norse_strong3
 <verbttype> == normal
 <gloss> == burn
 <infinitive> == brenna
 <language> == old norse
 <onset> == b r
 <coda> == n n.

Bera:

<> == Old_Norse_strong4
 <verbttype> == normal

<gloss> == carry
 <infinitive> == bera
 <language> == old norse
 <onset> == b
 <coda> == r.

Gefa:

<> == Old_Norse_strong5
 <verdtype> == normal
 <gloss> == give
 <infinitive> == gefa
 <language> == old norse
 <onset> == g
 <coda> == f.

Fara:

<> == Old_Norse_strong6
 <verdtype> == normal
 <gloss> == go, travel
 <infinitive> == fara
 <language> == old norse
 <onset> == f
 <coda> == r.

Fella:

<> == Old_Norse_weak
 <verdtype> == normal
 <gloss> == fell
 <infinitive> == fella
 <language> == old norse
 <root> == f e l l.

%%%%%%%%%% %%%%%%%%%%
 %% preterite present verbs-- Icelandic

Eiga2:

<> == Icelandic_strong
 <past> == "Eiga_weak2"
 <verdtype> == pretpres
 <infinitive> == eiga
 <language> == icelandic
 <gloss> == have, possess
 <onset> ==
 <coda> == g
 <coda past sg> ==
 <vowel past sg> == á
 <vowel past pl> == ei

```

<suffix past sg 2> == tt
<suffix past pl 2> == "<suffix present pl 2>"
<suffix past pl 3> == "<suffix present pl 3>".

```

Eiga_weak2:

```

<> == Icelandic_Weak
<verbttype> == pretpres
<gloss> == have, must
<stem> == átt.

```

Mega2:

```

<> == Icelandic_strong
<past> == "Mega_weak2"
<verbttype> == pretpres
<infinitive> == mega
<language> == icelandic
<gloss> == can, be able to, may
<onset> == m
<coda> == g
<coda past sg> ==
<vowel past sg> == á
<vowel past pl> == e
<suffix past sg 2> == tt
<suffix past pl 2> == "<suffix present pl 2>"
<suffix past pl 3> == "<suffix present pl 3>".

```

Mega_weak2:

```

<> == Icelandic_Weak
<verbttype> == pretpres
<gloss> == can, be able to
<stem> == m á t t.

```

Kunna2:

```

<> == Icelandic_strong3
<verbttype> == pretpres
<gloss> == may
<past> == "Kunna_weak2"
<language> == icelandic
<infinitive> == kunna
<onset> == k
<coda> == n n
<suffix past sg 2> == t
<suffix past pl 2> == "<suffix present pl 2>"
<suffix past pl 3> == "<suffix present pl 3>".

```

Kunna_weak2:

```
<> == Icelandic_Weak
<verbttype> == pretpres
<gloss> == may
<stem> == k u n n.
```

Muna2:

```
<> == Icelandic_strong3
<past> == "Muna_weak2"
<verbttype> == pretpres
<gloss> == may
<infinitive> == muna
<language> == icelandic
<onset> == m
<coda> == n
<suffix past pl 2> == "<suffix present pl 2>"
<suffix past pl 3> == "<suffix present pl 3>".
%%it is reverting back to the present tense
```

Muna_weak2:

```
<> == Icelandic_Weak
<verbttype> == pretpres
<gloss> == may
<root> == m u n.
```

Munu2:

```
<> == Icelandic_strong3
<verbttype> == pretpres
<gloss> == shall, will, may
<language> == icelandic
<infinitive> == muna
<vowel present sg> == u
<onset> == m
<coda> == n
<suffix past pl 2> == "<suffix present pl 2>"
<past> == "Munu_weak2".
```

Munu_weak2:

```
<> == Icelandic_Weak
<verbttype> == pretpres
<stem> ==
<suffix> == .
%no heteroclisic here to fill in the gaps in the past tense.
```

Skulu2:

```

<> == Icelandic_strong3
<verdtype> == pretpres
<past> == "Skulu_weak2"
<gloss> == shall, will
<language> == icelandic
<infinitive> == skulu
<suffix past pl 2> == "<suffix present pl 2>"
<suffix past sg 2> == t
<onset> == s k
<coda> == l.

```

Skulu_weak2:

```

<> == Icelandic_Weak
<verdtype> == pretpres
<stem> ==
<suffix> == .

```

Unna2:

```

<> == Icelandic_strong3
<verdtype> == pretpres
<past> == "Unna_weak2"
<gloss> == love
<language> == icelandic
<infinitive> == unna
<onset> ==
<coda> == n n
<suffix past pl 2> == "<suffix present pl 2>"
<suffix past pl 3> == "<suffix present pl 3>".

```

Unna_weak2:

```

<> == Icelandic_Weak
<verdtype> == pretpres
<gloss> == love
<root> == u n n.

```

Vita2:

```

<> == Icelandic_strong1
<verdtype> == pretpres
<past> == "Vita_weak2"
<gloss> == know
<language> == icelandic
<infinitive> == vita
<onset> == v
<coda> == t
<suffix past pl 2> == "<suffix present pl 2>"
<suffix past pl 3> == "<suffix present pl 3>".

```

Vita_weak2:

<> == Icelandic_Weak
 <verdtype> == pretpres
 <gloss> == know
 <root> == v i s s.

Thurfa2:

<> == Icelandic_strong3
 <verdtype> == pretpres
 <past> == "Thurfa_weak2"
 <gloss> == need, have to
 <language> == icelandic
 <infinitive> == þurfa
 <onset> == þ
 <coda> == r f
 <suffix past sg 2> == t
 <suffix past pl 2> == "<suffix present pl 2>"
 <suffix past pl 3> == "<suffix present pl 3>".

Thurfa_weak2:

<> == Icelandic_Weak
 <verdtype> == pretpres
 <gloss> == need, have to
 <root> == þurf.

%%%%%%%%%%
 %%%%%%%%% Strong Icelandic

Bíta:

<> == Icelandic_strong1
 <verdtype> == normal
 <gloss> == bite
 <infinitive> == bíta
 <language> == icelandic
 <onset> == b
 <coda> == t.

Bjóða:

<> == Icelandic_strong2
 <verdtype> == normal
 <gloss> == offer, invite
 <infinitive> == bjóða
 <language> == icelandic
 <onset> == b
 <coda> == ð.

Bresta:

```
<> == Icelandic_strong3
<verbttype> == normal
<gloss> == break
<infinitive> == bresta
<language> == icelandic
<onset> == b r
<coda> == s t
<suffix past sg 2> == .
```

Bera2:

```
<> == Icelandic_strong4
<verbttype> == normal
<gloss> == bear, carry
<infinitive> == bera
<language> == icelandic
<onset> == b
<coda> == r.
```

Gefa2:

```
<> == Icelandic_strong5
<verbttype> == normal
<gloss> == give
<infinitive> == gefa
<language> == icelandic
<onset> == g
<coda> == f.
```

Fara2:

```
<> == Icelandic_strong6
<verbttype> == normal
<gloss> == go, travel
<infinitive> == fara
<language> == icelandic
<onset> == f
<coda> == r.
```

Lifa:

```
<> == Icelandic_Weak
<verbttype> == normal
<gloss> == live
<infinitive> == lifa
<language> == icelandic
<root> == l i f.
```

%%%%%%%%%%
 %% pret-pres verbs -- German

Sollen:

<> == German_strong2
 <past> == "Sollen_weak"
 <verbttype> == pretpres
 <infinitive> == sollen
 <gloss> == should
 <language> == modern german
 <onset> == s
 <coda> == l l.

Sollen_weak:

<> == German_weak
 <verbttype> == pretpres
 <gloss> == should
 <root> == s o l l.

Wollen:

<> == German_strong2
 <past> == "Wollen_weak"
 <verbttype> == pretpres
 <infinitive> == wollen
 <gloss> == want
 <language> == modern german
 <onset> == w
 <coda> == l l
 <vowel pres sg> == i.

Wollen_weak:

<> == German_weak
 <verbttype> == pretpres
 <gloss> == want
 <root> == w o l l.

%this one is similar to sollen

Können:

<> == German_strong3
 <past> == "Können_weak"
 <verbttype> == pretpres
 <infinitive> == können
 <gloss> == can
 <language> == modern german
 <onset> == k

<coda> == n n
 <vowel pres pl> == ö.

Können_weak:

<> == German_weak
 <verbttype> == pretpres
 <gloss> == can
 <root> == k o n n.

Bedürfen:

<> == German_strong3
 <past> == "Bedürfen_weak"
 <verbttype> == pretpres
 <gloss> == need
 <infinitive> == bedürfen
 <language> == modern german
 <onset> == b e d
 <coda> == r f
 <vowel present pl> == ü.

Bedürfen_weak:

<> == German_weak
 <verbttype> == pretpres
 <gloss> == need
 <root> == b e d ü r f.

Dürfen:

<> == German_strong3
 <past> == "Dürfen_weak"
 <verbttype> == pretpres
 <gloss> == be allowed, permitted
 <infinitive> == dürfen
 <language> == modern german
 <onset> == d
 <coda> == r f
 <vowel present pl> == ü.

Dürfen_weak:

<> == German_weak
 <verbttype> == pretpres
 <gloss> == be allowed, permitted
 <root> == d u r f.

Mögen:

<> == German_strong2

<past> == "Mogen_weak"
 <verbttype> == pretpres
 <infinitive> == mögen
 <gloss> == may, to like
 <language> == modern german
 <onset> == m
 <coda> == g
 <vowel present pl> == ö.

Mogen_weak:

<> == German_weak
 <verbttype> == pretpres
 <gloss> == may, to like
 <root> == m o c h.

Vermogen:

<> == German_strong2
 <past> == "Vermogen_weak"
 <verbttype> == pretpres
 <infinitive> == vermögen
 <gloss> == may, be able to
 <language> == modern german
 <onset> == v e r m
 <coda> == g
 <vowel present pl> == ö.

Vermogen_weak:

<> == German_weak
 <verbttype> == pretpres
 <gloss> == may, be able to
 <root> == v e r m o c h.

Mussen:

<> == German_strong6
 <past> == "Mussen_weak"
 <verbttype> == pretpres
 <infinitive> == müssen
 <gloss> == have to, must
 <language> == modern german
 <onset> == m
 <coda> == s s
 <vowel present pl> == ü.

Mussen_weak:

<> == German_weak
 <verbttype> == pretpres

<gloss> == have to, must
 <root> == m u s s.

%%
 %
 %%% strong verbs

Treiben:

<> == German_strong1
 <verbttype> == normal
 <gloss> == drive
 <infinitive> == treiben
 <language> == modern german
 <onset> == t r
 <coda> == b.

Biegen:

<> == German_strong2
 <verbttype> == normal
 <gloss> == bend
 <infinitive> == biegen
 <language> == modern german
 <onset> == b
 <coda> == g.

Binden:

<> == German_strong3
 <verbttype> == normal
 <gloss> == bind, tie
 <infinitive> == binden
 <language> == modern german
 <onset> == b
 <coda> == n d.

Trinken:

<> == German_strong4
 <verbttype> == normal
 <gloss> == drink
 <infinitive> == trinken
 <language> == modern german
 <onset> == t r
 <coda> == n k.

Beiben:

<> == German_strong5
 <verdtype> == normal
 <gloss> == give
 <infinitive> == beißen
 <language> == modern german
 <onset> == b
 <coda> == ß
 <stem past> == biss.

Fahren:

<> == German_strong6
 <verdtype> == normal
 <gloss> == go
 <vowel present sg 2> == ä
 <vowel present sg 3> == ä
 <infinitive> == fahren
 <language> == modern german
 <onset> == f
 <coda> == h r.

Heben:

<> == German_strong7
 <verdtype> == normal
 <gloss> == lift
 <infinitive> == heben
 <language> == modern german
 <onset> == h
 <coda> == b.

Fallen:

<> == German_strong8
 <verdtype> == normal
 <gloss> == fall
 <infinitive> == fallen
 <language> == modern german
 <onset> == f
 <coda> == l l
 <stem past> == fiel.

%%%%%%%%%%%%%%%
 %%%%%%%%% weak verb

Folgen:

<> == German_weak
 <verdtype> == normal
 <gloss> == follow

```

<infinitive> == folgen
<language> == modern german
<root> == f o l g.

```

#show:

```

<infinitive>
<language>
<gloss>
<present sg 1>
<present sg 2>
<present sg 3>
<present pl 1>
<present pl 2>
<present pl 3>
<past sg 1>
<past sg 2>
<past sg 3>
<past pl 1>
<past pl 2>
<past pl 3>.

```

```

#hide: Verb ON_Verb Icelandic_strong Icelandic_strong1 Icelandic_strong2
Icelandic_strong3 Icelandic_strong4 Icelandic_strong5 Icelandic_strong6
Icelandic_strong7 Icelandic_Weak Old_Norse_strong Old_Norse_strong1
Old_Norse_strong2 Old_Norse_strong3 Old_Norse_strong4 Old_Norse_strong5
Old_Norse_strong6 Old_Norse_strong7 Old_Norse_weak Skulu_weak Vita_weak
Kunna_weak Muna_weak Thurfa_weak German_verb German_strong
German_strong1 German_strong2 German_strong3 German_strong4
German_strong5 German_strong6 German_strong7 German_strong8 German_weak
Sollen_weak Wollen_weak Konnen_weak Bedurfen_weak Mogen_weak Durfen_weak
Vermogen_weak Mussen_weak Wissen_weak Muna_weak2 Munu_weak2
Skulu_weak2 Unna_weak2 Vita_weak2 Thurfa_weak2 Eiga_weak Mega_weak
Eiga_weak2 Mega_weak2 Kunna_weak2.

```

```

%%%%%%%%%%

```

Output:

```

Eiga <infinitive> eiga
Eiga <language> oldnorse
Eiga <gloss> have must
Eiga <present,sg,1> á
Eiga <present,sg,2> átt
Eiga <present,sg,3> á

```

Eiga <present,pl,1> eigum
 Eiga <present,pl,2> eiguð
 Eiga <present,pl,3> eigu
 Eiga <past,sg,1> átta
 Eiga <past,sg,2> áttir
 Eiga <past,sg,3> átti
 Eiga <past,pl,1> áttum
 Eiga <past,pl,2> áttuð
 Eiga <past,pl,3> áttu
 Mega <infinitive> mega
 Mega <language> oldnorse
 Mega <gloss> can beableto
 Mega <present,sg,1> má
 Mega <present,sg,2> mátt
 Mega <present,sg,3> má
 Mega <present,pl,1> megum
 Mega <present,pl,2> meguð
 Mega <present,pl,3> megu
 Mega <past,sg,1> mátta
 Mega <past,sg,2> máttir
 Mega <past,sg,3> mátti
 Mega <past,pl,1> máttum
 Mega <past,pl,2> máttuð
 Mega <past,pl,3> máttu
 Skulu <infinitive> skulu
 Skulu <language> oldnorse
 Skulu <gloss> shall
 Skulu <present,sg,1> skal
 Skulu <present,sg,2> skalt
 Skulu <present,sg,3> skal
 Skulu <present,pl,1> skulum
 Skulu <present,pl,2> skuluð
 Skulu <present,pl,3> skulu
 Skulu <past,sg,1> skylda
 Skulu <past,sg,2> skyldir
 Skulu <past,sg,3> skyldi
 Skulu <past,pl,1> skyldum
 Skulu <past,pl,2> skylduð
 Skulu <past,pl,3> skyldu
 Vita <infinitive> vita
 Vita <language> oldnorse
 Vita <gloss> know
 Vita <present,sg,1> veit
 Vita <present,sg,2> veitt
 Vita <present,sg,3> veit
 Vita <present,pl,1> vitum

Vita <present,pl,2> vituð
 Vita <present,pl,3> vitu
 Vita <past,sg,1> vissda
 Vita <past,sg,2> vissdir
 Vita <past,sg,3> vissdi
 Vita <past,pl,1> vissdum
 Vita <past,pl,2> vissduð
 Vita <past,pl,3> vissdu
 Kunna <infinitive> kunna
 Kunna <language> oldnorse
 Kunna <gloss> beableto
 Kunna <present,sg,1> kann
 Kunna <present,sg,2> kannt
 Kunna <present,sg,3> kann
 Kunna <present,pl,1> kunnum
 Kunna <present,pl,2> kunnuð
 Kunna <present,pl,3> kunnu
 Kunna <past,sg,1> kunnda
 Kunna <past,sg,2> kunndir
 Kunna <past,sg,3> kunndi
 Kunna <past,pl,1> kunndum
 Kunna <past,pl,2> kunnduð
 Kunna <past,pl,3> kunndu
 Muna <infinitive> muna
 Muna <language> oldnorse
 Muna <gloss> remember
 Muna <present,sg,1> man
 Muna <present,sg,2> mant
 Muna <present,sg,3> man
 Muna <present,pl,1> munum
 Muna <present,pl,2> munuð
 Muna <present,pl,3> munu
 Muna <past,sg,1> munda
 Muna <past,sg,2> mundir
 Muna <past,sg,3> mundi
 Muna <past,pl,1> mundum
 Muna <past,pl,2> munduð
 Muna <past,pl,3> mundu
 Munu <infinitive> munu
 Munu <language> oldnorse
 Munu <gloss> will(probability)
 Munu <present,sg,1> mun
 Munu <present,sg,2> munt
 Munu <present,sg,3> mun
 Munu <present,pl,1> munum
 Munu <present,pl,2> munuð

Munu <present,pl,3> munu
 Munu <past,sg,1> munda
 Munu <past,sg,2> mundir
 Munu <past,sg,3> mundi
 Munu <past,pl,1> mundum
 Munu <past,pl,2> munduð
 Munu <past,pl,3> mundu
 Thurfa <infinitive> þurfa
 Thurfa <language> oldnorse
 Thurfa <gloss> need
 Thurfa <present,sg,1> þarf
 Thurfa <present,sg,2> þarft
 Thurfa <present,sg,3> þarf
 Thurfa <present,pl,1> þurfum
 Thurfa <present,pl,2> þurfuð
 Thurfa <present,pl,3> þurfu
 Thurfa <past,sg,1> þurfa
 Thurfa <past,sg,2> þurfdir
 Thurfa <past,sg,3> þurfdi
 Thurfa <past,pl,1> þurfdum
 Thurfa <past,pl,2> þurfuð
 Thurfa <past,pl,3> þurfdu
 Luedta <infinitive> líta
 Luedta <language> oldnorse
 Luedta <gloss> look
 Luedta <present,sg,1> lít
 Luedta <present,sg,2> lítr
 Luedta <present,sg,3> lítr
 Luedta <present,pl,1> lítum
 Luedta <present,pl,2> lítið
 Luedta <present,pl,3> líta
 Luedta <past,sg,1> leit
 Luedta <past,sg,2> leitt
 Luedta <past,sg,3> leit
 Luedta <past,pl,1> litum
 Luedta <past,pl,2> lituð
 Luedta <past,pl,3> litu
 Bjuf3uf0a <infinitive> bjóða
 Bjuf3uf0a <language> oldnorse
 Bjuf3uf0a <gloss> offer invite
 Bjuf3uf0a <present,sg,1> býð
 Bjuf3uf0a <present,sg,2> býðr
 Bjuf3uf0a <present,sg,3> býðr
 Bjuf3uf0a <present,pl,1> bjóðum
 Bjuf3uf0a <present,pl,2> bjóðið
 Bjuf3uf0a <present,pl,3> bjóða

Bjuf3uf0a <past,sg,1> bauð
 Bjuf3uf0a <past,sg,2> bautt
 Bjuf3uf0a <past,sg,3> bauð
 Bjuf3uf0a <past,pl,1> buðum
 Bjuf3uf0a <past,pl,2> buðuð
 Bjuf3uf0a <past,pl,3> buðu
 Veruf0a <infinitive> verða
 Veruf0a <language> oldnorse
 Veruf0a <gloss> become
 Veruf0a <present,sg,1> verð
 Veruf0a <present,sg,2> verðr
 Veruf0a <present,sg,3> verðr
 Veruf0a <present,pl,1> verðum
 Veruf0a <present,pl,2> verðið
 Veruf0a <present,pl,3> verða
 Veruf0a <past,sg,1> varð
 Veruf0a <past,sg,2> varðt
 Veruf0a <past,sg,3> varð
 Veruf0a <past,pl,1> urðum
 Veruf0a <past,pl,2> urðuð
 Veruf0a <past,pl,3> urðu
 Brenna <infinitive> brenna
 Brenna <language> oldnorse
 Brenna <gloss> burn
 Brenna <present,sg,1> brenn
 Brenna <present,sg,2> brennr
 Brenna <present,sg,3> brennr
 Brenna <present,pl,1> brennum
 Brenna <present,pl,2> brennið
 Brenna <present,pl,3> brenna
 Brenna <past,sg,1> brann
 Brenna <past,sg,2> brannt
 Brenna <past,sg,3> brann
 Brenna <past,pl,1> brunnum
 Brenna <past,pl,2> brunnuð
 Brenna <past,pl,3> brunnu
 Bera <infinitive> bera
 Bera <language> oldnorse
 Bera <gloss> carry
 Bera <present,sg,1> ber
 Bera <present,sg,2> berr
 Bera <present,sg,3> berr
 Bera <present,pl,1> berum
 Bera <present,pl,2> berið
 Bera <present,pl,3> bera
 Bera <past,sg,1> bar

Bera <past,sg,2> bart
 Bera <past,sg,3> bar
 Bera <past,pl,1> bárum
 Bera <past,pl,2> báruð
 Bera <past,pl,3> báru
 Gefa <infinitive> gefa
 Gefa <language> oldnorse
 Gefa <gloss> give
 Gefa <present,sg,1> gef
 Gefa <present,sg,2> gefr
 Gefa <present,sg,3> gefr
 Gefa <present,pl,1> gefum
 Gefa <present,pl,2> gefið
 Gefa <present,pl,3> gefa
 Gefa <past,sg,1> gaf
 Gefa <past,sg,2> gaft
 Gefa <past,sg,3> gaf
 Gefa <past,pl,1> gáfum
 Gefa <past,pl,2> gáfuð
 Gefa <past,pl,3> gáfu
 Fara <infinitive> fara
 Fara <language> oldnorse
 Fara <gloss> go travel
 Fara <present,sg,1> fer
 Fara <present,sg,2> ferr
 Fara <present,sg,3> ferr
 Fara <present,pl,1> farum
 Fara <present,pl,2> farið
 Fara <present,pl,3> fara
 Fara <past,sg,1> fór
 Fara <past,sg,2> fórt
 Fara <past,sg,3> fór
 Fara <past,pl,1> fórum
 Fara <past,pl,2> fóruð
 Fara <past,pl,3> fóru
 Fella <infinitive> fella
 Fella <language> oldnorse
 Fella <gloss> fell
 Fella <present,sg,1> felli
 Fella <present,sg,2> fellir
 Fella <present,sg,3> fellir
 Fella <present,pl,1> fellum
 Fella <present,pl,2> fellið
 Fella <present,pl,3> fella
 Fella <past,sg,1> fellda
 Fella <past,sg,2> felldir

Fella <past,sg,3> felldi
 Fella <past,pl,1> felldum
 Fella <past,pl,2> fellduð
 Fella <past,pl,3> felldu
 Eiga2 <infinitive> eiga
 Eiga2 <language> icelandic
 Eiga2 <gloss> have possess
 Eiga2 <present,sg,1> á
 Eiga2 <present,sg,2> átt
 Eiga2 <present,sg,3> á
 Eiga2 <present,pl,1> eigum
 Eiga2 <present,pl,2> eigið
 Eiga2 <present,pl,3> eiga
 Eiga2 <past,sg,1> átti
 Eiga2 <past,sg,2> áttir
 Eiga2 <past,sg,3> átti
 Eiga2 <past,pl,1> áttum
 Eiga2 <past,pl,2> áttuð
 Eiga2 <past,pl,3> áttu
 Mega2 <infinitive> mega
 Mega2 <language> icelandic
 Mega2 <gloss> can beableto may
 Mega2 <present,sg,1> má
 Mega2 <present,sg,2> mátt
 Mega2 <present,sg,3> má
 Mega2 <present,pl,1> megum
 Mega2 <present,pl,2> megið
 Mega2 <present,pl,3> mega
 Mega2 <past,sg,1> mátti
 Mega2 <past,sg,2> máttir
 Mega2 <past,sg,3> mátti
 Mega2 <past,pl,1> máttum
 Mega2 <past,pl,2> máttuð
 Mega2 <past,pl,3> máttu
 Kunna2 <infinitive> kunna
 Kunna2 <language> icelandic
 Kunna2 <gloss> may
 Kunna2 <present,sg,1> kann
 Kunna2 <present,sg,2> kannt
 Kunna2 <present,sg,3> kann
 Kunna2 <present,pl,1> kunnum
 Kunna2 <present,pl,2> kunnið
 Kunna2 <present,pl,3> kunna
 Kunna2 <past,sg,1> kunni
 Kunna2 <past,sg,2> kunnir
 Kunna2 <past,sg,3> kunni

Kunna2 <past,pl,1> kunnum
 Kunna2 <past,pl,2> kunnuð
 Kunna2 <past,pl,3> kunnu
 Muna2 <infinitive> muna
 Muna2 <language> icelandic
 Muna2 <gloss> may
 Muna2 <present,sg,1> man
 Muna2 <present,sg,2> manst
 Muna2 <present,sg,3> man
 Muna2 <present,pl,1> munum
 Muna2 <present,pl,2> munið
 Muna2 <present,pl,3> muna
 Muna2 <past,sg,1> mundi
 Muna2 <past,sg,2> mundir
 Muna2 <past,sg,3> mundi
 Muna2 <past,pl,1> mundum
 Muna2 <past,pl,2> munduð
 Muna2 <past,pl,3> mundu
 Munu2 <infinitive> muna
 Munu2 <language> icelandic
 Munu2 <gloss> shall will may
 Munu2 <present,sg,1> man
 Munu2 <present,sg,2> manst
 Munu2 <present,sg,3> man
 Munu2 <present,pl,1> munum
 Munu2 <present,pl,2> munið
 Munu2 <present,pl,3> munu
 Munu2 <past,sg,1> Ø
 Munu2 <past,sg,2> Ø
 Munu2 <past,sg,3> Ø
 Munu2 <past,pl,1> Ø
 Munu2 <past,pl,2> Ø
 Munu2 <past,pl,3> Ø
 Skulu2 <infinitive> skulu
 Skulu2 <language> icelandic
 Skulu2 <gloss> shall will
 Skulu2 <present,sg,1> skal
 Skulu2 <present,sg,2> skalt
 Skulu2 <present,sg,3> skal
 Skulu2 <present,pl,1> skulum
 Skulu2 <present,pl,2> skulið
 Skulu2 <present,pl,3> skulu
 Skulu2 <past,sg,1> Ø
 Skulu2 <past,sg,2> Ø
 Skulu2 <past,sg,3> Ø
 Skulu2 <past,pl,1> Ø

Skulu2 <past,pl,2> Ø
 Skulu2 <past,pl,3> Ø
 Unna2 <infinitive> unna
 Unna2 <language> icelandic
 Unna2 <gloss> love
 Unna2 <present,sg,1> ann
 Unna2 <present,sg,2> annst
 Unna2 <present,sg,3> ann
 Unna2 <present,pl,1> unnum
 Unna2 <present,pl,2> unnið
 Unna2 <present,pl,3> unna
 Unna2 <past,sg,1> unndi
 Unna2 <past,sg,2> unndir
 Unna2 <past,sg,3> unndi
 Unna2 <past,pl,1> unndum
 Unna2 <past,pl,2> unnduð
 Unna2 <past,pl,3> unndu
 Vita2 <infinitive> vita
 Vita2 <language> icelandic
 Vita2 <gloss> know
 Vita2 <present,sg,1> veit
 Vita2 <present,sg,2> veitst
 Vita2 <present,sg,3> veit
 Vita2 <present,pl,1> vitum
 Vita2 <present,pl,2> vitið
 Vita2 <present,pl,3> vita
 Vita2 <past,sg,1> vissdi
 Vita2 <past,sg,2> vissdir
 Vita2 <past,sg,3> vissdi
 Vita2 <past,pl,1> vissdum
 Vita2 <past,pl,2> vissduð
 Vita2 <past,pl,3> vissdu
 Thurfa2 <infinitive> þurfa
 Thurfa2 <language> icelandic
 Thurfa2 <gloss> need haveto
 Thurfa2 <present,sg,1> þarf
 Thurfa2 <present,sg,2> þarft
 Thurfa2 <present,sg,3> þarf
 Thurfa2 <present,pl,1> þurfum
 Thurfa2 <present,pl,2> þurfið
 Thurfa2 <present,pl,3> þurfa
 Thurfa2 <past,sg,1> þurfdi
 Thurfa2 <past,sg,2> þurfdir
 Thurfa2 <past,sg,3> þurfdi
 Thurfa2 <past,pl,1> þurfdum
 Thurfa2 <past,pl,2> þurfduð

Thurfa2 <past,pl,3> þurfdur
 Buedta <infinitive> bíta
 Buedta <language> icelandic
 Buedta <gloss> bite
 Buedta <present,sg,1> bít
 Buedta <present,sg,2> bítur
 Buedta <present,sg,3> bítur
 Buedta <present,pl,1> bítum
 Buedta <present,pl,2> bítuð
 Buedta <present,pl,3> bíta
 Buedta <past,sg,1> beit
 Buedta <past,sg,2> beist
 Buedta <past,sg,3> beit
 Buedta <past,pl,1> bitum
 Buedta <past,pl,2> bituð
 Buedta <past,pl,3> bitu
 Bresta <infinitive> bresta
 Bresta <language> icelandic
 Bresta <gloss> break
 Bresta <present,sg,1> brest
 Bresta <present,sg,2> brestur
 Bresta <present,sg,3> brestur
 Bresta <present,pl,1> brestum
 Bresta <present,pl,2> brestuð
 Bresta <present,pl,3> bresta
 Bresta <past,sg,1> brast
 Bresta <past,sg,2> brast
 Bresta <past,sg,3> brast
 Bresta <past,pl,1> brustum
 Bresta <past,pl,2> brustuð
 Bresta <past,pl,3> brustu
 Bera2 <infinitive> bera
 Bera2 <language> icelandic
 Bera2 <gloss> bear carry
 Bera2 <present,sg,1> ber
 Bera2 <present,sg,2> berur
 Bera2 <present,sg,3> berur
 Bera2 <present,pl,1> berum
 Bera2 <present,pl,2> beruð
 Bera2 <present,pl,3> bera
 Bera2 <past,sg,1> bar
 Bera2 <past,sg,2> barst
 Bera2 <past,sg,3> bar
 Bera2 <past,pl,1> bárum
 Bera2 <past,pl,2> báruð
 Bera2 <past,pl,3> báru

Gefa2 <infinitive> gefa
 Gefa2 <language> icelandic
 Gefa2 <gloss> give
 Gefa2 <present,sg,1> gef
 Gefa2 <present,sg,2> gefur
 Gefa2 <present,sg,3> gefur
 Gefa2 <present,pl,1> gefum
 Gefa2 <present,pl,2> gefið
 Gefa2 <present,pl,3> gefa
 Gefa2 <past,sg,1> gaf
 Gefa2 <past,sg,2> gafst
 Gefa2 <past,sg,3> gaf
 Gefa2 <past,pl,1> gáfum
 Gefa2 <past,pl,2> gáfuð
 Gefa2 <past,pl,3> gáfu
 Fara2 <infinitive> fara
 Fara2 <language> icelandic
 Fara2 <gloss> go travel
 Fara2 <present,sg,1> fer
 Fara2 <present,sg,2> ferur
 Fara2 <present,sg,3> ferur
 Fara2 <present,pl,1> farum
 Fara2 <present,pl,2> farið
 Fara2 <present,pl,3> fara
 Fara2 <past,sg,1> fór
 Fara2 <past,sg,2> fórst
 Fara2 <past,sg,3> fór
 Fara2 <past,pl,1> fórum
 Fara2 <past,pl,2> fóruð
 Fara2 <past,pl,3> fóru
 Lifa <infinitive> lifa
 Lifa <language> icelandic
 Lifa <gloss> live
 Lifa <present,sg,1> lif
 Lifa <present,sg,2> lifur
 Lifa <present,sg,3> lifur
 Lifa <present,pl,1> lifum
 Lifa <present,pl,2> lifið
 Lifa <present,pl,3> lifa
 Lifa <past,sg,1> lifdi
 Lifa <past,sg,2> lifdir
 Lifa <past,sg,3> lifdi
 Lifa <past,pl,1> lifdum
 Lifa <past,pl,2> lifduð
 Lifa <past,pl,3> lifdu
 Sollen <infinitive> sollen

Sollen <language> moderngerman
 Sollen <gloss> should
 Sollen <present,sg,1> soll
 Sollen <present,sg,2> sollst
 Sollen <present,sg,3> soll
 Sollen <present,pl,1> sollen
 Sollen <present,pl,2> sollt
 Sollen <present,pl,3> sollen
 Sollen <past,sg,1> sollte
 Sollen <past,sg,2> solltest
 Sollen <past,sg,3> sollte
 Sollen <past,pl,1> sollten
 Sollen <past,pl,2> solltet
 Sollen <past,pl,3> sollten
 Wollen <infinitive> wollen
 Wollen <language> moderngerman
 Wollen <gloss> want
 Wollen <present,sg,1> woll
 Wollen <present,sg,2> wollst
 Wollen <present,sg,3> woll
 Wollen <present,pl,1> wollen
 Wollen <present,pl,2> wollt
 Wollen <present,pl,3> wollen
 Wollen <past,sg,1> wollte
 Wollen <past,sg,2> wolltest
 Wollen <past,sg,3> wollte
 Wollen <past,pl,1> wollten
 Wollen <past,pl,2> wolltet
 Wollen <past,pl,3> wollten
 Konnen <infinitive> können
 Konnen <language> moderngerman
 Konnen <gloss> can
 Konnen <present,sg,1> kann
 Konnen <present,sg,2> kannst
 Konnen <present,sg,3> kann
 Konnen <present,pl,1> können
 Konnen <present,pl,2> kannt
 Konnen <present,pl,3> können
 Konnen <past,sg,1> konnte
 Konnen <past,sg,2> konntest
 Konnen <past,sg,3> konnte
 Konnen <past,pl,1> konnten
 Konnen <past,pl,2> konntet
 Konnen <past,pl,3> konnten
 Bedurfen <infinitive> bedürfen
 Bedurfen <language> moderngerman

Bedürfen <gloss> need
 Bedürfen <present,sg,1> bedarf
 Bedürfen <present,sg,2> bedarfst
 Bedürfen <present,sg,3> bedarf
 Bedürfen <present,pl,1> bedürfen
 Bedürfen <present,pl,2> bedarft
 Bedürfen <present,pl,3> bedürfen
 Bedürfen <past,sg,1> bedürfte
 Bedürfen <past,sg,2> bedürftest
 Bedürfen <past,sg,3> bedürfte
 Bedürfen <past,pl,1> bedürften
 Bedürfen <past,pl,2> bedürftet
 Bedürfen <past,pl,3> bedürften
 Dürfen <infinitive> dürfen
 Dürfen <language> moderngerman
 Dürfen <gloss> beallowed permitted
 Dürfen <present,sg,1> darf
 Dürfen <present,sg,2> darfst
 Dürfen <present,sg,3> darf
 Dürfen <present,pl,1> dürfen
 Dürfen <present,pl,2> darft
 Dürfen <present,pl,3> dürfen
 Dürfen <past,sg,1> durfte
 Dürfen <past,sg,2> durftest
 Dürfen <past,sg,3> durfte
 Dürfen <past,pl,1> durften
 Dürfen <past,pl,2> durftet
 Dürfen <past,pl,3> durften
 Mogen <infinitive> mögen
 Mogen <language> moderngerman
 Mogen <gloss> may tolike
 Mogen <present,sg,1> mog
 Mogen <present,sg,2> mogst
 Mogen <present,sg,3> mog
 Mogen <present,pl,1> mögen
 Mogen <present,pl,2> mogt
 Mogen <present,pl,3> mögen
 Mogen <past,sg,1> mochte
 Mogen <past,sg,2> mochtest
 Mogen <past,sg,3> mochte
 Mogen <past,pl,1> mochten
 Mogen <past,pl,2> mochtet
 Mogen <past,pl,3> mochten
 Vermögen <infinitive> vermögen
 Vermögen <language> moderngerman
 Vermögen <gloss> may beableto

Vermogen <present,sg,1> vermog
 Vermogen <present,sg,2> vermogst
 Vermogen <present,sg,3> vermog
 Vermogen <present,pl,1> vermogen
 Vermogen <present,pl,2> vermogt
 Vermogen <present,pl,3> vermogen
 Vermogen <past,sg,1> vermochte
 Vermogen <past,sg,2> vermochtest
 Vermogen <past,sg,3> vermochte
 Vermogen <past,pl,1> vermochten
 Vermogen <past,pl,2> vermochtet
 Vermogen <past,pl,3> vermochten
 Mussen <infinitive> müssen
 Mussen <language> moderngerman
 Mussen <gloss> haveto must
 Mussen <present,sg,1> muss
 Mussen <present,sg,2> musst
 Mussen <present,sg,3> muss
 Mussen <present,pl,1> müssen
 Mussen <present,pl,2> musst
 Mussen <present,pl,3> müssen
 Mussen <past,sg,1> musste
 Mussen <past,sg,2> musstest
 Mussen <past,sg,3> musste
 Mussen <past,pl,1> mussten
 Mussen <past,pl,2> musstet
 Mussen <past,pl,3> mussten
 Treiben <infinitive> treiben
 Treiben <language> moderngerman
 Treiben <gloss> drive
 Treiben <present,sg,1> treibe
 Treiben <present,sg,2> treibst
 Treiben <present,sg,3> treibt
 Treiben <present,pl,1> treiben
 Treiben <present,pl,2> treibt
 Treiben <present,pl,3> treiben
 Treiben <past,sg,1> trieb
 Treiben <past,sg,2> triebst
 Treiben <past,sg,3> trieb
 Treiben <past,pl,1> trieben
 Treiben <past,pl,2> triebt
 Treiben <past,pl,3> trieben
 Biegen <infinitive> biegen
 Biegen <language> moderngerman
 Biegen <gloss> bend
 Biegen <present,sg,1> biege

Biegen <present,sg,2> biegst
 Biegen <present,sg,3> biegt
 Biegen <present,pl,1> biegen
 Biegen <present,pl,2> biegt
 Biegen <present,pl,3> biegen
 Biegen <past,sg,1> bog
 Biegen <past,sg,2> bogst
 Biegen <past,sg,3> bog
 Biegen <past,pl,1> bogen
 Biegen <past,pl,2> bogt
 Biegen <past,pl,3> bogen
 Binden <infinitive> binden
 Binden <language> moderngerman
 Binden <gloss> bind tie
 Binden <present,sg,1> bende
 Binden <present,sg,2> bendst
 Binden <present,sg,3> bendt
 Binden <present,pl,1> binden
 Binden <present,pl,2> bendt
 Binden <present,pl,3> binden
 Binden <past,sg,1> band
 Binden <past,sg,2> bandst
 Binden <past,sg,3> band
 Binden <past,pl,1> banden
 Binden <past,pl,2> bandt
 Binden <past,pl,3> banden
 Trinken <infinitive> trinken
 Trinken <language> moderngerman
 Trinken <gloss> drink
 Trinken <present,sg,1> trinke
 Trinken <present,sg,2> trinkst
 Trinken <present,sg,3> trinkt
 Trinken <present,pl,1> trinken
 Trinken <present,pl,2> trinkt
 Trinken <present,pl,3> trinken
 Trinken <past,sg,1> trank
 Trinken <past,sg,2> trankst
 Trinken <past,sg,3> trank
 Trinken <past,pl,1> tranken
 Trinken <past,pl,2> trankt
 Trinken <past,pl,3> tranken
 Beiben <infinitive> beißen
 Beiben <language> moderngerman
 Beiben <gloss> give
 Beiben <present,sg,1> beiße
 Beiben <present,sg,2> beißt

Beiben <present,sg,3> beißt
 Beiben <present,pl,1> beißen
 Beiben <present,pl,2> beißt
 Beiben <present,pl,3> beißen
 Beiben <past,sg,1> biss
 Beiben <past,sg,2> bissst
 Beiben <past,sg,3> biss
 Beiben <past,pl,1> bissen
 Beiben <past,pl,2> bisst
 Beiben <past,pl,3> bissen
 Fahren <infinitive> fahren
 Fahren <language> moderngerman
 Fahren <gloss> go
 Fahren <present,sg,1> fahre
 Fahren <present,sg,2> fährst
 Fahren <present,sg,3> fährt
 Fahren <present,pl,1> fahren
 Fahren <present,pl,2> fahrt
 Fahren <present,pl,3> fahren
 Fahren <past,sg,1> fuhr
 Fahren <past,sg,2> fuhrst
 Fahren <past,sg,3> fuhr
 Fahren <past,pl,1> fuhren
 Fahren <past,pl,2> fuhr
 Fahren <past,pl,3> fuhren
 Heben <infinitive> heben
 Heben <language> moderngerman
 Heben <gloss> lift
 Heben <present,sg,1> hebe
 Heben <present,sg,2> hebst
 Heben <present,sg,3> hebt
 Heben <present,pl,1> heben
 Heben <present,pl,2> hebt
 Heben <present,pl,3> heben
 Heben <past,sg,1> hob
 Heben <past,sg,2> hobst
 Heben <past,sg,3> hob
 Heben <past,pl,1> hoben
 Heben <past,pl,2> hobt
 Heben <past,pl,3> hoben
 Fallen <infinitive> fallen
 Fallen <language> moderngerman
 Fallen <gloss> fall
 Fallen <present,sg,1> falle
 Fallen <present,sg,2> fallst
 Fallen <present,sg,3> fallt

Fallen <present,pl,1> fallen
Fallen <present,pl,2> fallt
Fallen <present,pl,3> fallen
Fallen <past,sg,1> fiel
Fallen <past,sg,2> fielt
Fallen <past,sg,3> fiel
Fallen <past,pl,1> fielen
Fallen <past,pl,2> fielt
Fallen <past,pl,3> fielen
Folgen <infinitive> folgen
Folgen <language> moderngerman
Folgen <gloss> follow
Folgen <present,sg,1> folge
Folgen <present,sg,2> folgst
Folgen <present,sg,3> folgt
Folgen <present,pl,1> folgen
Folgen <present,pl,2> folgt
Folgen <present,pl,3> folgen
Folgen <past,sg,1> folgte
Folgen <past,sg,2> folgtest
Folgen <past,sg,3> folgte
Folgen <past,pl,1> folgten
Folgen <past,pl,2> folgten
Folgen <past,pl,3> folgten

Chapter 6 – Analysis and Conclusions

The code is divided into two categories: strong and weak verbs. The top nodes are generalizations about both, and in sections beneath it, there are nodes labeled as either 'strong,' or 'weak.' For example, at the top, there is the following node that everything inherits from:

```
Verb:
  <> == <"<verbttype>">
  <normal> == "<stem>" "<suffix>"
  ...
```

Below, there are language specific verb nodes:

```
ON_Verb:
  <> == Verb
  ...
```

```
German_Verb:
  <> == Verb
  ...
```

Icelandic is identical to Old Norse on this level so lower levels inherit directly from the Old Norse node. From here, it divides into:

```
Old_Norse_strong:
  <> == ON_Verb
  ...
```

```
Old_Norse_strong1:
  <> == Old_Norse_strong
  ...
```

```
Old_Norse_weak:
  <> == ON_Verb
  ...
```

And so on with all the classes and other languages. Then, at the preterite-present leaf nodes, they can inherit from the strong and the weak, making it unnecessary to formally create a new category for the preterite-presents, since they are essentially just made up of preexisting parts.

Inside the nodes, the paths are labelled by stem, suffix, or vowel – this allows greater control. In some cases the stem is irregular but the suffix is not, or vice versa. Sometimes only the stem vowel needs to be different. If it was simply <stem> with none of this granularity, then there would be greater redundancy. The vowel path is to address the ablauts, and morphosyntactic property sets can be appended to it.

Strong verb stems were created with <onset><vowel><coda> and weak verb stems were created with <root>. The reason for this was twofold; one, if a language has the preterite-present style ablaut alternation, it is in the strong verbs. Not all languages have it; German, as discussed, does not – it has ablaut alternation between past and present but not within strong past, contrasting the sg and pl. However, both Old Norse and Icelandic strong verbs do have this pattern while the weak verbs do not. In this case, breaking the strong verb into three parts is helpful to allow for small modifications, though the primary reason is to deal with the ablauts. The <root> is important instead of a <stem> because the root can be defined and then the past tense stem defined as:

<stem past> == “<root>” d

Or something similar to this. The root can be generalized and the past suffix doesn't need to be repeated multiple times.

The second reason is it is helpful to have a different way of stem creation between weak and strong so there is no confusion about which stem is which at the preterite-present lexical leaf nodes.

However, there is a downside to this method – because the ablauts and stems are so specific and granular, this makes it harder to make generalizations higher up in the hierarchy.

One further point about strong and weak verbs: all of the strong verbs have formal classes in the code, but though weak verbs do have classes, they are not present. This is because the classifications for weak verbs are not particularly based on the stems like the strong verbs, so the classes were not useful in this context.

6.1 – Innovations in DATR and insights from this DATR theory

Deponency has been modeled in DATR before (Brown & Hippisley, 2012: 186-219) but not on a multilingual basis and not with preterite-present verbs specifically. The heteroclisis adds an additional complication because we are not just swapping the past and the present, we are combining the strong and weak inflectional classes. While this didn't push DATR to its limits, it is a new analysis.

The DATR theory provides an interesting look at the deponent verbs, including how overrides are dealt with. For example, in Icelandic:

Muna2:

```
<> == Icelandic_strong3
<past> == "Muna_weak2"
```

```

<verdtype> == pretpres
<gloss> == may
<infinitive> == muna
<language> == icelandic
<onset> == m
<coda> == n
<suffix past pl 2> == "<suffix present pl 2>"
<suffix past pl 3> == "<suffix present pl 3>".

```

Muna_weak2:

```

<> == Icelandic_Weak
<verdtype> == pretpres
<gloss> == may
<root> == m u n.

```

The bolded lines are where the paradigm is reverting back to the regular present, not preterite-present form.

Old Norse *eiga* is another interesting atypical example.

Eiga:

```

<> == Old_Norse_strong
<past> == "Eiga_weak"
<verdtype> == pretpres
<infinitive> == eiga
<language> == old norse
<gloss> == have, must
<onset> ==
<coda> == g
<coda past sg> ==
<vowel past sg> == á
<vowel past pl> == ei
<suffix past sg 2> == tt.

```

Eiga_weak:

```

<> == Old_Norse_weak
<verdtype> == pretpres
<gloss> == have, must
<stem> == átt.

```


Eiga has an alternate <coda> for the singular present, though it is coded as the past because it is drawing from the strong past. There is no matching class of *eiga* so all the vowels are defined at the leaf node, and a suffix override is present as well. In the present tense/weak class, instead of a root, it jumps to a stem to override the past tense marker that is stated in *Old_Norse_weak* because it isn't present in *eiga*:

```
<stem past> == "<root>" d
```

All German verbs but *sollen* require an additional line in their leaf node to create the ablaut:

Können:

```
<> == German_strong3
<past> == "Können_weak"
<verbttype> == pretpres
<infinitive> == können
<gloss> == can
<language> == modern german
<onset> == k
<coda> == n n
<vowel pres pl> == ö.
```

At a higher level, the orthogonal multiple inheritance made Icelandic exceptionally easy to model, because of its similarity to Old Norse:

```
Icelandic_strong4:
<> == Icelandic_strong
<vowel> == "Old_Norse_strong4".
```

The vowel patterns are the same, but some of the suffixes are different between the languages. Because I was able to inherit from *Icelandic_strong* and the vowels from the Old Norse strong class IV, no new code needed to be added for any of the strong verb classes, only at *Icelandic_strong*.

Deponency

The deponency was successfully defined at the topmost node, and some overrides were made further down where the deponency was not perfect. This supports my claim that these verbs are not irregular and that the deponency was successfully modeled without excessive overrides and extra code. Very little code needed to be added to model the preterite-present verb. Besides the code at the top, there did need to be an extra leaf node at the bottom for every preterite-present.

Things the model did not do well

Some generalizations which are obvious by simply glancing at the paradigms were not easily captured in this theory. For example, it is difficult to show the relationship between suffixes: for example, -ur and -r. While I broke my stems down quite a bit, this was still more than I was able to do so the code sees them as completely distinct and unrelated.

This three language DATR theory is proof that this could be expanded to more Germanic languages. In the future, I'd like to unify the model more and get at all the underlying forms so that small variations caused by phonological processes would not throw off larger generalizations. Additionally, the model is efficient, but there is still far more redundancy than I would like. Further testing would yield better practices. The fact that the set notation of DATR could not be shuffled was also very limiting and forced me into some awkward maneuvers – I do not believe the paradigm signatures of the verbs in these languages required a static order or that having a set order contributed to the formalism. In this vein, I will consider KATR for future work in this topic since it allows shuffling of the set notations.

Additionally, I'd like to delve deeper into the historical side of things, possibly including PIE verbs and having Proto-Germanic stems play a larger role. I think that allowing for more diachronic data could help reflect in reflecting a historical model; or it could be that when other languages are added the picture becomes clearer as well. Regardless, while I was able to create an efficient model of a modern synchronic inflectional system, it does not reflect the historical development which is something I will strive for in future work.

Abbreviations

PGmc – Proto-Germanic

PIE – Proto-Indo-European

OHG – Old High German

Got – Gothic

Prs – present

Ind – indicative

Inf – infinitive

Prf – perfect

Ptcp – participle

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