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CHAPTER 9:

Frequency and analogy in Early Modern Frisian verb inflection

This chapter is based on collaborative research between Arjen Versloot and Oscar Strik.

9.1 Introduction

The results in the previous two chapters have shown that there are interesting analogical patterns to be found in the history of inflection class change — and stability — in Swedish and Frisian. It has also become clear that the analogical models were better, overall, at predicting the stability of verbs than at predicting the correct direction of inflection class shift: in all cases, the proportion of correct predictions was higher for the verb systems as a whole than for the subgroup of verbs that had historically undergone shift.

This leads us to conclude that analogy by itself — as modelled by the *Analogical Modeling* program (AM) and the *Minimal Generalization Learner* (MGL) — does not possess the full conservative force needed to explain historical patterns of stability. Analogy can account for the majority of cases where verbs remained stable, but still predicted that a minority would change, when this was not the case. In other words, it was a bit too eager to reorganise the system. As mentioned earlier — section 2.4.2 (p. 22) — another candidate for explaining diachronic stability is token frequency, particularly in that a higher token frequency is thought to make forms more resistant to morphological change, and therefore to inflection class shift. In this chapter, we present a pilot study that relates the results of analogical modelling to the token frequency of the verbs involved.

9.1.1 Methodology

To investigate the role of token frequency in inflection class stability and change, we have gathered the frequencies of all Early Modern Frisian verbs in the dataset, based on their frequencies in the *Taaldatabank*

Frysk (Drukker *et al.* 2009). These are the actual frequencies of the verbs in their sources, and are not based on a backwards extrapolation of the frequencies of the verbs in Modern Frisian.

For all of the verbs in the modelling step between Early Modern and Modern Frisian (see chapter 8), the outcomes predicted by the AM model were analysed, noting the outcome predicted as most likely, and seeing how this outcome compared to the actual outcome (inflection class) of the verb in Modern Frisian.¹ This resulted in a four-way categorisation:

stable verbs, predicted as stable	stable verbs, predicted as unstable
unstable verbs, predicted as stable	unstable verbs, predicted as unstable

The top left category contains only correct predictions, while the top right and bottom left category only contain incorrect predictions. The bottom right category contains a mix of correct and incorrect predictions, depending on whether the model predicted the *direction* of the shift correctly. For the sake of simplicity, we call these combinations of prediction outcome and historical stability/change *change categories*. For each category, we calculated the average token frequency, both overall, and by looking at differences between inflection class groupings. All frequencies are expressed as \log_2 .

9.2 Frequency per change category

9.2.1 Overall results

First, we take a look at the overall frequency distribution, which is presented in Table 9.1. We see that on average the category of “stable predicted as change” — verbs that have historically remained stable, but for which AM predicted a change — has the highest average frequency. This indicates that if it had been able to take into account the verbs’ actual token frequency, the model might have predicted more stability for these verbs, and have overall better results. Looking at the overall results, however, we also see that verbs that have changed historically have, on average, a slightly higher token frequency (3,38) than verbs that have historically remained stable (3,30). This shows that simply having a high token frequency is on average not a stabilising factor.

1. Note that verbs that disappeared from the language in this period are disregarded in the analysis where the analogical results are compared with frequency. They are incorporated, however, in the analysis of the frequency hierarchy in section 9.4 (p. 173).

ALL VERBS		predicted as				average	total n=
		stable	n=	changed	n=		
historical outcome	stable	2,80	450	4,45	193	3,30	643
	changed	2,97	78	3,55	196	3,38	274
	average	2,83		4,00			
	total n=		528		389		

TABLE 9.1 : Average \log_2 frequency per outcome category, all verbs.

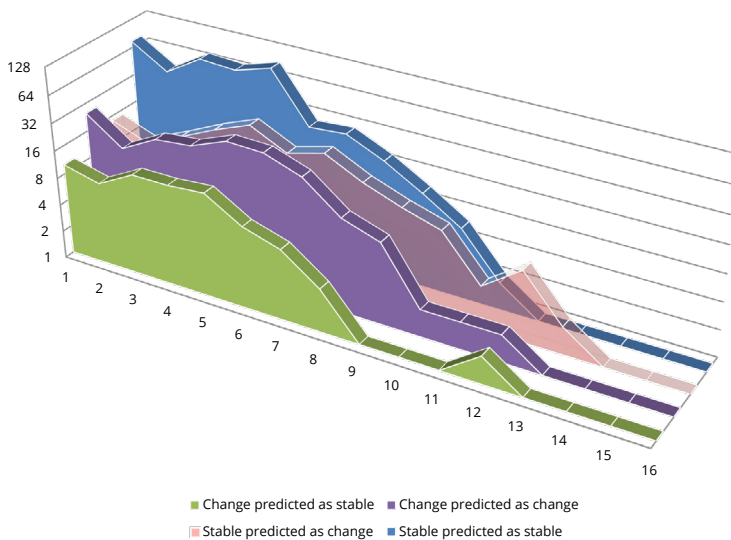


FIGURE 9.1 : Histogram of \log_2 frequencies per change category, all verbs.

Why this may be the case will be explained in what follows.

To see if there are more subtle interactions between frequency and stability/change, we looked at the frequency *distributions* of each change category. The frequency distributions for the verbs overall per change category are shown in Figure 9.1. The low frequency verbs are mostly located in the “stable predicted as stable” category: these are predominantly weak verbs that were correctly predicted by the model. In addition, we see a noticeable bump in the higher frequency range in the “stable predicted as change category”. It is in part this bump that is responsible for the higher average frequency of this change category in the overall results.²

2. The tail end of this bump is formed by a small number (12) of irregular verbs; these are actually relatively stable and have a very high frequency, but the model predicted

STRONG VERBS		predicted as				average	total n=
		stable	n=	changed	n=		
historical outcome	stable	6,55	18	5,42	52	5,71	70
	changed	5,84	2	5,12	21	5,19	23
average		6,48		5,33			
total n=			20		73		

TABLE 9.2 : Average \log_2 frequency per outcome category, strong verbs only.

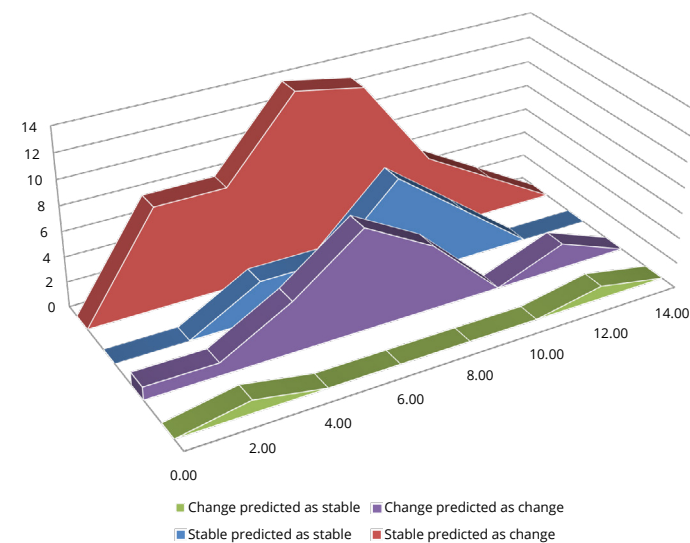


FIGURE 9.2 : Histogram of \log_2 frequencies per change category, strong verbs only.

9.2.2 Results for strong verbs only

We get a more nuanced idea of how the frequencies are distributed among the various groups of verbs by separating them out. Table 9.2 shows the average frequency (\log_2) per change category for the strong verbs only, while in Figure 9.2, we see the distribution of frequencies for these verbs.³ We see here that — as is universally the case in the Germanic languages — the average token frequency of strong verbs is

that 10 of these would change.

3- In this analysis, as well as the analyses for W1 and W2 verbs below, we only looked at ‘pure’ verbs: that is, we excluded verbs with a hybrid strong/weak paradigm, W1/2 hybrids, and verbs with other irregularities.

W1 VERBS		predicted as				average	total n=
		stable	n=	changed	n=		
historical outcome	stable	3,84	55	4,20	53	4,02	108
	changed	2,13	7	2,86	52	2,77	59
average		3,64		3,54			
total n=			62		105		

TABLE 9.3 : Average \log_2 frequency per outcome category, W1 verbs only.

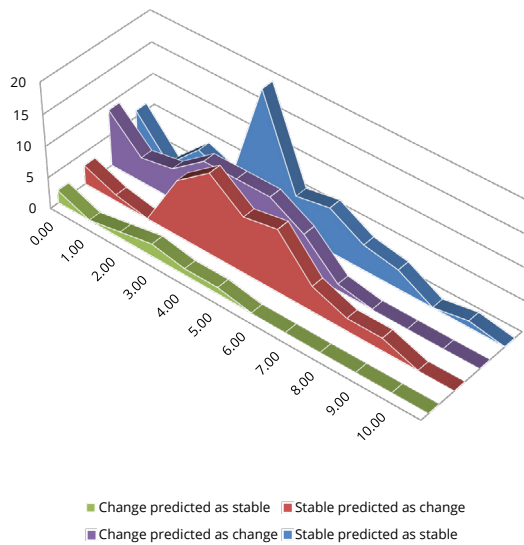


FIGURE 9.3 : Histogram of \log_2 frequencies per change category, W1 verbs only.

much higher than that of verbs overall. The “stable predicted as stable” group is small, but here we see that the average token frequency is the highest. This is not a problem for the hypothesis that high frequency verbs would be more stable: even if the model were to have been more conservative for these verbs, the prediction would still have been correct.

The two largest groups are those for which the model predicted change, and in 52 cases this was not justified (the “stable predicted as change” group). We see that among the strong verbs, this is by far the largest group, and that indicates that the model would have performed better in the prediction of stability and change if it had been

more conservative with regard to verbs with a high token frequency.

On average, the verbs that changed historically have a lower token frequency, which supports the basic hypothesis that higher token frequency is a conservative force, at least for the strong verbs.

9.2.3 Results for W1 only

Table 9.3 lists the average frequency values (\log_2) per change category for W1 verbs, while in Figure 9.3, we see the distribution of frequencies for these verbs. In several ways, the W1 verbs behave like the strong verbs, although the overall average frequency is lower (3,58). The highest frequencies are found in the historically stable categories, and those predicted (wrongly) as having changed have the highest average frequency (4,2). In this sense, W1 verbs behave like strong verbs in the sense that a higher token frequency means a resistance to change. Again, the model would have performed better had a higher token frequency been tied to a resistance to change.

9.2.4 Results for W2 only

Table 9.4 shows the average frequency (\log_2) per change category for W2 verbs, and in Figure 9.4 we see the distribution of frequencies for these verbs. From the average frequencies, it becomes clear that — regardless of the model's predictions — the stable W2 verbs have a slightly lower average token frequency (2,33) than the verbs that changed, historically (2,4). This shows that for W2 verbs, a higher token frequency is actually *conducive* to change. W2 verbs below a certain level of frequency seem to be less likely to shift to a different class than those with higher frequencies. This is in direct contrast to the results for strong and W1 verbs.

This shows that a simple positive correlation between token frequency and stability must be rejected. Instead, we see that one class (W2) is more stable when its verbs have a low token frequency, while the others (W1, strong, and irregular verbs) have a higher average frequency among stable verbs. To further explore these findings, we will first look more closely at the interaction between analogical pressure (as predicted by the model), frequency, and change. Afterwards, we will take a more fine-grained look at the frequency distribution of the historical patterns of stability and change in the Frisian inflection classes.

9.3 The interaction of token frequency and analogy

We will now re-examine the modelling results in relation to frequency in the following way: in the cases where AM predicted that a verb would change, we are dealing with an *analogical pressure* towards

		predicted as				average	total n=
		stable	n=	changed	n=		
historical outcome	stable	2,30	350	2,52	53	2,33	403
	changed	2,14	41	2,64	45	2,40	86
	average	2,29		2,57			
	total n=		391		98		

TABLE 9.4 : Average \log_2 frequency per outcome category, W2 verbs only.

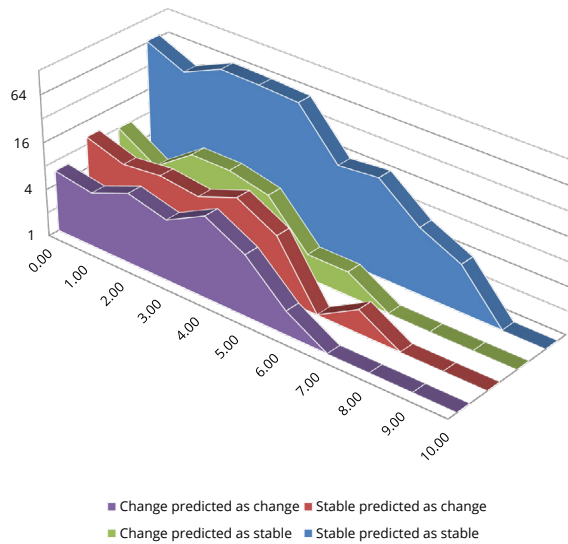


FIGURE 9.4 : Histogram of \log_2 frequencies per change category, W2 verbs only.

change. The verb in question is sufficiently similar to verbs in another inflection class that the model predicts that the verb would fit there better. As explained in chapter 6, this pressure is a measure of phonological similarity between verbs, combined with the type frequency of inflection patterns. We can compare the presence or absence of such an analogical pressure towards change with the average frequency of a group of verbs, and with the actual historical status of the verb: was it stable or did it change? We have summarised the relationship between these factors for each verb group analysed above — strong, W1, and W2 verbs — in Table 9.5. The table should be read as follows: the second and third column indicate whether there is an analogical

	analogical pressure	relative frequency	result: Δ = change = = stability	% of historically stable verbs
Strong	+	+	=	71%
	+	-	Δ	
	-	+	=	90%
	-	-	Δ	
Weak 1	+	+	=	50%
	+	-	Δ	
	-	+	=	89%
	-	-	Δ	
Weak 2	+	-	=	54%
	+	+	Δ	
	-	-	=	90%
	-	+	Δ	

TABLE 9.5: Interaction between analogical pressure, frequency, and historical stability, per inflection class. The symbol “+” stands for high analogical pressure or frequency, while “-” indicates low analogical pressure or frequency.

pressure towards change, and/or a higher frequency in comparison to other verbs in the class. Keep in mind that the analogical pressure is a prediction made by the analogical model, while the frequency is a *post hoc* analysis of a comparison of these predictions and the historical outcomes. In the case of strong and W1 verbs, a high frequency is conducive to stability, while in the case of W2 verbs, it is conducive to change. The fourth column lists the results of the interaction of these two factors: analogy and token frequency. The fifth column indicates the proportion of verbs that has historically remained stable for each analogical pressure category.

For the groups in question, all this means the following. When the analogical pressure is low (-), very few verbs change, regardless of class. For strong and W2 verbs only 10% of these verbs change, and for W1 verbs this is 11%. However, as mentioned above, in the case of strong and W1, the verbs that shift are relatively infrequent, whereas in the case of W2 verbs, the shifting verbs are on average *more* frequent.

When the analogical pressure is high (+), more verbs change across the board. Among strong verbs with high analogical pressure to change, 29% has changed historically; this score is 46% for W2 and 50%

for W1. Again, for strong verbs and W1 verbs, the verbs that change have a lower than average token frequency, while the W2 verbs that change have a higher than average token frequency.

This leads us to conclude that analogical pressure is an important trigger for change. Where a phonology-based analogical pressure was absent, only 10–11% of verbs shifted historically. When there *was* analogical pressure, the rates of historical shift are much higher. In both cases, token frequency influences the stability of the verb, but the nature of this influence depends on the class of the verb in question.

9.4 A frequency-based hierarchy of Frisian inflection classes

Now that the relation between analogy and token frequency has been established, we want to take a closer look at the precise way in which token frequency influences stability for each inflection class. In this analysis, we treat hybrid verbs — strong/weak hybrids and hybrids of W1 and W2 — as classes unto themselves.

We've grouped the verbs in our dataset according to their origin class in Early Modern Frisian on the one hand, and their destination class in Modern Frisian on the other. For each of these groups, we list the average token frequency of the verbs in the group (\log_2). These averages are given in Table 9.6, and visualised on a surface in Figure 9.5. As we can see, there is a clear hierarchy among the classes. Looking at the verbs that remained stable — the greyed-out cells in the table — we see a gradual decline of average token frequency along the following cline: $S > S/W > W1 > W1/2 > W2$.

This cline is mostly confirmed by the average frequencies of all the verbs per destination class — the bottom row of the table — with the exception of W1/W2, which has a slightly higher average frequency than W1. The cline is also reflected in the average frequencies of the verbs that are not stable. In general, the farther down the cline a verb moves, the lower its frequency, and the farther up the cline it moves, the higher its frequency. For example, strong verbs gaining a weak variant form ($S > S/W'$) have an average frequency of 5,30, while strong verbs changing to W2 ($S > W2'$) have an average frequency of 2,17. At the other end of the spectrum, W2 verbs changing to W1 ($W2 > W1'$) have an average frequency of 2,11, while those changing to S ($W2 > S'$) have an average frequency of 3,40.

The surface also illustrates the multidimensionality of this inflection class cline. The highest point may be found at the stable strong verbs, and on average, the surface inclines downwards towards the stable W2 verbs. All other interactions tend to produce results in between,

Result (ModFris class)	Origin (EModFris class)										
	Strong		Strong/Weak		Weak 1		Weak 1/2		Weak 2		Total
	freq.	n =	freq.	n =	freq.	n =	freq.	n =	freq.	n =	
S	5,91	72	5,49	19	3,39	2	2,92	2	3,40	5	5,59
S/W	5,30	11	5,58	11	4,06	2	4,09	1	3,17	4	4,98
W1	3,68	4	5,73	6	4,02	107	3,96	21	2,11	24	3,78
W1/2	1,73	2	—	0	2,84	25	3,45	23	2,31	51	2,69
W2	2,17	3	4,81	1	2,49	29	3,68	30	2,33	403	2,43
O	0,00	1	0,00	1	1,06	15	0,52	5	0,85	120	0,85
Total	5,46	93	5,39	38	3,35	180	3,48	82	2,04	607	

TABLE 9.6 : Average token frequency (\log_2) by original and new inflection class.

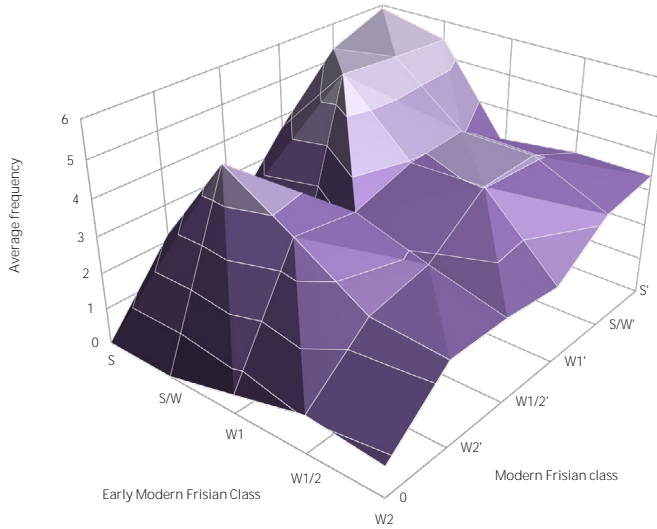


FIGURE 9.5 : Average token frequency (\log_2) of verbs, grouped by original and new inflection class.

		from									
		S		S/W		W1		W1/2		W2	
to	S			19	70%	2	3%	2	3%	5	2%
		S/W	11	52%			2	3%	1	2%	4
	W1	4	19%	6	22%			21	36%	24	12%
	W1/2	2	10%	0	0%	25	34%			51	25%
	W2	3	14%	1	4%	29	40%	30	51%		
	o	1	5%	1	4%	15	21%	5	8%	120	59%
% shifts		23%		71%		41%		72%		34%	

TABLE 9.7 : Proportion of every inflection class that shifted to other classes (final row), along with the proportional direction of shift. In this table, the stable cases are left out: only shifts are shown.

with the exception of several combinations of origin and destination class where only a handful number of verbs are attested: these groups are less reliable. A special case that fits the general pattern, however, is the group of disappearing verbs, which have, unsurprisingly, the lowest frequencies of all.

In Table 9.7 we show how many verbs shifted from one class to another, also in relation to the total number of verbs in that class. The hybrid classes S/W and W1/2 are much more unstable than their ‘pure’

counterparts. In addition, we see that most verbs that shift do so in the direction of a class that is adjacent in the cline presented above, either one step up or down.

9.5 Conclusion

A number of conclusions may be drawn from this analysis. First of all, for both strong and W1 verbs, a higher frequency promotes *stability*, while for W2 verbs, on the other hand, higher frequency is conducive to *change*. We have also shown that when analogical pressure towards change is low, approximately 90% of verbs are stable. When analogical pressure towards change is high, however, the rate of historical change increases to between 27 and 50%, depending on the verb class. In short, analogical pressure is always conducive to change, while the influence of frequency depends on which class a verb is part of. If the verb is high on the cline, a lower frequency is conducive to change, while the inverse applies to a verb in a class that is low on the cline. As for classes in between, they tend to change when their frequency diverges from the average frequency of the verbs in their class.

When a verb changes, the frequency is also a factor in determining the direction of the shift. Verbs tend to change towards classes that are adjacent on the cline, except when the frequency is much higher or lower than the class average. This indicates that there is no default class in Frisian that all verbs revert to when destabilised. Instead there is merely an ordered range of classes with particular profiles in terms of phonological structure (hence analogical pressure) and average frequency.

We've now gathered enough information to draw a conclusion about what influences the actuation and direction of inflection class shift. Analogical pressure towards change — which is also another way of saying there is not enough analogical pressure to remain stable — is a prerequisite for change in the majority of cases. Whether a verb actually changes, and in what direction (on the cline) is influenced by the verb's token frequency.

Analogy itself also influences the direction of change, of course. For strong verbs becoming weak, this is relatively trivial, since both Frisian weak classes have a wide phonological scope and therefore have no trouble incorporating (previously) strong verb stems. Even so, strong verbs tend to shift to W1 relatively often in Frisian, perhaps because their phonological stem form is a better fit for W1, which tends to contain simple, monosyllabic stems — see Haverkamp *et al.* (MS). For weak verbs becoming strong, the matter is slightly different. Where there is analogical pressure to shift, it will be towards a class that has

the same stem vowel as the weak verb in question, along with other phonological aspects of the stem form.⁴ Even then, the weak verb must be sufficiently more frequent than the ‘gravity’ of its class to escape upwards along the cline towards the strong verbs.

We should emphasise that some aspects of these conclusions are less robust than others. Particularly the idea that a higher than average frequency pushes verbs to move *up* the cline is difficult to confirm because the number of verbs that actually do so is quite small. Research on different Germanic verb systems and periods may provide us with more information, the better to judge the merit of this idea.

It is also worth investigating whether the cline we suggest here is compatible with a formal analysis such as that presented by Dammel (2011: 187), where the Frisian verbs are analysed according to their inflectional strategies and placed on a scale with “additive” strategies on one end, and “suppletive” strategies the another, with “modulatory” strategies in between. These are all matters for future research.

To summarise: analogy and frequency together give shape to a cline of inflection classes in Frisian. In most cases, the analogical coherence of a class is sufficient to keep verbs in their place. However, when verbs diverge from their peers both in terms of analogy *and* frequency, they may shift and find a new home in another class.

4. Recall that analogical pressure, as modelled by AM in this book, looks at all the phonemes of the verb stem, but with particular emphasis on the vowel.