

Dental fricatives and stops in Germanic: deriving diachronic processes from synchronic variation*

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This paper presents evidence for four important arguments: 1) Particular conditions in the development of the English language have allowed phonetic variation in the dental fricative to persist with few phonemic developments over the course of time. 2) The range of variation in production of the modern American English dental fricative reflects the range of actual outcomes in the other Germanic languages developing out of Proto-Germanic. 3) Relying on the uniformitarian principle, that the kinds of processes we can observe in the present are the same as processes that shaped languages in the past, this paper illustrates that the kinds of variation that are present in the Modern American English dental fricative are the same kinds of variation that can be posited to have existed in the dental fricative in Proto-Germanic. 4) These three points support, and are supported by, the theory, derived from multiple branches of linguistics, that sound change is the result of different phonemic interpretations and generalizations derived from ongoing variation. The spread of these generalizations is what gives us measurable and widespread sound changes such as those that have produced the various modern instantiations of the dental fricative.

Keywords: dental fricative, uniformitarian principle, variation, Germanic, sound change

1. *Introduction - some guiding principles*

The uniformitarian principle has been applied in different ways to historical linguistics nearly since the beginning of its acceptance as a scientific principle in other fields. Its most recent incarnation can be summarized as follows: Assuming the same conditions are present, processes that occurred in the past are of the same kind as processes that can occur in the present, and vice versa (see Labov 1974, Ohala 1992, and Janda & Joseph 2003b, among others). As it is a generally accepted principle, it may be invoked to support the points argued for in this paper. By understanding synchronic

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processes, we are able to postulate similar diachronic processes.

One result of incorporating new understanding of synchronic processes into historical linguistics is the emergence of usage-based models of sound change. The field has long wanted such a model that could be expanded to make predictions. Thomas Toon (1992:440) laments, “A strong theory of language change would predict the direction of sound change after having established a set of possible changes and having described the sorts of pressures which apply to languages in flux. No such theory, of course, exists ...” Cooperative ventures among historical linguists, sociolinguists, psycholinguists, phonologists and phoneticians (and all linguistic subfields, really) will eventually lead us to this theory. For now, the pieces are starting to come together, and it seems that prototype and exemplar models have much to offer. At the moment, it is true that we cannot know the outcome of purported ‘sound change in progress,’ though a fair number of historical linguists take note of, and incorporate these observable processes into their analyses of historical changes (see Ohala (1992 and 1993), Labov (1994), Weinreich, Herzog, & Labov (1968), among others). We have also not yet come to the point where we may identify sound change before it has begun. Even sound change in progress is debatable, overlapping at many points with stable variation.¹ While we may not yet be able to *predict* the outcome or the actuation of sound change, we may be able to understand *how sound change originates* by examining stable variation in a language.

A language that is on the verge of sound change and a language that has emerged from a completed sound change will have one major difference -- that in the post-sound change case, the changed sound will exhibit variation that forms a different pattern, that more often resembles the innovative form than the older form. The variation does not go away; it merely takes on different dimensions. I refer here to the undeniable phonetic reality that all sounds exhibit variation. Thus, “phoneme” is not a physical reality by any means, but rather a psychological abstraction² based on the ability of the mind to create

¹ In this context, the use of the term, “stable variation,” departs from that conceived in Labov (1966, 1974, etc.), and is taken to mean *any* variation that is neither the cause of nor a participant in a current sound change (though this does not preclude the possibility of future sound change).

² This is not a new idea. See Sapir (1933) “La Realite Psychologique des Phonemes,” and Jones (1957) *The History and Meaning of the Term “Phoneme,”* especially pp. 7-8. However, the

generalizations and categories from patterns of variation.³ Much as the boundaries of color categories may vary from person to person based on his/her experience, the question of where to draw the boundaries of a particular phoneme is subject to, among other things, what exemplars⁴ the individual is exposed to, and how the mind sorts and groups the myriad realizations into categories. Variation is what enlarges the area of what one could perceive as a token of a particular category. This variation can persist and expand without causing any large-scale (phonemic) changes until it reaches some imbalance, at which point the category makes a noticeable shift (including merging with another category or splitting into two categories). At this point, cognitive processes become more transparent: phonological analogy and/or lexical analogy⁵ may occur, resulting in broader environmental conditions or lexical conditioning, social variables may be assigned, and a sound change may spread, or not, as the case may be.⁶

2. *A case study -- English*

The subject of this investigation, the American English non-sibilant dental fricative, is a

cognitive aspect of phonology has lately received much attention. See, among others, Nathan (1996) and Pierrehumbert, Beckman, and Ladd (2001), especially section 6: Categorization.

³ There are various positions on this ranging from the extreme idea that there are no phonemes, only unique utterances which are somehow stored in the mind, categorized and linked to each other, to the equally extreme notion that there are a very limited and well-defined range of non-competing allophones for each phoneme. A more reasonable position in this paper follows that offered by Janda (2003), who cites the psycholinguistic study from Derwing et al. (1986), which builds on Jaeger (1980), and concludes that “ ‘it is perhaps quite incorrect to regard the phoneme as the sharply defined kind of category that one finds in classical set theory.’ Rather, the phoneme is ‘something more akin to a ‘natural category’ ... in the sense of Rosch...[(1973): i.e.,] one that is best represented by a particular prototype exemplar, with other members tailing off gradually...[;] see Jaeger and Ohala [(1984)]” (415).

⁴ An historical analysis using prototype categorization is offered by Aski (2001) and is also argued for in Repp and Libermann (1990), among others. In depth treatment of exemplar modeling can be found in Bybee and Hopper (2001), among others. These theories are tied together under the concept of a “usage-based framework” that has its origins in perceptual psychology, and was carried over into linguistics beginning with Rosch (1973).

⁵ Following Hock (2003), sound change and analogy are here envisioned as two “points on a continuum of changes that may be considered analogical in a larger sense” (441), hence the grouping of the many kinds of analogical change under the headings ‘phonological analogy’ and ‘lexical analogy.’

⁶ Note that Janda and Joseph’s (2003) “Big Bang Theory of Sound Change” also makes a distinction essentially between the phonetic and the cognitive, but their posited ‘exceptionless’ starting point is disputed here.

sound that is not all that common among the world's languages. It is acknowledged that, as a matter of description, there are two dental fricative *phonemes* in Modern English, voiceless /θ/ and voiced /ð/. There are a few minimal pairs, such as *thigh* and *thy*, *either* and *ether*, and some near-minimal pairs, such as *breath* and *breathe*. Despite the existence of minimal pairs, the distinction between these phonemes carries little, if any, functional load. Further examination makes clear why they are referred to here as one sound. Recall that phonemes represent a psychological construct rather than the phonetic reality. A number of studies on categorical perception (see Repp & Libermann 1990, Miller 2001, among many others) have shown that every phoneme admits a certain amount of variation, and that even the boundaries between phonemes and amount of allowable variation can be manipulated (see Volaitis & Miller 1992, Norris, McQueen, and Cutler 2003, among others).

In English, the dental fricative phonemes are the only pair of phonemes that are represented by one grapheme, the <th> digraph. Thus, there is no distinction in writing between the voiced and the voiceless phoneme, with the exception of the 'silent e' voicing cue for verbs such as *bathe*.⁷ The dental fricative is the only sound produced at this place of articulation⁸, regularly ranging from between the teeth (interdental) to just in front of the alveolar ridge (post-dental)⁹, and is free to vary in manner without impinging on the boundaries of any other phoneme because it is unique in its place of articulation. Sometimes, however, it does overstep phonemic boundaries, resulting in well-known substitutions such as the alveolar stops or labio-dental fricatives that occur in some sociolects and dialects, such as AAVE (Wolfram 1970, 1974, among others) or London Cockney English (Wells 1982; Hughes, Trudgill & Watt 2005, among others).

In an acoustic analysis of the dental fricative as produced in the conversational speech

⁷ However, subjects of a study currently underway frequently fail to make use of this cue in word lists, pronouncing *bathe* as *bath*, *teethe* as *teeth*, etc.

⁸ Although sometimes /θ/ and /ð/ are referred to as "interdental fricatives," because of the variation in place, they are better described simply as (non-sibilant) "dental." This is in contrast to the sibilants /s/ and /z/, which may be considered "alveolar," but are also distinguished by their sibilance, and are not investigated here.

⁹ The dental fricatives are also sometimes fronted to a labial or retracted to an alveolar articulation in running speech. Variation between apical and laminal productions also appears to mix in with the variation in place, though it is unclear to what degree.

of Ohio residents, Smith (2007) found that voicing and voicelessness in the dental fricative can be accounted for much more reliably by assimilation to voicing or voicelessness of surrounding segments than by the phonemic description of [+/-voice]. In fact, environmental assimilation accounted for 76% of voicing, while the phonemic description (whether it was supposed to be phonemically voiced or voiceless) accounted for only 45%, as found by the partial correlation statistic. In this study, there was also widespread variation in manner of articulation, with production of the dental fricative realized anywhere from a stop, (usually following a stop, nasal, and/or pause) to an approximant (usually intervocalically). The voiced phoneme had greater variation in both manner and voicing than did the voiceless, which suggests that the voiceless /θ/ may be the more dominant phoneme,¹⁰ while the voiced variant, subject to greater frequency effects due to its place in several high frequency function words, may hold allophonic status. It is now well documented that higher frequency words are much more likely to be reduced and result in greater variability (Pierrehumbert 2003, among others). High frequency tokens found in high frequency words are thus more likely to exhibit greater variation. While the phonetic boundaries for all sounds are somewhat mobile, the dental fricative allows for a much greater range of variation, with a much more permeable boundary between the voiced and voiceless phoneme. Thus, while the dental fricative may be categorized as two phonemes based on criteria such as the minimal pair test, its phonetic reality is much less distinct.

Historically, the dental fricative was one voiceless phoneme in Old English, with a voiced allophone between voiced sounds (much as the voicing can be generalized today). It could be represented orthographically with *thorn* <þ> or *edh* <ð>, which could be used interchangeably to represent either the voiced or voiceless variant. At this time, the alveolar and labio-dental fricatives were also subject to voicing assimilation, but were written with only the voiceless graphemes /s/ and /f/ (Mitchell & Robinson 2001:15). After the Norman Conquest brought unprecedented numbers of loanwords into English, /s/ and /f/ became contrastive with /z/ and /v/, respectively, due to loanwords that

¹⁰ This hypothesis is currently under investigation in a goodness-rating task.

contained these sounds in contrastive positions. Borrowing between dialects that had different distributions, such as the initial voiced fricatives in dialects in the Southwest of England, may also have contributed to the phonologization, creating opposing forms such as *fox* and *vixen*. The sounds in assimilatory voicing patterns, and in the new borrowed lexemes became phonemic by around 1250. French did not have a word-initial voiced dental fricative, however, so it is more difficult to ascertain when the phonologization of /θ/ and /ð/ occurred. While English gained new graphemes for the voiced /v/ and /z/, /θ/ and /ð/ were reduced to a single grapheme in Middle English, that is <th>. Who (re)introduced¹¹ the digraph is unknown, but it occurred some time after other Norman innovations in writing took place, such as the introduction of <v> and <u>, <z>, and <g>. Lass (1992:59) points out that word-initial <th> in function words was likely to have been voiced in the 14th century, citing Chaucerian rhyme as evidence (“*sothe* : *to the*, ‘*sooth*’ : ‘*to the*’”). Because there was still no written distinction¹², though, it is difficult to say if this was a meaningful departure from earlier times, when voicing assimilation could just have easily occurred across word boundaries when no pause between words occurred. The modern variation observed in Smith (2007) is not tied to word boundaries, but seems more likely to be related to positions of prosodic prominence, where pauses and micro-pauses are more likely. Another possible contributing factor to the voicing of word-initial <th> in function words is that their high frequency may have allowed a larger amount of variation, which became generalized as a voicing contrast. Note that the phonologization of these sounds occurred after the paradigm leveling that reduced the number of different forms of these function words. For example, the definite article, *the*, is inflected for case, gender, and number in Old English, yielding approximately 12

¹¹ Hogg (1992:76-7) suggests that the <th> digraph was originally borrowed from the Irish, and notes that it was used occasionally in very early manuscripts from the 8th century, and was presumably taught with other Latin letters by monks, though it had given way to <þ> and <ð> by the end of the 8th century. The <th> digraph was also used in Old Saxon, to represent the voiceless dental fricative, although our records for this do not begin until the 9th century.

¹² William Bullokar, an orthographer in 1580, makes note of a distinction between two sounds represented by <th> (though not “in the east part of Sussex or Kent,” where they are all pronounced [d]). All sounds represented by <th> in the following phrase should correspond to the sound of “thee,” (though what that is, he does not describe): “both thy father and thy mother loathe thee, for this, thy breathing on them” (spelling normalized).

distinct forms of this word. The increased frequency of single forms of certain types of words may have created the situation that allowed reduction and variation of these high frequency words that now carry much less grammatical information. Word-final /ð/ appeared with the loss of verb endings, stranding the medially-voiced fricative at the end of the verb, probably by the 15th century, preceding by a couple of centuries the settlement of North America.

How is it, then, that we have this modern pattern of variation in voicing that is remarkably similar to the pattern found in Old English? At the same time, we have lexical descriptions of phonemic voicing that require phonologization to have taken place. One might suppose that Ohio speakers of American English are undergoing some kind of sound change, possibly a merger. But evidence from widespread and diverse studies, exemplified below, makes this analysis unlikely. Even a geographically and sociolinguistically diverse merger is much more problematic than the alternative solution. A more likely explanation is that the dental fricative continues to exhibit variation similar to that found in Old English, with different categorization. We don't know how Old English speakers categorized the dental fricative, or if they had any awareness of a voicing distinction. Our assumptions of their categorization are based on modern outcomes and cross-language comparison, while our estimates of the modern phonemes are based on modern speakers' intuitions and linguists' theoretically motivated judgments. If we ignored the linguists' judgments and the intuition of the speaker, we might be left with a single phoneme with multiple allophones. This is not advocated, however, because "phoneme" is, after all, a mental generalization, which cannot happen without the speaker.¹³

Modern speakers have ideas about which phoneme goes in which word, though this varies by speaker for a number of words: *with*, *within*, *brothel*, *ether*, *thanks* are a few examples that have shown robust variation of lexicalized phonemes across speakers in the current research. Let it be posited that this lexical variation is caused by phonetic variation and different speakers' generalizations thereof. Because of the ambiguous nature of <th>, the process is allowed to continue without literacy-related corrections.

¹³ Linguists are, of course, optional!

This is similar to generalizations that have taken place in other fricatives, such as the divergence of two lexical items, *of* and *off*, from Proto-Germanic **af*, and the more recent devoicing of /v/ in the phrase *have to*, which has become lexicalized for a few young speakers, even to the point of developing new forms such as “*hafing to*” (Joseph 1992). While the written difference between /f/ and /v/ may impact how well these new forms are received, there are no such limitations on re-categorization of <th>. Without written or social correctives¹⁴, one can imagine a large number of potential permutations of categorization and re-categorization of <th>.

Research in other subfields of linguistics supports the hypothesis that lexical variants are based on mental re-categorization of variation. More frequent lexical items are more likely to be reduced (Pierrehumbert 2003), and lexeme split can result, as in the cases of *of* and *off*, and *have* and *have to*, above. The frequency of function words beginning with <th> also contributes to the disproportionate frequency of the voiced phoneme. Despite relative token frequency, acquisition research shows that the dental fricative phonemes are the most difficult to acquire. The age of acquisition (at 90%) of /θ/ is 7 years, and /ð/ is 8 years, even though /ð/ is the 13th (out of 42) most frequent sound of American English (Edwards 2003:120-5).¹⁵ Polka, Colantonio & Sundara (2001) showed that English-speaking infants were much less likely to be able to distinguish between /d/ and /ð/ than between /b/ and /v/ (which, like most phonemic distinctions, was readily observable by the age of 12 months). These results suggest that the production of the dental fricative which the infants are exposed to is variable and overlaps to some extent with the alveolar (dental) stop, so that they are unable to interpret a phonemic pattern at this age. In a production experiment, Campbell and Besner (1981) elicited word-initial <th> in nonsense words. These words were pronounced generally with the voiceless variant, sometimes even when subjects were made to believe that the words were supposed to be function words. Placing the nonsense words into grammatical contexts

¹⁴ An undergrad in a linguistics class confided that he had stopped using the word “thanks” after much harassment by his peers because of his use of the voiced variant. I cite this case to point out that social factors may play a corrective role in curtailing variation.

¹⁵ In comparison, the age of (90%) mastery for production of /p/ is 3 years, for /i/ is 2-3 years, and even the notoriously difficult /r/ is 6 years.

that encouraged the subject to use them as function words produced more voicing, but even this was irregular. The authors speculated that because function words are closed-class, subjects are resistant to incorporate new pseudo-words into the voicing paradigm. Since that time, phonetic analysis has revealed that voicing in fricatives is continuous rather than categorical (Stevens et al. 1992). Phonetic analysis of these results would have given greater accuracy to the authors' judgments of whether subjects produced voiced or voiceless tokens. It has also since been found that lexical knowledge can alter the perception of phonemes (Frauenfelder, Scholten & Content 2001, Miller 2001, among others), such that one hears the sound that one expects to hear, given a certain word. So, Campbell and Besner, without the benefit of today's phonetic analysis software, may even have contributed to the mixed results of their study.

All of this evidence points to a state of continuous variation in the dental fricative that has allowed different interpretations of phonemic categories based on *voicing*. Variation in the *manner* of articulation has not been as thoroughly examined, but we turn to that here.

Returning to the older state of the language, Old English, as the other West Germanic languages, showed evidence of strengthening of Verner's /ð/ to /d/ (for a more detailed discussion of Verner's Law, see section 3). This is why there was only one dental fricative phoneme, /θ/, and a voiced allophone, /ð/. However, there was variation between /ð/ and /d/ in medial positions, often attributed to analogy -- paradigmatic, semantic, four-part, and other; for example, *burden* vs. *burthen*, *fader* vs. *father*, *murder* vs. *murther*. It is also possible that early Scandinavian influence, with its medial fricatives, compounded this situation, which persisted well into Middle English, though it should be noted that Old Saxon also demonstrates this type of variation in medial positions. The adoption of certain variants by non-native speakers of English hints at what the production must have been like at the time these variants were adopted. For example, in varieties of African American Vernacular English, the use of /d/ for word-initial /ð/ suggests that when this variant was adopted, the voicing was a more prominent feature than the frication, and that the sound in these words was already somewhat retracted, especially when found alongside /v/ for medial position /ð/, and /f/ for /θ/ in most cases. The adoption of /d/ for

word-initial /ð/ by immigrants in some areas such as Wisconsin, Michigan, and Minnesota, which has persisted as a class-marker (Rose 2006), suggests the same of function words, but with the use of /t/ for word-initial /θ/, the evidence is not as strong (because we can't overlook interference from the immigrant's native language), though it may suggest a greater frequency of an affricated /tθ/ in these areas (see Wolfram (1974) for discussion of the common use of this affricate in New York).

All of these variants and more are produced by modern-day Ohio English speakers in Smith (2007) as natural variation of the dental fricative during conversational speech. The speakers studied do not have an imbalance that favors production in another place or manner that would cross phonemic boundaries, so there is no sound change in progress to report, only stable variation that centers around a dental fricative space. Modern speakers tend to favor a dental fricative or stop+fricative word-initially (when preceded by a pause) for both phonemes, and a retracted, approximant-like production when /ð/ is bunched between voiced sounds in an unstressed position. /θ/ is more likely to be realized as a fricative (voiced or voiceless) when in similar unstressed positions, and /ð/ is more likely to be retracted. These findings suggest some difference between the two phonemes, though it may be a function of frequency, and requires further study.¹⁶ None of these patterns are categorical, and variation is found in the full range of voicing, in manner from approximants to stops, including nasals, and in place from labial to alveolar, and also includes such irregularities as gemination, resyllabification, and devoicing of adjacent segments. This variation, as discussed below, reflects the full range of outcomes found in the other Germanic languages, for example, as dental/alveolar stops in German or the dental approximant in Danish. These sounds are more than distantly related; they are illustrations of the range of variation that was likely to have existed in Proto-Germanic, and resulted in different outcomes in the daughter languages.

3. Proto-Germanic and other Germanic developments

¹⁶ This is currently under investigation. Video-taped interviews are being examined to ascertain whether visual cues can be correlated with acoustic measurements to determine retraction, which will aid in sorting these from measurements corresponding to manner.

Proto-Germanic developed labial, dental, and velar fricatives from Proto-Indo-European (PIE) obstruents, as a result of sound changes described by Grimm's and Verner's laws, as follows: PIE plain voiceless stops became fricatives. The voiced aspirated stops became voiced fricatives, except in initial position, where they became plain voiced stops. Where Verner's Law applied, it converted voiceless fricatives to voiced fricatives after unstressed syllables, which left voiced fricatives primarily in medial position, and the majority of voiceless fricatives occurring in initial and final position. After Proto-Germanic became a root-stressed language, these fricatives would no longer have been in complementary distribution, but the generalities noted above created the perfect circumstances for analogical leveling, which is frequently seen in verbal paradigms, and a different kind of analogical leveling based on the position of the fricative in a word.

There are differences in how the individual Germanic languages handled the dental fricative after the reconstructed proto-language stage, with some of them making multiple changes in place, manner, and/or voicing.¹⁷ The main thrust of changes seems to favor neutralization of the voicing distinction, or a change of one or both phonemes in manner of articulation to stop or approximant. In West Germanic, all instances of /ð/ hardened into stops, leaving only the voiceless dental fricative. In Old High German, Grimm's /θ/ eventually became /d/ and /ð/ became /t/ (essentially reversing Verner's and Grimm's Laws in this respect). By the 8th century, /ð/ had changed to /t/, presumably having first become /d/, as in Old English, then becoming /t/ during the High German Consonant Shift. Orthographically, initial /θ/ was written as <th> (as in *thenkan*), and it was not subject to the High German Consonant Shift, although regular /t/ was (PGmc **tanþ-* > OHG *zand*). As such, it is reasonable to assume that this <th> sound was still distinct at this time, possibly retaining some frication, and/or a dental place of articulation, contrasting with the alveolar /t/, which changed to /ts/ or /s/. Medially and finally, /θ/ began to be transcribed as <d>, presumably representing a stop /d/, in Old High German (as in *zand*), and by the Middle High German period, initial <th> had also become <d>

¹⁷ Examples from various languages are to be found in Appendix A. Behind each of these generalizations, however, lies manifold known and unknown dialectal and individual variation.

(OHG *thenkan* > MHG *denkan*). As mentioned earlier, Old English regained voiced /ð/ from voicing assimilation of /θ/, (*baþian* > [*baðian*]) and some instances of /d/ became /ð/ in Middle English, either by analogy or medial weakening (*burthen*, *mother*), and a few instances of /ð/ became /d/ (*murder*). The Old Saxon development paralleled Old English, with some influence from High German, which became greater in the middle periods of both languages. Old Saxon, from its earliest records (dating only back to the 9th century), utilized the <th> digraph to represent both the voiced and voiceless variant, which was considered voiceless in word-initial and word-final position and generally voiced intervocally (Gallée 1910:185). <ð> and <d> were also believed to represent /ð/, especially in medial position, though <d> (presumably /d/) eventually replaced even initial <th> and <ð> entirely by the end of the 11th century, showing the complete change from fricative to stop. Dialects in Southwest England underwent initial voicing, which may be related to this change, but the continental Low German dialects voiced and hardened initial /θ/ into /d/, and ended up with the voiced stop word-initially and medially, and a voiceless stop in word-final position.

Old Norse retained both the voiced and voiceless dental fricative, which leveled into an assimilatory voicing pattern similar to that found in Old English, with the primary exception that word-final segments were voiced. The orthography in Old Icelandic shows <þ> and <ð> were used variably (as in Old English), though with general patterns in which <þ> was used more commonly for the voiceless and <ð> for the voiced variant. Because the voiced and voiceless variants were in complementary distribution, this written distinction was unnecessary,¹⁸ and <ð> eventually dropped out of written Icelandic until the late 17th century, when it was re-introduced by a few writers, and popularized in the 18th century by Rasmus Rask. In the 20th century, the voicing distinction between <þ> and <ð> was finally standardized (Dalen 2002:1413). In Icelandic and Danish, new voiced fricatives were formed from regular lenition of medial stops, and later from word-final stops as well. Most Swedish and Norwegian dialects witnessed strengthening of the dental fricative to /t/ and /d/. (for example PGmc **tanþ*

¹⁸ Though, one must wonder, why was the <ð> character borrowed, if it did not indicate a voicing distinction? The same question applies to Old English.

‘tooth’ > Swed. *tand*). Danish did as well, but only word-initially. In modern Danish, however, the remaining voiced fricative is produced more like an approximant than a fricative, with virtually no frication (Dan. *tíð* ‘time’ > [tið]). Icelandic voiced fricatives are also classified as approximants, and are in opposition with voiced stops in medial position (Höskuldur 1994:147-9). Faroese took this lenition a step further, losing the sound altogether through vocalization, replacement, and complete assimilation, though the orthography established in the mid 19th century retained the etymological spelling (*deyður* ‘dead’ > [dejur]. See Barnes & Weyhe 1994:194).

We know little about the East Germanic branch, because there are very few written records and no living language that represents this branch. From the Gothic texts we do have, the dental fricative appears to be represented by two letters, a rune (not thorn) that represents the voiceless fricative and a type of letter <d> that could double as a voiced fricative or stop. From the distribution of these letters and based on the patterns in the other Germanic languages, it is assumed that medial <d> represented /ð/, while elsewhere the rune represented the voiceless variant, including word-initially, word-finally, next to another voiceless sound, and when geminated (Robinson 1992:56). Gothic is unique in the outcome of Verner’s law, in that it does not follow the same pattern as any of the other Germanic languages. The reconstruction of this outcome is problematized by the fact that the only Gothic texts to survive are much earlier (4-6th century) than other Germanic texts, and that they are few. It is not agreed upon whether Verner’s law did not completely apply, or applied differently somehow, or if Gothic underwent analogical leveling much earlier than the other Germanic languages. Because an alphabet had to be invented for Gothic, relying heavily on Greek and to some extent Latin, one might be inclined to believe that the irregularities are not caused by interchangeability of letters, and indeed, the texts show regularity in their preference for one variant over another in specific lexical items. This problem is not to be solved here, but illustrates another pattern of variation of the dental fricative.

To summarize: each language took a slightly different path after the changes described by Grimm’s and Verner’s laws, with the outcomes of each finding representation in the variation of the dental fricative in American English as described

above. Verner's Law describes a specific type of voicing assimilation that left Proto-Germanic with a voiced and voiceless dental fricative in complementary distribution. After the shift from pitch-accent to root-stress, the voicing of fricatives was no longer in complementary distribution, which seems to have resulted in an imbalance that sought resolution in various ways later in each language. At the time of the development of runes in the North and West Germanic branches, there was only one rune for the dental fricative, which could indicate that even at this time, voicing was not distinct. Since that time, each language (and separately each dialect in each language) has gone through multiple phases of either eliminating voicing distinctions by various patterns of complementary distribution or creating distinctions that are more stable by using different places of articulation (such as alveolar or labio-dental) or manners of articulation (such as stops and approximants).

In general, maintaining a voicing distinction in any pair of fricatives is difficult due to articulatory constraints. First, voiced fricatives require the perfect balance of two opposing forces, that is low enough pressure in the mouth so that the buildup of pressure behind the vocal folds is sufficient to set these in motion, but at the same time high enough pressure in the mouth to produce frication (Ladefoged & Maddieson 1996:176-8). This is one reason why many languages do not have phonemically voiced fricatives. Overreaching the voicing target frequently results in an approximant, while narrowing the closure in the mouth to increase pressure for frication can result in a stop. The voicing status of surrounding segments also tends to overlap with the fricative, creating perfect conditions for assimilatory voicing, with neighboring voiceless segments eating away at the voicing of the fricative, and residual voicing of adjacent voiced sounds blending into the fricative. One way in which a language may be more likely to maintain a distinction is if there is at least an additional distinctive feature, such as duration, or a change in manner or place. If one is more fricative-like and another more stop-like, or if one is more advanced and the other more retracted, these seem more likely to survive in opposition. The dental fricative, in particular, is a very uncommon sound among the

world's languages.¹⁹ Additionally, the voiceless dental fricative is the quietest sound (other sounds are frequently measured in relation to how much greater their amplitude is than /θ/ (Edwards 2003)). It is not the case that the dental fricative is doomed or unnatural, but that it is special in many ways that make it a worthy target of investigation, especially diachronically. In order to properly understand the reasons for and ways in which it can change, some synchronic analysis of its properties and specific difficulties will inform us of the very facts that we are missing from its historical profile. This is the case of the American English dental fricative, which continues to display variation of the sort that has led to repeated sound changes, and remains unresolved.²⁰

4. *Discussion and Conclusion*

Modern variation can tell us about the potential directions that a sound change might take. This may be helpful in discovering early sound changes in progress, and making predictions of potential sound changes and potential outcomes. On the other side of the coin, outcomes of sound change can tell us about the variation that must have existed at some stage in a language, and language splits or other multiple outcomes tell us even more about the earlier variation. This may seem an obvious point, that there must have been competing variants, and among these, the “winners” of the sound change are certainly represented. Multiple outcomes provide information about more variants. But, what is the point of reconstructing variation?²¹

We can examine the variation and where it led (and if it didn't lead anywhere, that's important, too). We may be able to make comparisons and draw conclusions from the kinds of variation about the stability of the situation. If we have enough data, we may be able to find out a central target of a phoneme and how far the boundaries extend, and in which directions. We may compare this with modern perceptual research, to see how listeners process different types of variation. From this, and from the outcome of the

¹⁹ Only 32 out of 451 UPSID languages have either or both dental fricatives, only 22 have the voiced dental fricative (Maddieson & Precoda 1990).

²⁰ I use the word “unresolved” here to indicate that the variation is not particularly focused, but is rather spread out in a way that, so to speak, *invites* re-analysis.

²¹ For a discussion of variation and its place in the comparative method, see Joseph 2006.

sound change, we may be able to surmise why a phoneme that is subject to sound change is, so to speak, “unstable.”²² We can then ask, was the instability resolved by the sound change? This may play a key role in chain-shifts and mergers, in which instability of one phoneme is resolved at the expense of another, which may resolve its instability by variation tending towards or away from the other phoneme. Thus, variation that continues to be unstable is more likely to undergo another sound change, quite possibly a contributing factor of the High German Consonant Shift. Unresolved variation may also contribute to analogy of all types.

This gives us some predictive power. If the variation resulting from a sound change is just as unstable as the variation that actuated the sound change, it is likely to change again. If the instability is resolved (perhaps temporarily), then that chapter of sound change may be closed, though if something else in the system changes, it may again become unstable. This is why languages are continually in a state of flux. “Stability” is very transitory, as phonetic variation will always continue to accumulate and the dynamics of the language will change, creating new pressures within the system, and new challenges for the speaker’s mind to sort out. This gives historical linguists an important opportunity to prove our relevance to 21st century linguistics. Scouring the records for evidence of variation before a sound change and reporting in depth on all the variation that is observed after a sound change can help us develop better predictive models. Variation that does not result in sound change must also contribute to this model, so we can better understand under which circumstances a change is not actuated. Combining this information with synchronic analyses of variation in psycholinguistics, phonetics, and sociolinguistics can help us better determine when a sound is likely to become unstable, and what outcomes we may observe. As our probabilistic models become more able to account for this variation, we may be able not only to predict sound change, but also to more accurately reconstruct languages and dialects for which we are lacking direct phonetic evidence.

²² Here the word “unstable” is used to indicate a point at which the mental processes involved with keeping track of the variation and categorization into phonemes, words, and grouping of other information contained in the sound wave, such as indexical information, are forced to make *new* decisions about these categorizations, creating new categories or generalizing across boundaries into other pre-existing categories.

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Appendix A

Lexical correspondences

*PIE	*māter	*pə ₂ ter	*bhrāter	*m̥r-tro	*mad-	*bhreu-	*dī-ti	*tū
*P-Gmc	*mōðer	*faðer	*brōþar	*mur- þra	*mat-	*brauda	*tī-ði	*þū
OIce	móðir	faðir	bróðir	morð	matr	brauð	tíð	þú
Mod. Ice	móðir	faðir	bróðir	morð	matur	brauð	tíð	þú
Dan	mor /mo:a/ (pl. mødre)	far /fa:r/ (pl. fædre)	bror /bro:a/ (pl. brødre)	mord /mo:a ² ð/	mad /ma: ² ð/	brød /brœ ² ð/	tid /tið/	du
Swed	moder	fader	broder	mord	mat	bröd	tid	du
OE	mōder	fæder	brōðor	morþor	mete	brēad	tīd	þū
Mod. Eng	mother /mʌðə/	father /fɑðə/	brother /brʌðə/	murder /mɜdə/	meat /mit/	bread /brɛd/	tide /taɪd/	thou /ðəu/
OS	mōdar	fader	brōðar	morð	mat	brōd	tīd	thū
Dutch	moeder	vader	broeder	moord	(mnd. met)	brood	tijd	(mnd. du)
OHG	muoter	fater	bruoder	mord	maz	brôt	zīt	thū
German	Mutter /mʊtɜ:/	Vater /fatɜ:/	Bruder /brʊdɜ:/	Mord /mort/	(Messer)	Brot /brɔt/	Zeit /tsaɪt/	du
GOT		atta (/faðar/)	brōþar	maúrþr	mats			þu

*PIE	*tong	*bhe-to	*bhe-to	*dont	*an-tero	
*P-Gmc	*þank-jan		*baþ	*tanþ	*anþara	
OIce	þekkja	bað-ast (refl)	bað	tǫnn	annarr	eða
Mod. Ice	þekkja	baða	bað	tönn	annar	eða
Dan	tænka /tɛŋgə/	bada /be:ðə/	bad- /be:ð/	tand /ta:n/	andre /andro/	enten /endən/
Swed	tänka	bada	bad	tand	andra	endera
OE	þencan	baþian	bæ	tōþ	ōþer	eþþe
Mod. Eng	think	bathe	bath	tooth	other	either
OS	thenkian	baðian	bað	tand	ôðar	ettha
Dutch	denken	baden	bad	tand	(ander)	
OHG	thenken	badōn	bad	zand	ander	eddo
German	denken	baden	Bad	Zahn /tsa:n/	ander	oder
GOT	þogkjan			tunþ-us	anþar	aíþþau