

# THE SOCIOPHONETICS OF BRITISH HEAVY METAL MUSIC: T VOICING AND THE FOOT-STRUT SPLIT

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## ABSTRACT

Drawing from Trudgill's finding that some American phonetic features are common in British pop-songs [14], this paper explores whether this principle applies to a genre as distinctly British (in its original form) as Heavy Metal. We worked on a database comprised of the full studio discography, and some isolated vocal tracks and interviews of two bands: Iron Maiden and Def Leppard. We analyzed two phenomena: i) T Voicing as an index of Americanization and ii) if the typical Northern British lack of FOOT-STRUT Split found in Def Leppard's interviews is preserved in songs. Results showed that a certain degree of Americanization is attested. While part of it can probably be attributed to Trudgill's idea that the American cultural domination in the music industry leads to imitation, other factors come into play.

**Keywords:** sociophonetics, metal studies, varieties of English, T Voicing, FOOT-STRUT Split

## 1. INTRODUCTION

In 1983, Peter Trudgill brought to light a tendency for British pop singers to deviate from their spoken accent to adopt American phonetic features when singing, as a consequence of American cultural domination in the music industry [14]. But does this logic apply to all music genres? What about a genre as specific as Heavy Metal?

Heavy Metal was born out of the daily struggles of Northern England's working class youth facing de-industrialization in the late 1970s and early 1980s [17]. Industrial cities like Birmingham or Sheffield became home to many emblematic Heavy Metal bands, to the point that some even argue that Heavy Metal music could only have come from this particular geographical area [7], although iconic metal bands such as Iron Maiden or Motörhead originate from other parts of the country. Northern or not, Heavy Metal is (in its original form) distinctly

British, and the aim of this paper is to study if and to what extent this British identity is conveyed in the music through band members' accents, or if Trudgill's finding can be extended to this very particular genre.

Investigations of accent and dialect features in songs using Trudgill's study as a point of departure have already been done, such as [1] on the band Arctic Monkeys or more generally [9] on British Rock, Pop and Folk. In recent years however, Trudgill's Americanization argument has left scholars somewhat dissatisfied. Though mainly confirming Trudgill's point, [13] has attempted to extend it, drawing on ethnomusicology, the sociology of music and discourse analysis but does admit that the USA model has lost its resonance over the years. [6] argues that this tendency to Americanize pronunciation might be better seen simply as a general style-norm for most Anglophone Pop and Rock. [3] views this Americanization as a restrictive perspective, and analyzes popular music performance through the dimensions of voice and place to which he confers a specific definition, as subordinated to the organizing principles of genre. However, scholars do agree on the fact that there is an undeniable modification of accent from speaking to singing voice, that goes beyond the necessary changes occurring when one sings. This modification is perhaps not as strong today since artists have moved away from the USA model [1, 13], but it was relevant when [14] was published, which roughly coincides with the golden age of Heavy Metal in the years 1976 to 1983 [16].

In order to see whether a certain British identity is maintained in Heavy Metal music despite the established tendency for popular music to follow the USA model, we analyzed Heavy Metal bands' speaking and singing voice; focusing on two main features that distinguish Northern British English and Southern British English from General American: the phonological process of T Voicing and the presence or absence of the FOOT-STRUT Split. T Voicing is a phenomenon that concerns the intervocalic con-

sonant in words such as *city*, *waiting* or *better*, in which the /t/ may end up sounding like a /d/ to certain people, because it is pronounced as a voiced flap or tap [18]. There are disagreements on whether this process is a flap or a tap, hence our preference for the neutral term of T Voicing. Another ground for disagreement with the phenomenon of T Voicing is when it occurs after a nasal, more particularly /n/, in words such as *winter*. While some agree that it is an example of T Voicing [4], others have viewed this specific combination of consonants as actually involving /t/ deletion followed by /n/ flapping [15]. In any case, even if they are not proper occurrences of T Voicing, it is a phenomenon that is considered American and sufficiently similar to T Voicing [18] that we decided to keep it in the study. As for the phonemic FOOT-STRUT Split, [18] describes its absence as the main characteristic distinguishing Northern English accents from Southern English ones, and in this case, General American.

For the purpose of this paper, the Heavy Metal bands Iron Maiden and Def Leppard will serve as examples. It is precisely because those bands are fairly different in terms of themes, lyrics, music and sound that a comparison between them seems relevant. Indeed, Iron Maiden are often seen as the epitome of conservative authenticity in Heavy Metal [12], whereas Def Leppard have attained a legitimate position within the genre by adopting a more commercial position-taking strategy [5], consequently targeting the American market.

## 2. CORPUS

The data consisted of all audio files from all official studio albums by the two bands. Both bands released their debut album in 1980 and their latest album in 2015. The data for Iron Maiden included all of the 153 songs contained in their 16 albums. Def Leppard's 11 albums include 133 songs. We also collected the lyrics for the 286 songs and automatically converted them to phonetic symbols [10]. Since the acoustic analysis of a singer's voice cannot be performed with regular audio tracks where all instruments are mixed together, isolated voice tracks – 6 for Def Leppard and 8 for Iron Maiden – were downloaded from Youtube. A careful auditory inspection was carried out in order to make sure that these isolated tracks really came from the original recordings. And in order to make the comparison between speaking and singing voice possible, interviews – 8 for Def Leppard and 9 for Iron Maiden – whose recording dates span most of the two bands' career were also included in the database.

## 3. T VOICING

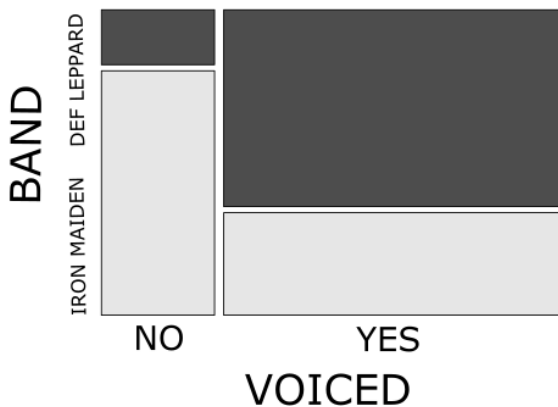
### 3.1. Analysis

Based on the phonetic transcription of all songs in the database, all word-internal /t/ were automatically extracted. Sequences like *gotta*, *gonna* or *wanna* were not regarded as single words and therefore discarded. The authors separately inspected the resulting list of /t/ tokens to decide which ones could be potentially voiced, based on the word's stress pattern. The latter were then manually spotted and segmented with the Praat program [2]. The segmented interval delimited the trochee within which /t/ occurred. The authors independently carried out an auditory analysis in order to determine whether the voiced tapped allophone or the voiceless stop was produced. The potential impact of trochee duration on the realization of /t/ as either a voiced tap or a voiceless stop was tested by means of logistic regression. Very long trochees (38 above 1.5 sec.) were left out of this analysis.

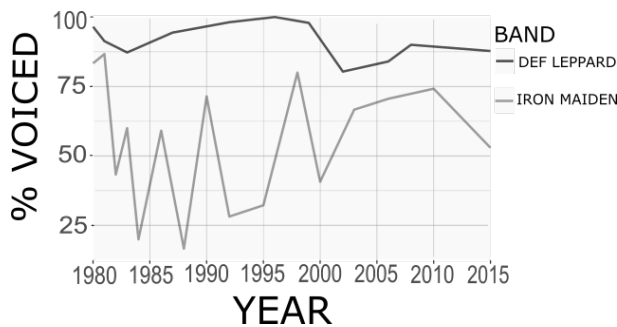
### 3.2. Results

Among the 1,051 potentially voiced tokens in the whole database, 795 were identified as voiced. Fig. 1 shows /t/ counts cross-tabulated by band and allophone (voiced vs voiceless). A two-proportion z-test showed that the proportion of voiced /t/ in the Def Leppard data was significantly higher than the equivalent proportion in the Iron Maiden data ( $\chi^2 = 171$   $df = 1$   $p < 0.001$ ), confirming the visual impression from the figure that the bias toward T Voicing is greater for Def Leppard. The proportions of voiced (91.4 %) and voiceless (8.6 %) /t/ for Def Leppard were submitted to a binomial test in an attempt to check that the deviation from perfect equal frequency was significant, which turned out to be the case ( $p < 0.001$ ). The same procedure for Iron Maiden – voiced (55.5 %) and voiceless (44.5 %) – reached statistical significance too ( $p = 0.018$ ). Fig. 2 shows the proportion of voiced /t/ per album for each band as a function of time. The logistic regression with type of /t/ allophone as dependent variable and band and trochee duration as independent variables showed significant effects of band ( $p < 0.001$ ) and duration ( $p < 0.001$ ) but no significant interaction ( $p = 0.072$ ). In other words, if the band is Def Leppard, the likelihood that T Voicing will occur increases, and if duration is short, then T Voicing is more likely to happen too. The lack of interaction shows that the effect of duration on T Voicing is similar in both bands.

**Figure 1:** Frequency of voiced and voiceless allophones of /t/ in Def Leppard and Iron Maiden's entire studio discography.



**Figure 2:** Proportion of voiced /t/ over time.



#### 4. FOOT-STRUT SPLIT

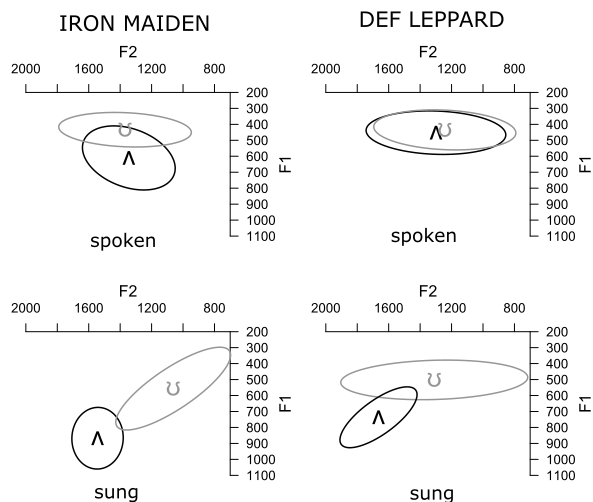
##### 4.1. Analysis

The vowels / $\Lambda$ / and / $\upsilon$ / from the interviews were segmented and their F1 and F2 values at temporal midpoint were manually extracted with Praat [2]. The data for Iron Maiden contained 185 / $\Lambda$ / and 69 / $\upsilon$ / tokens. For Def Leppard, 153 / $\Lambda$ / and 52 / $\upsilon$ / were analyzed. The two phonemes were also extracted from the isolated vocal tracks we had collected. While formant estimation was quite challenging in the interviews due to speech type (spontaneous) and the poor quality of some recordings, most vowels from the isolated sung tracks had to be discarded because no formant contours were visible in the spectrograms. Formant data from sung vowels was available for 24 / $\Lambda$ / and 6 / $\upsilon$ / for Iron Maiden, and 25 / $\Lambda$ / and 6 / $\upsilon$ / for Def Leppard.

##### 4.2. Results

According to Mann-Whitney tests, the difference in F1 between / $\Lambda$ / and / $\upsilon$ / in Iron Maiden's spoken data was highly significant ( $W = 1583$   $p < 0.001$ ) while no statistical difference could be found in terms of F2 ( $W = 6678$   $p = 0.571$ ). The same tests applied to Def Leppard's spoken data showed no such difference in F1 ( $W = 3467$   $p = 0.167$ ) or F2 either ( $W = 3422$   $p = 0.133$ ). The difference between / $\Lambda$ / and / $\upsilon$ / in Iron Maiden's isolated vocal tracks reached statistical significance both in the F1 ( $W = 5$   $p < 0.001$ ) and F2 dimension ( $W = 0$   $p < 0.001$ ). Def Leppard's sung vowels exhibited a significant difference in F1 ( $W = 4$   $p < 0.001$ ) and a marginally significant difference in F2 ( $W = 28$   $p = 0.017$ ). The results are displayed in Fig. 3 where ellipses encompass one standard deviation around the mean.

**Figure 3:** F1 and F2 values in spoken and sung vowels.



#### 5. DISCUSSION AND CONCLUSION

One of Trudgill's conclusion is that it is fitting to sound American when performing a predominantly American activity [14]. Heavy Metal has undeniable British origins but despite that, pronunciation traits associated to a British identity are not fully preserved in the songs of Iron Maiden and Def Leppard. While it is indisputable that their accents are Americanized, there are other factors apart from the desire to imitate American phonetic features that seem to favor the realization of T Voicing and the FOOT-STRUT Split.

While both bands seem to favor T Voicing in

songs (whereas auditory analysis tells us that they do not show this trait in interviews), they do not do it to the same extent. Def Leppard have displayed a strong preference for the voiced allophone throughout their career. While Heavy Metal is not per se American, the US market was a bigger and more lucrative market than its British equivalent [16], which might have influenced a band like Def Leppard to turn itself towards the USA early on in their career. Their fascination with the USA was seen as offensive by their early British followers, culminating in the public throwing garbage at the band on stage at the 1980 Reading Festival in England [11]. The very high proportion of the voiced allophone in Def Leppard's music could thus confirm the point of view expressed in [5] that the 1980s saw the need for certain metal musicians to borrow from the popular cultural mainstream to gain success in the field. This is corroborated by the fact that Def Leppard's music is considered to belong to a subgenre of Heavy Metal known as Lite or Pop Metal [16]. Often scorned, it is seen as lacking authenticity compared to canonical Heavy Metal [16], providing a potential explanation for the move away from its traditional British origins and in turn, accent. Conversely, although T Voicing is on average more frequent than the voiceless plosive allophone in Iron Maiden, the proportion of voiced /t/ is lower than in Def Leppard. Iron Maiden differs in terms of authenticity from Def Leppard: they have mostly stuck to their roots when it comes to music production, embracing the identity generated by their early creativity [12] and have established themselves as an authority in Heavy Metal by rarely deviating from their musical standards. As a result, T Voicing may be less frequent because they are maintaining more of their British identity.

Another explanation for Iron Maiden's propensity to slightly favor T Voicing over its voiceless counterpart is the possibility that it is easier to produce in a sung context. [9] argues that a voiced /t/ is more sonorous and thus more singable. [4] shows that a T Voicing articulatory configuration is more similar to the configuration of vowels than that of consonants, which seems like a plausible reason to favor T Voicing in singing as a way to ease the transition from vowel to /t/ to vowel. Furthermore, [8]'s finding that T Voicing involves a shortening of closure duration could be seen as another factor if one assumes that the goal of singing is to minimize moments where voicing is interrupted, as they make singing more difficult [9].

This however does not account for the uneven distribution of T Voicing over the years in Iron Maiden, as can be seen in Fig. 2. Six albums show a par-

ticularly low proportion of voiced /t/. The first two Iron Maiden albums, which have comparatively high proportions of voiced /t/, were recorded with singer Paul Di'Anno, who was replaced in the third album by main vocalist Bruce Dickinson. Dickinson also left the band from 1993 to 1999, resulting in two other albums being recorded with singer Blaze Bayley. This change of personnel adds yet another potentially confounding factor to the analysis.

A last remark concerns the inconsistency in T Voicing for certain words in both bands. We found that a total of 47 word-internal /t/ were realized as both voiced and voiceless in different occurrences, in words such as *water*, *city* or *satellite*. There are rules on the variability of T Voicing, namely that flapping is optional unless preceded by a primary or secondary stress [15], but they apply to actual General American speakers. Another explanation for this variability is suggested by Trudgill. Mainly, this inconsistency in following the USA model can be attributed to lack of ability: most of the modifications made by British singers are variable simply because they are not American English speakers [14, 9].

Although we ran into difficulties with our analyses of the FOOT-STRUT Split due to the poor quality of the recordings, it is still worth discussing what we found. As expected, the lack of the FOOT-STRUT Split observed in Def Leppard's interviews (the band is from Sheffield) is not maintained in their sung productions. Unlike Def Leppard, the FOOT-STRUT Split is present in both Iron Maiden's interviews and songs. This reveals Def Leppard's adaptation to either the standard national British pronunciation or the USA model, which also features this Split [18]. Given the context of the study and the results obtained on T Voicing, we are inclined to think that the latter prevails: the fact that Def Leppard exhibit the FOOT-STRUT Split in their sung productions shows a certain degree of Americanization.

While some American phonetic features are attested, like T Voicing and the FOOT-STRUT Split, three points can be made by way of conclusion. First, neither band demonstrates full Americanization: both Iron Maiden and Def Leppard maintain a non-rhotic pronunciation, where /r/ is excluded from preconsonantal and absolute-final environments, a typical English phonetic feature as opposed to the General American rhotic pronunciation [18]. Second, it seems that other factors, both phonetic and sociological, do come into play on top of imitating the American model. Lastly, because accents in singing voice seem so inconsistent, we posit that perhaps they should be considered varieties of English in their own right.

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