A Probable Case of Clicks Influencing the Sound Patterns of Some European Languages

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John jerome Ohala
University of California, Berkeley

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John J. Ohala

Department of Linguistics,
University of California,
Berkeley, Calif., USA

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Abstract

In the history of various European languages (Latin, Spanish, English, Swedish, and various dialects of French) there are instances of the cluster *mn* appearing as *mpn*. There are philological controversies as to whether this 'epenthetic' *p* was actually pronounced or was just a learned hypercorrect spelling. I offer here a novel phonetic scenario supporting the claim that the *p* was pronounced and arose in a phonetically natural way: I posit that in the *mn* cluster there was temporal overlap of the *m* and *n* closures. The simultaneous labial and apical closure would create a pocket of air between them which, when the labial closure was released, would undergo a momentary rarefaction of pressure and thus be released with a click-like burst. Listeners would be likely to interpret this stop burst auditorily as a pulmonic [p] and this would be the basis of their own pronunciations.

1. Introduction

In this paper I offer a phonetic explanation for the introduction of the [p]'s in [mn] clusters as exemplified in table 1. Before launching into the details of the account there is some background to discuss.

2. Other Cases of 'Epenthetic' Stops

As such, so-called intrusive or epenthetic stops are familiar in many languages, both diachronically and synchronically. Table 2a gives some examples of intrusive stops that are due to sound change and table 2b some examples of what might be synchronic, non-dis-

John J. Ohala
Department of Linguistics
University of California
Berkeley, CA 94720 (USA)

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Table 1. Examples of *mn* > *mpn* in various languages

Middle English (OED)

nempne < nemna 'to name'
dampne ~ dempne < damn
solempne < solemn
sompnen < somnian 'collect, sum'
sompnour < somnour 'summoner'
dampnable (< Latin dampnabilis?) < damnable

Latin [Brugmann, 1904, pp. 230–231; Leumann, 1977]

dampnum ~ damnum
sollempnis ~ sollemnis
columpna ~ columna
alumpnus ~ alumnus
sompnus ~ somnus
contempno ~ contemno
condempnaveris (< Cato, 2nd c. B.C.)
sollempnia (< Cato, 2nd c. B.C.)

Old Spanish [Millardet, 1923, pp. 293ff.; Menendez-Pidal, 1926, pp. 315–316]

hombre < homĭnem
nombre < nōmĭne
hembra < femĭnam
nopne < nomĭne
alupnar < alumĭnare
firmedumpne ~ firmedumbre (< firme-dumne) 'firmness'
costumpne ~ costumne ~ costumbre

Landais Dialects of French [Millardet, 1923]

dampnadge	< damnaticu
condempna, condampna	< condemnare
sollempnes, solempnials	< solemnis
nompnar	< nōmĭnare
fempne	< fēmĭna

Old Swedish [Wessén, 1951, p. 32]

nampn (< namn) 'name'
hämpna < hämna 'revenge'

Old Provençal [Grandgent, 1905]

dompna < domna < domĭna
dampnar < damnare

Table 2. 'Epenthetic' stops

a. Historical, phonologized, stops	
English	glimpse < gleam dempster < deem + ster
Sotho	vontʃa 'to show' < *voniʃa (causative of 'to see') [Meinhof, 1929, p. 49, transcription simplified].
Greek	hesthlos < heslos [Wetzels, 1985]
Italian	Ischia < *iskla < *istla < Latin insula 'island' [Wetzels, 1985]
b. Synchronic, phonetic, stops	
English	some[p]thing team[p]ster
	pul[t]se Il[t]se

tinctive, intrusive stops. But the environments in which these stops appear are quite different from those in table 1. As the extensive phonetic and phonological literature on this topic makes clear [Bindseil, 1838, cited by Weymouth, 1856; Passy, 1890, pp. 215–216; Grandgent, 1896; Phelps, 1937; Millardet, 1910; Ohala, 1971, 1974; Barnitz, 1974; Fourakis and Port, 1986], these stops arise as epiphenomena from the assimilatory blending of two adjacent consonants, thus the labels 'intrusive' and 'epenthetic' (< ἐπένθεσις 'insertion; placing in addition') are not totally appropriate.[1] For example, the [p] in *warm*[p]*th* arises from the assimilatory denasalization and devoicing of the latter portion of the [m] under the influence of the orality and voicelessness of the following [θ]. In the case of the [t] in *el*[t]*se,* the stop comes from the delateralization and devoicing of the latter portion of the [l] under the influence of the following voiceless median (i.e., non-lateral) fricative [s]. I have attempted to give a unified account of these phenomena [Ohala, in press] and have proposed for them the more descriptive label 'emergent' stops, using the term 'emergent' as in evolutionary biology: a novel structure that arises due to the fortuitous re-arrangement of *pre-existing* elements.

A summary of that account is the following:

(1) Given two vocal tract configurations, X and Y, each of which creates a defined air space having two valves, a and b, through which, if open, air may flow, and given a sequence of these two sounds XY, where X has a open and b closed and Y has a closed and, optionally, b open: in the transition between X and Y there may occur the simultaneous closure of a and b, thus forming a stop which will be released by the first valve to be opened.

In the case of nasal + oral obstruents, the oral valve (closed during the production of the nasal consonant) will be the first to be released

[1] However, see Piggott and Singh [1985], Wetzels [1985], Clements [1987], who regard one or more of these cases as involving true epenthesis and motivated as repair of non-optimal syllable structure.

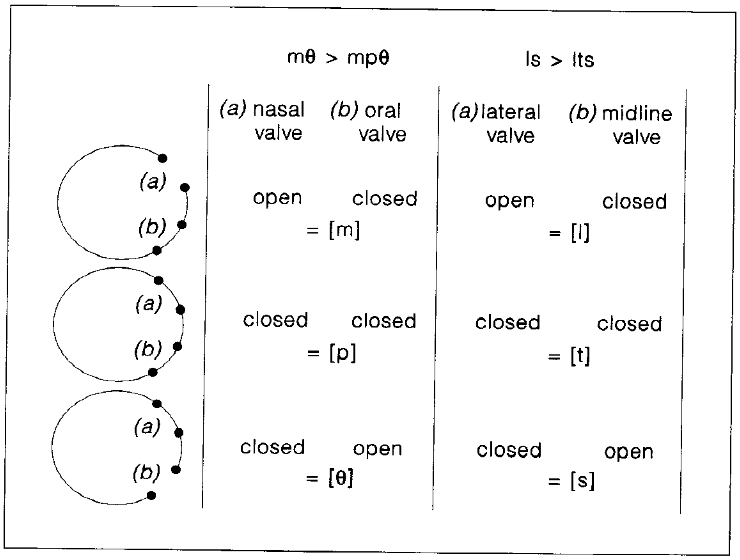

Fig. 1. Left column: Schematic representation of the vocal tract as an air space with two valves, *a*, and *b*. The middle and the right columns outline how sequences like *mθ* and *ls*, which have complementary states of their valves, can, in the transitions between the two sounds, produce an emergent stop due to simultaneous closure of both valves.

and so the emergent stop will be homorganic with the nasal. In the case of oral obstruent + nasal, it is the nasal valve (closed during the production of the oral obstruent) which will be released first; this will yield a nasally released stop whose 'place' will be associated with the following nasal, e.g., Sanskrit *griṣma* ~ *griṣpma* [Varma, 1961, p. 123]. Similar principles govern the place of the stop in clusters of the sort *ls* and *sl* where it will be, respectively, a *t* homorganic with the *s* and a laterally released *t*. Figure 1 presents a schematic representation of this principle and indicates how this would apply to phonological processes such as *mθ* > *mpθ* and *ls* > *lts*.

Restricting the discussion to cases where a nasal is part of the cluster, there are two cluster types: one, like *warm*[p]*th*, where there is a nasal and an adjacent oral obstruent, and another, like *thimble*, where there is a nasal and an adjacent sonorant. In the first case, the oral obstruent requires a closed velopharyngeal valve in order to maintain the air pressure differential across the oral constriction; without the closed nasal valve the pressure would be vented through the nose and the oral obstruent would lack important acoustic-auditory cues from frication or bursts. In the case of *thimble*, there is no aerodynamic requirement that the velopharyngeal valve be closed but there may be an acoustic-auditory reason: nasalization of /l/ and certain other sonorants, including high vowels (i.e., those with a characteristically low F_1 – the region of the spectrum where nasal coupling has its greatest effect) would distort their acoustic shape and possibly cause them to be confused with other sounds.

Thus in both cases there is a nasal consonant which has the oral valve closed and the nasal valve open adjacent to a sound which has the oral valve open and the nasal valve closed – whether the nasal valve is closed either for aerodynamic or acoustic-auditory reasons.

But there are neither aerodynamic nor acoustic reasons for the nasal valve to be closed for either member of an *mn* cluster. Just the opposite: the nasal valve should be open throughout the cluster.

Could the [p] have arisen in this cluster due to dissimilation (or differentiation[2]), as proposed by Millardet [1923, pp. 97ff]? Possibly, but if so, it manifests itself in a very unusual way. The fact that the stop is voiceless [p] even though flanked by the two voiced nasals [m] and [n] seems to be unprecedented and inexplicable. According to the theory of dissimilation I have argued for elsewhere [Ohala, 1981, 1986, 1993], dissimilation arises from the listener's hypercorrection or unnecessary normalization of the speech signal when a peculiar sequence of a speech sound and its environment resemble what could be a sound distorted by that environment. For example, in Latin there is testimony from contemporary grammarians that vowels were rounded (presumably non-distinctively) in the environment of /w/ [Devine and Stephens, 1977, pp. 37–42]. It is reasonable to suppose that Latin listeners knew how to 'parse' this non-distinctive rounding off of the vowel and to a nearby [w]. Given the word *quinque* 'five', phonetically [kwiŋkwe], some listeners may have regarded the first /w/ as a predictable (non-distinctive) product of the second /w/ and therefore parsed it out of the signal (and formed their own conception of its lexical specification with only the second /w/ present). Thus the pronunciation [kiŋkwe] would arise, the immediate ancestor of Italian *cinque* [tʃiŋkwe].

But it seems unlikely that a [p] would be lost or somehow changed into an [m] in an *mn* cluster such that, given that cluster, the listener would be motivated to 'restore' the deleted or altered [p]. One might make such a case for dissimilation (listener's hypercorrection) if the stop were [b], but in the cases under discussion it rather shows up as [p] with remarkable regularity in the languages where this process is found (table 1).

A final bit of evidence undercutting the notion that this is a dissimilatory process is that the comparable cluster [nm] appears not to have undergone any similar change whereby a stop gets inserted. Grandgent [1905, p. 71] notes that *anma* (< Latin *anĭma)* was dissimilated to *arma* (and in other dialects to *alma* [Meillet, 1903]) but without any stop being inserted between the nasals. There are also other developments for *nm* clusters in other Romance dialects but none include an intervening stop.

3. Philological Controversies

Finally, it must be acknowledged that in many of the cases cited in table 1 there is controversy among philologists as to the significance of the inserted [p]'s.

Regarding the cases in Late Latin (about 3rd century), although Brugmann [1904, pp. 230–231] regarded them as the product of a phonetically natural process, his basis for this is far from clear: he lumps them together with forms showing intrusive stops in nasal + obstruent clusters (Latin *exemp-lum* but *exĭmo; emp-tus* but *ĕmo),* which, as reviewed above,

[2] Differentiation is a phonological process posited by Meillet [1903] to handle cases of sound change where one of two similar abutting sounds becomes more unlike the other. Meillet thought that such cases could not properly be described as dissimilations because, following Grammont, he conceived of dissimilation as arising from a strategy by the speaker to avoid repetitions of two similar articulations and that this would not apply to two abutting sounds. I have presented evidence that dissimilations are triggered by misapprehensions of the listener (essentially that they are due to listeners' perceptual 'hypercorrections' [Ohala, 1981, 1986, 1993]. Given this view, there is no bar to including the cases considered by Meillet under dissimilations; the separate category of 'differentiation' is unnecessary. But it must be added that the various cases Meillet treated as differentiation are a heterogeneous set and some are not covered by any known theory of dissimilation and in all likelihood involve completely different etiologies.

have a phonetic motivation that cannot properly be invoked in the case of *mn* clusters. Leumann [1977, p. 214] regards these forms as hypercorrect spellings influenced by the variants *sumptus* ~ *sumtus* where the former was the 'correct' form (though, coincidentally, the *p* here is originally intrusive but with a historically much more ancient origin).

Janson [pers. commun.] agrees with Leumann but for different reasons: he suggests that the pair forming the basis of the hypercorrection was the verb *contemno,* perfect *contemp-si,* participle *contemp-tus* (the suffix *-n-* here, he notes, is a present marker). Thus, some writers might easily have thought that the *-p-* should have been there in the present (whereas in fact it is almost certainly intrusive, just as in *sumo sumpsi sumptus).* From this beginning, the fashion of *-mpn-* for *-mn-* might have spread. Janson adds that Latin spelling in late antiquity was a matter for the schools, mostly archaistic and far removed from the actual pronunciation.

Janson also advises against attaching too much importance to the forms *condempnaveris* and *sollempnia* which are attributed to Cato (about 200 B. C.), but which are transmitted only in quotations from late Latin writers and may have been made to look as they thought old Latin should look.

Grandgent [1905, p. 70] suggests that Provençal *mpn* is merely a spelling variant of *mn* though Millardet [1910, p. 97–98; 1923, pp. 290–298] who also discovered similar forms in the Landais dialects, disagreed and believed that they reflected actual pronunciations.

There is also difference of opinion on the history of some of the Old Spanish forms in table 1. Millardet [1923, pp. 294–297] notes two theories concerning the development *mn* > *mbr* in Old Spanish, e.g. Latin *homĭnem* > *hombre.* According to one theory, the *mn* became *mr* and then later *mbr.* In the other, *mn* became *mbn* and then *mbr.* Millardet himself favors a scenario whereby the *n* first differentiated into the *r,* thus partaking of other differentiations of one or the other member of nasal clusters: I am not in a position to dispute either of these theories – merely to suggest that perhaps a third possibility exists: that at some point intermediate between *mn* and *mbr* there was *mpn.* If not, then some of the forms resulting in *mbr* are not examples of the emergent [p]. But in any case there are different words (the last four in table 1 under Old Spanish) for which an *mpn* stage is attested.

It is also worth noting that the disputes about development of *mn* clusters or the nature of textual variants showing *mpn* in these various languages are, with one exception, *different and based on different language-specific factors.* There is surely some evidential value in the finding that these variants show up in substantially the same form in so many different languages where the language-specific factors varied. I believe this supports the notion that some universal phonetic factors are at work. (Even so, Janson [pers. commun.] suggests caution in treating the data from the various European languages as independent since they all come from cultures that might have been influenced by a spelling fashion in Late and Medieval Latin preferring *mpn* over *mn.* More convincing evidence that *mpn* was a natural outcome of *mn* would come from non-European sources.) In any case, some of the skepticism exhibited as to whether *mpn* clusters represented real pronunciations or viable intermediate stages must have been motivated by the absence of a plausible phonetic account of how they might have originated. I present here a candidate phonetically based scenario for the development of these [p]'s.

4. Emergent Clicks

Marchal [1987] in a paper entitled 'Des clics en français?' presented instrumental phonetic evidence showing the existence of epiphenomenal clicks in French. Specifically, in medial [-tk-] clusters electropalatographic records show temporal overlap of the constrictions for the [t] and the [k]. During this overlap, a small pocket of air is trapped between the tongue and the palate, delimited by the closure all around the alveolar ridge (midline and sides) as well as the contiguous closure in the velic region. In the process of releasing the [t], the area (and thus the volume) of the portion without contact increases. A burst was associated with the [t] release and since it occurred while the [k] closure was still intact, could only be a click release, not the normal release of a pulmonic egressive stop. As mentioned, this click was epiphenomenal, i.e., non-distinctive, born out of the fortuitous temporal overlap of consonantal constrictions in a cluster.

Silverman and Jun [1994] presented aerodynamic data in order to demonstrate articulatory overlap between the two stop closures in Korean utterances like [ipku]. They found marked negative pressures in the oral cavity (pressure sampled just behind the lips) while the pharyngeal pressure was positive. Although they do not mention the term 'click', what they found were epiphenomenal clicks.

In this context the discovery by Ladefoged [1962] is important that labial-velar double consonants which are common especially in West African languages, [k͡p, g͡b] may exhibit negative oral pressures during their formation. Even the labial-velar nasal [ŋ͡m] can involve a click (velaric ingressive) component with its concomitant stop burst on release.

I therefore propose the following scenario to account for the [p] appearing in [mn] clusters:

(a) There was substantial overlap between the labial and the apical closures in these clusters.

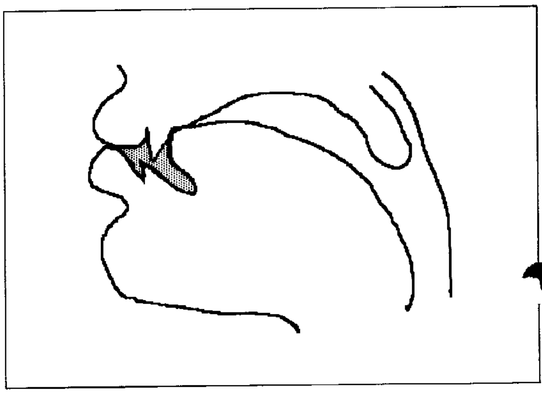

Fig. 2. The shaded area indicates the isolated pocket of air created by the simultaneous overlap of the stop closures for the labial [m] and the apical [n].

(b) This would create a small pocket of air trapped between the lips and the tongue, as shown in figure 2.

(c) Upon releasing the labial closure, the first member of the cluster, this air pocket would probably have its volume increased due to the lowering of the lower lip and, possibly, the jaw.

(d) This volume increase acting on a fixed mass of air would create a negative pressure in this air pocket much as in the case of the labial-velar doubly-articulated nasal [ŋ͡m]. This 'event' would constitute, in effect, a click, although not a click like any that the IPA has thus far recognized or which has been previously attested in any human language.

(e) The release of this click, if the magnitude of the negative pressure was sufficient and the release was abrupt, would be audible to listeners. Presumably these listeners would have had no prior experience with clicks in their language and would interpret it as the most similar sound familiar to them. The sound that it would resemble would be [p], i.e., the stop characterized by a brief, weak, highly diffuse (broad band) burst. Accordingly, if listeners paid any attention to this

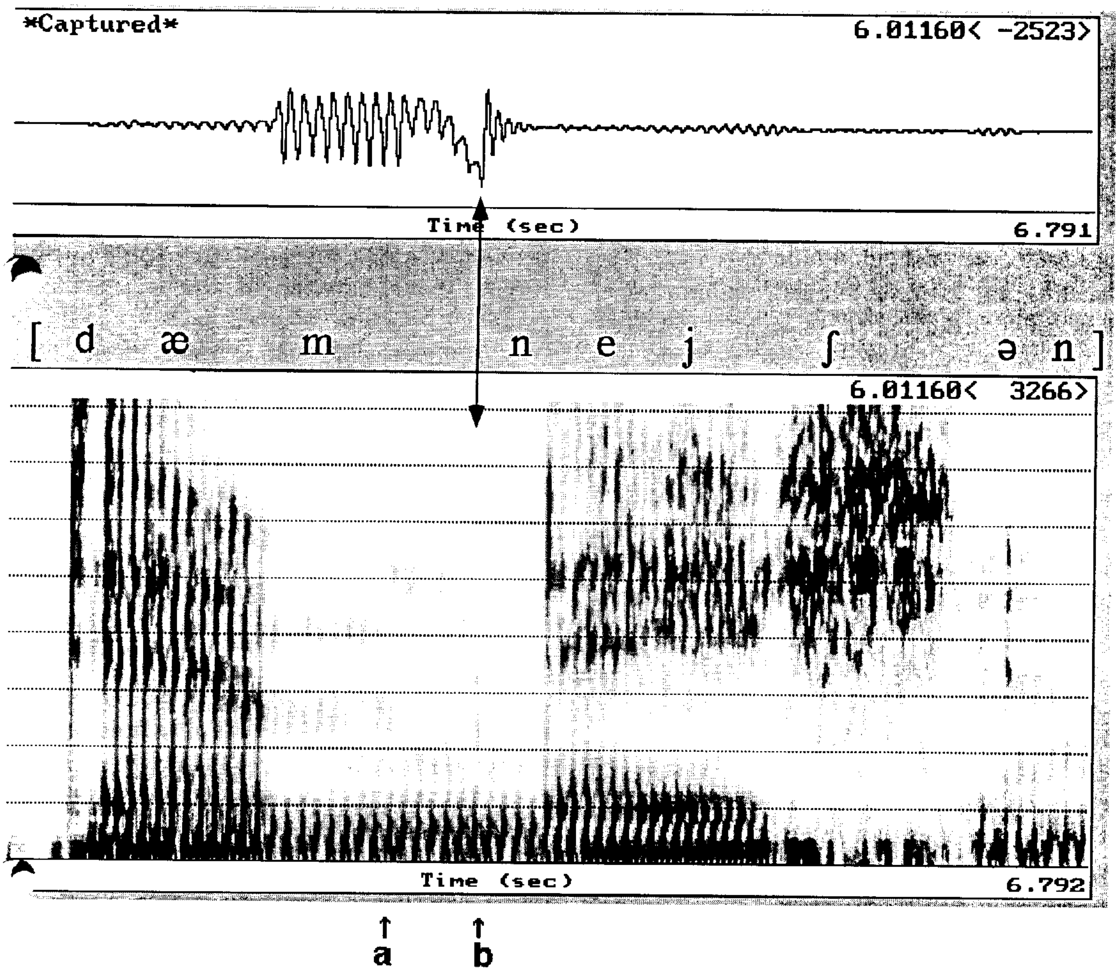

Fig. 3. Time-aligned trace of oral pressure sampled just behind the lips (top) and a wide-band spectrogram (bottom) an utterance of the word *damnation* by the author. See text for detailed discussion.

burst and interpreted it as an independent, distinctive element in speech[3], they would be likely to interpret it as a [p].

I can easily detect such epiphenomonal clicks in [mn] clusters in my own speech in the utterance of such words as *damnation, somnambulant,* and *condemnation,* especially when whispering them. Admittedly, the burst of this click is hard to detect auditorily when these words are uttered on normal voicing (where the amplitude of voicing masks the weak click burst), but I regard it as sufficient for the case I wish to make that such a stop-like burst exists in [mn] clusters and that a rational account can be given for its origin. All that is necessary for the initiation of a sound change is that one speaker produced such a

[3] In the terms of the models of sound change I have previously presented, such an interpretation by listeners would constitute hypo-correction [Ohala, 1993] or a dissociation parsing error [Ohala, 1994].

burst that one listener could detect it [Ohala, 1989, 1993].

Figure 3 presents simultaneous acoustic and aerodynamic data obtained during a single utterance (by me) of the word *damnation* [dæmneiʃn]. At the top is oral pressure sampled via a catheter placed between the lips and projecting just behind them. A wide-band spectrogram is time-aligned underneath it. The signal from the pressure transducer exhibits some microphonics, i.e., periodic pulsations of the glottal wave which are particularly large during a nasal. The onset of the [n] closure, point 'a', which is also the beginning of the period of overlap between the [m] and [n] closures, is marked in two ways in the data: first there is an abrupt change in the spectrum of the nasal murmur and, second, the amplitude of the microphonics in the pressure signal decreases. This weakening of the microphonics presumably occurs because the catheter behind the lips no longer has direct access to the vocal tract proper; it is now sampling pressure in the air pocket trapped between the labial and apical closures (fig. 2). The smaller microphonics that still appear are no doubt due to the acoustic transparency of the tissues. (The fact that during the period of overlap the spectrogram shows only the spectrum characteristic of [n] – and not, say, some 'hybrid' spectrum – is normal since it is only the rear-most constriction in the oral cavity which determines the nasal spectrum [Ohala, 1979]). A clear negative impulse develops during the period of overlap between the labial and apical closures. The overlap, of course, is inferred, but the negative pressure could not have occurred for any other conceivable reason. The end of the overlap, point 'b', is marked in two ways: by the abrupt return of the oral pressure to the resting level and the simultaneous occurrence of the brief broad band noise spike in the spectrogram. The simultaneity of the release of the negative pressure behind the lips and the occurrence of a noise burst (see double-headed arrow) is strong evidence that the two are causally linked. Of course, the speaker is hardly unaware of the hypothesis and one may legitimately question whether figure 3 shows a 'natural' pronunciation. However, it does demonstrate that the posited emergent click formed by the overlap of two nasal consonants is physically possible.

If the account given here of the attested historical variation between /-mn-/ and /-mpn-/ is accepted it would be the *first time that a click has been implicated in the development of a sound pattern in a language outside sub-Saharan Africa.*

5. Discussion

Principle (1) given above to account for the emergence of the stops in cases like *warm*[p]*th* and *el*[t]*se* will also cover the case of emergent clicks if 'valve' is understood as a mechanism for letting air flow into, as well as out of, the specified cavity and if what emerges from the overlap of closures includes clicks as well as stops[4]. In the scheme presented in (1), the labial closure would be valve 'a' and the apical closure, valve 'b'. However, there are some constraints which apply uniquely to the emergent clicks which would not apply to the other types of emergent stops. As discussed above, in the case of sequences of nasal + oral obstruent, the constituent consonants may appear in either order to generate a stop. The same is true of sequences of lateral + median fricative [Ohala, in press]. Theoretically, it would seem that the order of the complementary sequence of valve openings and closings should not mat-

[4] See also Ohala [in press] for the application of this principle to emergent ejectives from the overlap of oral closure plus glottal stop.

ter in the case of emergent clicks, yet in the presentation above it appeared that whereas *mn* clusters produced stops (from clicks), clusters of *nm* did not. The difference is that in an *nm* sequence, a click, if it did form, would be released at the apical site while the lips were still closed. The resulting burst would thus be attenuated by the closed lips and would not be detectable. This would account for the apparently asymmetrical behavior of *mn* vs. *nm* clusters as regards the appearance of an emergent stop.

Thus, emergent clicks should be possible with any consonant cluster where both had full closures, as long as the more forward articulation is in C_1 position. Not only *mn* but also *mɲ, mŋ, pt, pk, dg, db, tk, pn, bn, mt,* etc. Marchal [1987] and Silverman and Jun [1994], cited above, have demonstrated clicks in *tk* and *pk* clusters. When C_1 is a stop and it is released as a click due to overlap with C_2, the burst will probably be interpreted by the listener simply as the 'normal' release of the stop and no sound change would occur. It is only when the listener could not plausibly associate the click release of C_1 with the phonetic character of C_1 that a sound change would possibly occur. This would happen when C_1 is a nasal, for which a stop burst release is normally unexpected. In fact, sequences such as *mt* are known to undergo changes to *mpt,* e.g. English *empty* (< OE *ǣmettig, ǣmtig,* 'empty, unoccupied'), Dutch *hemt* ~ *hempt* 'shirt' [Wetzels, 1985]. In such cases the usual explanation is to regard the emergent stop *p* as having formed by the overlap of the closure of the velic valve and the labial valve but it is possible that some of these cases may have involved overlap of the closure of labial and the apical valves thus resulting in a click release at the labial site which was then interpreted by listeners as a [p], as with the *mn* > *mpn* cases discussed above. This issue deserves further study.

I have focused on cases where clicks formed due to the fortuitous overlap of oral constrictions. What about cases of intended overlap? As noted above, Ladefoged [1962] has already documented with instrumental evidence the existence of a click element in the production of the labial-velar double consonants [k͡p, g͡b, ŋ͡m]. In the case of the (somewhat rare) labial-apical stops [p͡t], [b͡d], e.g., in Chaddic languages such as Margi and Bura, Maddieson [1983] has conducted a pertinent phonetic study. He examined these sounds in the speech of a Bura speaker in order to evaluate the claim that these were singleton, doubly articulated, consonants, not clusters. He found clear acoustic evidence that the labial and apical closures were not completely in phase since the onset of the stops showed transitions characteristic of a labial closure and the offset of an apical closure. In addition he found a brief stop burst in the middle of the consonantal closure and concluded from this that the labial release could only show a burst if it was released prior to the formation of the apical closure (because if the apical closure was made prior to the labial closure it would effectively continue to trap the air under pressure behind it and thus prevent any stop burst). Hence he concluded that these were clusters of sequentially formed stops rather than doubly articulated stops. But from the account given here of how a labial-apical overlap in a nasal cluster may exhibit a stop burst, the existence of the burst in the Bura stops examined by Maddieson cannot, without further evidence, be used to rule out overlap between the labial and apical closures in these stops. The burst which was found could be the burst from a click (as in the *mn* clusters discussed above), and, if so, would arise precisely because of overlap between the two places of closure. Further research is required to resolve this point.

The reader may or may not be convinced by my argument that instances of the change *mn* > *mpn* in the historical record came about from a fortuitous click produced to the articulatory burst that one listener could detect it [Ohala, 1989, 1993].

Figure 3 presents simultaneous acoustic and aerodynamic data obtained during a single utterance (by me) of the word *damnation* [dæmneiʃn]. At the top is oral pressure sampled via a catheter placed between the lips and projecting just behind them. A wide-band spectrogram is time-aligned underneath it. The signal from the pressure transducer exhibits some microphonics, i.e., periodic pulsations of the glottal wave which are particularly large during a nasal. The onset of the [n] closure, point 'a', which is also the beginning of the period of overlap between the [m] and [n] closures, is marked in two ways in the data: first there is an abrupt change in the spectrum of the nasal murmur and, second, the amplitude of the microphonics in the pressure signal decreases. This weakening of the microphonics presumably occurs because the catheter behind the lips no longer has direct access to the vocal tract proper; it is now sampling pressure in the air pocket trapped between the labial and apical closures (fig. 2). The smaller microphonics that still appear are no doubt due to the acoustic transparency of the tissues. (The fact that during the period of overlap the spectrogram shows only the spectrum characteristic of [n] – and not, say, some 'hybrid' spectrum – is normal since it is only the rear-most constriction in the oral cavity which determines the nasal spectrum [Ohala, 1979]). A clear negative impulse develops during the period of overlap between the labial and apical closures. The overlap, of course, is inferred, but the negative pressure could not have occurred for any other conceivable reason. The end of the overlap, point 'b', is marked in two ways: by the abrupt return of the oral pressure to the resting level and the simultaneous occurrence of the brief broad band noise spike in the spectrogram. The simultaneity of the release of the negative pressure behind the lips and the occur rence of a noise burst (see double-headed ar row) is strong evidence that the two are cau sally linked. Of course, the speaker is hardl unaware of the hypothesis and one may legi imately question whether figure 3 shows 'natural' pronunciation. However, it doe demonstrate that the posited emergent clic formed by the overlap of two nasal cons nants is physically possible.

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[4] See also Ohala [in press] for the application this principle to emergent ejectives from the overl of oral closure plus glottal stop.

overlap of the *m* and *n*, which click was reinterpreted by listeners as a *p*. But at least I hope the argument demonstrates that this issue, as with many important issues in phonology, will not be fully resolved without fully embracing the data, methods, and theories of phonetics.

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