

SYLLABIC AND NON-SYLLABIC /l/ AND /n/

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1. INTRODUCTION

One controversial issue in phonology has been the interpretation of syllabic consonants in English. Whether syllabic consonants should be given phonemic status or should be interpreted as consisting of schwa plus consonant has divided students of phonology. Cohen (1957) and Wells (1965), among others, have dealt with this problem in detail.

Our interest here is in the phonetic characteristics which differentiate the syllabic from the non-syllabic /l/'s and /n/'s.

Gimson (1970) deals with the problem of the phonemic interpretation of syllabic and non-syllabic consonants (pp. 53-54), and also mentions that /l/ is dark «as a syllabic sound following a consonant» (p. 201). No other phonetic characteristic is mentioned as regards syllabic consonants.

Ward (1968) does not mention what are the phonetic characteristics of syllabic as being different from non-syllabic consonants though she deals with syllabic nasals and laterals (pp. 139 and 142).

O'Connor (1967) tells us that «Syllabic /l/ is usually dark (p. 73) and that syllabic /n/ in [lesn] will have the same length as the final vowel in lesser» (p. 66).

MacCarthy (1967) also says that «syllabic /l/ is always fairly dark (p. 124).

Jones (1962) gives us the fullest account of the phonetic characteristics differentiating the two types of sounds. He says that «a consonant is sometimes given extra prominence by increasing its length and it may thus become syllabic» (p. 56). He also states clearly (Jones 1959) that «in words with syllabic /l/ and /n/ these sounds derive their syllabic character from their length», and together with this increase in length «there is also a compensatory shortening of the preceding sounds».

As for experimental work related to this problem, Lehiste (1964) in her comprehensive study on the consonant /l/ and its allophones, has dedicated one paragraph to syllabic /l/. All the cases analysed by Lehiste are examples in which the syllabic consonant appears at the end of the word, e.g. «apple», «angle», etc. The results at which she arrived are that syllabic /l/'s have a second formant lower than final /l/'s, e.g. «fill», «sell», etc., and also a lower third formant. Other characteristics include the lack of aspiration present in the voiceless plosives which precede them, so that the voicing of the /l/ starts immediately after the release of the consonant, and the relatively great intensity associated with this type of sound. No mention of length is made since these sounds are not in contrast in final position.

2. AIM

In view of the lack of certainty expressed above, it seemed worthwhile to determine the nature and values of the physical cues underlying the distinction between syllabic and nonsyllabic /l/ and /n/.

PART I: ANALYSIS

3. AIM OF THE ANALYSIS

In order to find out what the physical cues just mentioned above are, we shall analyse acoustically pairs of words in which the only opposition was the presence of a syllabic consonant in one of the items versus a non-syllabic consonant in the other. As there is no opposition word-finally all the examples of this type («little», «apple», «sudden») are discarded. Once this category of items is excluded we rely on words where the syllabic and non-syllabic sound appears in medial position. We find that while for /l/ there are several minimal pairs, for /n/ they are scarce.

4. MATERIAL

The following pairs have been chosen:

- 1) nesliŋ-nesliŋ.
- 2) sakliŋ-sakliŋ.
- 3) kədliŋ-kədliŋ.
- 4) gaembliŋ-gaembliŋ.
- 5) laitniŋ-laitniŋ.

1) «Nestling» [ˈnesliŋ] and «nestling» [ˈnesliŋ] are two different words and morphologically, syntactically and semantically they are different. A «nestling», «a young bird still at the nest» may differ from «nestling», present participle or gerund of «to nestle», also in its pronunciation. In Jones' English Pronouncing Dictionary, the former is entered as being pronounced either [ˈnesliŋ] or [ˈnestliŋ], while the latter, the verb form, as [ˈnesliŋ], the most common pronunciation used by native speakers, and [ˈnesliŋ], a variant also used, but less common.

2) «Suckling» [ˈsakliŋ] and «suckling» [ˈsakliŋ] have two different morphological structures, they occupy two different places in the structure of the sentence and they have two different meanings. The former, a noun, means a «baby or young animal not yet weaned». The latter is a verbal form from «to suckle».

The pronunciation given in Jones' E.P.D. is the one given above for both items, but the verbal form has an alternative pronunciation [sakliŋ, a variant relegated to second place, whose pronunciation coincides with that of the noun. It is interesting to note that while in the previous pair the verbal form had as the most common pronunciation the variant with non-syllabic /l/, in this pair the most common pronunciation is with syllabic /l/, even when the pronunciation of both verbal forms in these two pairs is governed by the same rules, (Jones 1959).

3) «Codling» [ˈkədliŋ] and «coddling» [ˈkədliŋ] represent two different lexical items. The first member of the pair is a word made up of two morphemes, one independent morpheme {cod}, and one bound one, {liŋ}, which appeared in the two previous pairs also. The meaning of «codling» is «a young cod» or «a kind of cooking apple». «Coddling», on the other hand, has a different morphological structure since the bound morpheme is {iŋ}, not {liŋ}, and the independent one is the unmarked form of the verb from which it derives.

The pronunciation given here is that given by Jones' E.P.D. where there is also included a variant with non-syllabic /l/ in the verb form; this form is between brackets, indicating a less common variety.

4) «Gambling» [ˈgaembliŋ] and «gambolling» [ˈgaembliŋ-gaembəliŋ], have the same morphological structure since it is the suffix {iŋ} which is added to the unmarked verbal form.

Syntactically they are the same too, since both play the same role in the structure of the language at this level. As far as meaning is concerned they refer to two different actions or activities.

One characteristic of this pair is the absence of a common phonetic form that could be the realization of both items as we saw in previous pairs. In this case both are verbal forms. Another characteristic of this pair is the possibility of a realization [ˈgaembəliŋ] for the second member, alternating with the more common realization with syllabic /l/, according to Jones in the E.P.D.

5) With «lightning» [ˈləɪtnɪŋ] and «lightening» [ˈləɪtɪŋ] syllabic and non-syllabic /n/ will be studied. The two members of the pair differ in their orthography, in their phonological structure, and in their pronunciation. Jones' E.P.D. gives the latter word an alternative pronunciation which is the same as that for the first word, in which case the same phonetic form can be the realization of either word, though it is the realization with syllabic /n/ which is mostly used.

5. INFORMANTS

The informants used in this experiment were Dr. J. B., early thirties, lecturer at the Department of Phonetics, U.C.L., and Mr. S. M., mid-twenties, postgraduate student engaged in research at the Department of Phonetics, U.C.L.

6. PROCEDURE

The items to be uttered were given in a list, in phonetic script, mixed up with other items unrelated to the problem under study here. In the list no two items in contrast were one after the other, but were separated by several other items related to a variety of other linguistic and phonetic points to be tested.

We made use of a sequence of pips as tempo markers in the manner described in Alvarez González (1974).

The list with the items was given to the informants to whom we explained all the steps we were going to take. The informant sat in the middle of the anechoic room in front of a microphone Beyer M 100 at a distance of about a foot from their mouth.

The informant was asked to pronounce each item in the list after the two pips were heard through the loudspeaker.

The microphone was connected to an amplifier the output of which led into a Revox 77A tape recorder.

Broad-band spectrograms were made of all items using a Kay Sona Graph sound spectrograph. Measurements from the spectrograms were made and plotted. The results are given below.

Every item was measured twice. Where the discrepancy between the first measurement and the second was above 8 msec, a third measurement was taken which was final. If the discrepancy was 8 msec or less, the mean value of the two was taken as final.

7. RESULTS

To make things brief I am going to give only the results obtained in pair 1, since the results obtained in the four other pairs are of the same order, as will be shown below in 8, General Summary and Conclusions.

In table 1 we show the durational values for each sound segment for each speaker. The figures given in the table correspond to the average value of two utterances for each item by each informant.

informant	M	B		M	B
n	100	126	n	130	136
e	92	89	e	79	110
s	212	220	s	174	168
l	48	68	l	118	192
i	91	58	i	116	146
η	-	-	η	-	-

Table 1. Duration of the segments in the pair [^hnesliη]-[^hnes|iη].

8. GENERAL SUMMARY AND CONCLUSIONS

Now we summarize the acoustic features which operate consistently to differentiate minimal pairs where syllabic and non-syllabic consonants are in opposition.

a) Syllabic /l/'s and /n/'s are longer than their non-syllabic counterparts. The differences of duration vary according to the different informants. In B this difference is of the order of 200%. The largest difference was 400%, in pair 2, and the smallest 180%, in pair 1. The difference in pair 3 and 5 is 200% and that of pair 4, 250%. In M the percentages were smaller, of the order of 60%. The largest percentage was 140% in the first pair and the smallest 50% in pairs 2 and 3.

b) There exists some difference, too, in the duration of the consonant preceding the syllabic and non-syllabic sound. The difference of duration associated with this consonant is much smaller than that associated with the /l/'s and /n/'s. The percentages also vary according to the speakers. Once more the difference in duration in these consonants is greater in B than in M. In B this difference ranges from 100% in pair 2 to 30% in pairs 1 and 4, and in the two other pairs the percentage noted was 50%. In M pairs the biggest percentage was 50%, in pair 2, and the smallest was 0%, in pairs 3 and 4. In pair 1 the percentage noted was 25% and in pair 5 40%.

c) In the case of /l/, the formant structure when it is syllabic differs from that when it is not, in having, in B examples, F2 at about 1.000 Hz., compared with the same formant in non-syllabic /l/ at about 1.500 Hz., and F3 at about 2.400 Hz., which in non-syllabic examples appears at 2.600 Hz. In M examples the differences are much smaller. Syllabic /l/ has its F2 at about 1.400 Hz., while non-syllabic /l/ has it at 1.500 Hz. The difference in F3 is not consistent. We see, then, that while in informant B syllabic /l/ is dark compared with non-syllabic /l/, which is clear, in informant M differences are minimal and not consistent, and both types of /l/ are clear.

d) Differences in the duration of other segments, although present at times, are not systematic; at least this is true in M examples, though in B pairs the /i/ after the syllabic consonant appeared to be longer rather consistently, with a difference of the order of 20%, which is not very great.

9. DISCUSSION

We saw in the introduction that some scholars, in particular Jones (1962 and 1959), had made the claims that «in words with syllabic /l/ and /n/, these sounds derive their syllabic character from their length» and also that «there is compensatory shortening of the preceding sounds».

In the present experiment we have provided confirmation that this is the case. /l/'s and /n/'s are much longer when they are syllabic. The second remark is correct if it refers to the consonant which immediately precedes the syllabic consonant, though the difference in duration in this case is much smaller than the difference in duration between the syllabic and non-syllabic consonants themselves.

As for the quality of syllabic /l/ the results obtained in this experiment are in agreement with Lehiste's, though the question under study differed slightly. Lehiste concerned herself with syllabic /l/'s at word final and our work dealt with syllabic and non-syllabic /l/'s at word medial. All the same, it is interesting to note that the results agree in relative terms since the figures given in her work for the different formant structures of /l/ are lower in relation to F2 and F3 than the values present in this analysis.

One thing which is not in agreement with Lehiste's results is her statement that the voiceless plosives when followed by syllabic /l/ lack aspiration, so that the voicing starts immediately after the release of the plosive. In this work two pairs have voiceless plosives preceding the syllabic consonant. In pair 2 it was /k/ and in all the cases, i. e. preceding syllabic and non-syllabic /l/, the plosive was aspirated and this happened in the four utterances of each speaker. On the other hand, in pair 5 no aspiration was present in any of the utterances of either speaker. This could be due to the fact that /t/ is homorganic with /n/ and /l/, but not /k/, though this explanation is far from satisfactory. I should favour the explanation that it has to do with the way the plosive is released, and when it is released laterally there will be aspiration but not so if it is released through the nasal cavity.

The statement by MacCarthy (1967) and O'Connor (1967) that syllabic /l/ is «usually» or «fairly» dark is true to a certain extent. In B it was darker than non-syllabic /l/ but not so in informant M.

PART II: SYNTHESIS

10. INTRODUCTION

In this second part of our investigation synthetic speech is used. Synthetic speech presents us with great advantages in the study of speech. To ascertain the role played by any acoustic cue present in an utterance is in many cases a very difficult task in the analysis of speech. With synthetic speech, however, we keep all the cues under control and can put in whatever we want and in the amount we want. As we can alter any of the cues at will, and also by the amount wanted, we can investigate one by one all the potentially significant cues in order to determine which cue or cues are primarily responsible for the linguistic effect caused, or if there is interaction and interdependence between several of them.

11. AIM OF THIS PART

In this part we study the effect that the duration of /l/ has in the identification of either «gambling» or «gambolling».

In Part I we saw that syllabic consonants in word medial position were longer than their non-syllabic counterparts. We saw that there were some differences between speakers in the durational amount by which the syllabic consonants differed from the non-syllabic ones. With synthetic speech we can not only show whether duration is the main cue for the differentiation between the two, but also see where the dividing line is drawn.

Another factor arising from the analysis was that syllabic /l/ had a formant structure dif-

ferent from the non-syllabic /l/, the former being darker, especially in speaker B, than the latter, which was clear. We shall see also whether the formant structure of the /l/ is a necessary cue.

12. PRODUCTION OF SYNTHETIC SPEECH

To produce the synthetic stimuli we used a parallel terminal analog synthesizer controlled by a laboratory computer. The computer was a PDP-12 manufactured by Digital Equipment Corporation, Maynard, Mass., USA.

The synthesiser used, a JAWORD, consists of fourteen time varying frequency and amplitude parameters and an excitation source which may be either pulses, noise or a mixture of both. Only a few, ten at most, of the fourteen time varying parameters can be in action at a given time, depending on the excitation source chosen.

The time parameter in the synthetic stimuli was controlled from the computer. We can alter the durational value of an item also at will and this is what we are going to do here with the /l/. Each alteration of duration produced a new stimulus and this was recorded three times. The output of the synthesizer was connected to the input of a Revox 77A tape recorder for this purpose.

13. MATERIAL

The duration of the different segments were as follows: /ae/ 190 msec including 60 msec of transition at the beginning to mark the velar plosive; /m/ 80 msec, and /b/ 40 msec. The duration of /l/ ranged from 50 to 200 msec in steps of 10 msec. /i/ 90 msec; /ŋ/ 220 msec. The formant structure of /l/ had an F1 at 320 Hz., F2 at 1.480 Hz., and F3 at 2.600 Hz., i.e. a clear /l/.

The reason for choosing this pair was that while other pairs have one pronunciation that can be applied to both members, in this there is no such common form according to Jones' E.P.D., so there is no danger of confusing the two members of the pair.

14. PROCEDURE

Once the 16 stimuli were recorded we intermixed them with other items used to test other hypotheses concerned also with the duration of consonants. This was done to avoid any systematic patterning in order.

The recordings were listened to by 40 young students, male and female, mostly undergraduate, from University College, London. They came from different parts of the country and most of them were reading subjects unrelated to speech. They listened to the tape either through headphones, most of them, or through a loudspeaker.

Each listener was given a sheet of paper on which was typed a number followed by the two or three lexical items to be identified. Both number and item corresponded to the order of stimuli on the tape. The listener was asked to make a cross in front of the lexical item he or she thought corresponded to the stimulus heard.

15. RESULTS

The results obtained were tabulated. In fig 1 we show the percentage of listeners' judgements of the stimuli, as being «gambling» or «gambolling» as a function of the duration of /l/.

We see that, in the context studied, a duration of the /l/ of 60 msec or below is interpreted as non-syllabic /l/, while a duration above 110 msec is interpreted as syllabic /l/. This proves that the duration of the consonant makes /l/ syllabic or non-syllabic. It seems improbable that the formant structure of the consonant makes any difference in the interpretation of these classes of sounds.

The results obtained here support Jones' statement that «syllabic consonants derive their syllabic character from their length» (1959, p. 136).

16. CONCLUSIONS

The results obtained in this experiment give support to the following conclusions:

1) The duration of /l/ distinguished «gambling» from «gambolling»; a relatively short duration was interpreted as non-syllabic /l/ while a relatively long duration was perceived as a syllabic /l/; therefore duration is a sufficient cue to differentiate syllabic from non-syllabic /l/.

2) Though the formant structure of the /l/ was one associated with clear /l/, it did not prevent the item from being interpreted as having syllabic /l/.

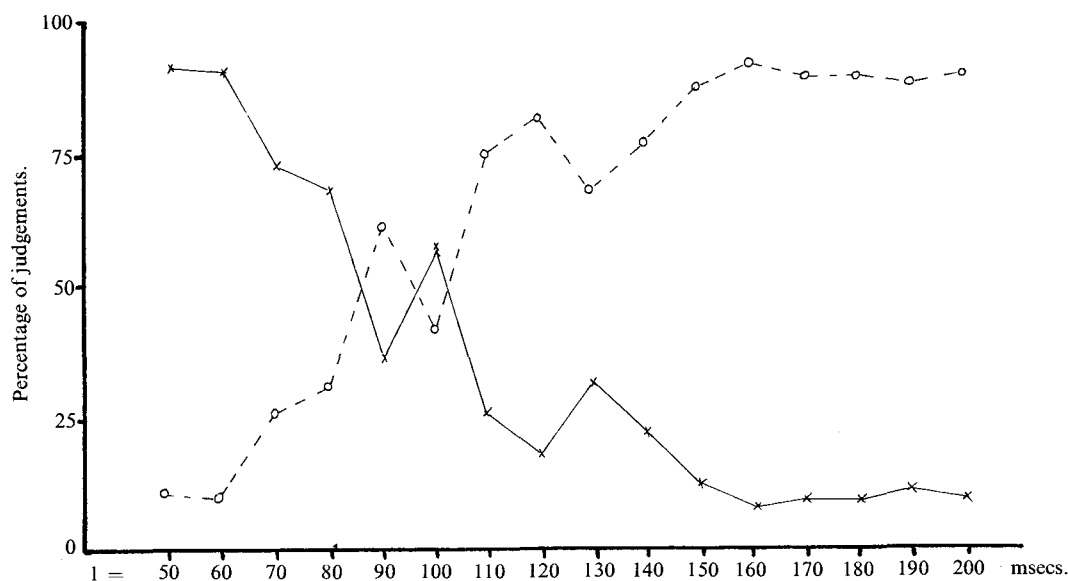


Figure 1. Percentage of listeners' judgements for the test stimuli as being «gambling» x, or «gambolling» o, as a function of the duration of (l).

BIBLIOGRAPHICAL REFERENCES

- ALVAREZ GONZALEZ, J. A. (1974): «Consonant duration in English». Unpublished doctoral thesis. University College, London.
- COHEN, A. (1957): *The Phonemes of English*. Mouton: The Hague.
- GIMSON, A. C. (1970): *An Introduction to the Pronunciation of English*. London.
- JONES, D. (1959): «The use of syllabic and non-syllabic «l» and «n» in derivatives of English words ending in syllabic «l» and «n». *Zeitschrift für Phonetik, Sprach-*

- wissenschaft und Kommunikationsforschung, 12: 136-144.
- (1962): «An Outline of English Phonetics». Heffer, Cambridge.
- LEHISTE, I. (1964): «Acoustical characteristics of selected English consonant». *International Journal of American Linguistics*, vol. 30.
- MACCARTHY, P. (1967): *English Pronunciation*. Heffer, Cambridge.
- O'CONNOR, J. D. (1967): *Better English Pronunciation*. Cambridge University Press.
- WARD, I. C. (1968): *The Phonetics of English*. Heffer Cambridge.
- WELLS, J. C. (1965): «The phonological status of syllabic consonants in English R. P.». *Phonetica* 13: 110-113.

 **INDICE**