

Speech Mechanism and Ease of Articulation: A Case Study of Consonant Cluster Reduction in English

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ABSTRACT

The study investigates the process of speech production based on the activities of the flexible muscles of the tongue when speaking. Speech production has a tendency to drop certain consonant sounds when used in sequences of patterns in particular occurrences in English. This study tries to utilize the process of "ease of articulation" assumption which is inapplicable to the well known phonological approach, known as "context sensitive", when we deal with consonant deletion in normal utterances. "Ease of articulation" depends on less efforts, less time, and less space, with reference to the fast and flexible movements of the tongue, referring to biologically as "economy of description" in modern linguistics. Certain phonological and morpho-phonological rules can handle the problems, with some biological explanation used to explore some facts about speech production.

Key words: speech mechanism, biological activities, sensitive contexts, articulation.

Introduction

By nature , the mechanism of speech production has a tendency to move towards adapting specific patterns of articulation accounted for by a number of phonological and morpho-phonological rules with some constraints that could violate these rules for some physiological reasons in particular contexts that have nothing in common with context-sensitive or context-free known in phonology .

We will try to avoid some simplification of defining the linguistic term "consonant clusters" in patterns which will be clarified throughout this investigation, where the term a "sequence of consonants", or "chains of sequences of consonants " in speech production ; that will be exchangeable with "consonant clusters".

The mechanism of tongue movements, based on a bundle of tireless and flexible muscles when activated relative to the traditional terms, place and manner of articulation, we notice the essential relationship between the parts of the tongue and the places of articulation when sounds uttered in chains of speech according to tongue shape and height. This subject has phonetically been investigated with a fair amount of research, contributing a lot to the dynamics of articulation mechanism (cf. Culter, A.1982, Dickson, R. D.,

and Dickson, W. M. 1982), relevant to the high level of the neurological involvement in the organization of the productive movements resulting in the output of the muscular commands. The transformation of these commands into articulatory movements producing speech sounds in chains of utterances (cf. Clark, J. and Yallop, C. 1995 . PP. 85- 97, and Ladefoged, P., PP.55- 60). Supra-segmentals in English will be avoidable, though they are essential in speech communication and consonant sound segmentation.

Some Functions of the Organs of Speech in Utterances

We know simple facts about human speech sound production in normal situations where sounds influence or being influenced by other neighboring sounds (left to right or right to left); traditionally , sound changing of this kind known as "assimilation", "dissimilation", "co-articulation" that includes segment "insertion" "deletion", etc ... These linguistic terms could be listed under the conventional term "context-sensitive", and "context free" or , as we try to prove in this study, that it could be due to biomechanical performance properties of the oral and nasal cavities ,and aerodynamic reasons. In this case the organs of speech form a biomechanical system, subject to the domain of the brain This system governs all human mechanical and physiological activities, including the neurological system and sub-systems (cf. Clark and Yallop P. 8).

Almost all sound changes in natural languages are traditionally handled by phonological and morpho-phonological rules (exempting historical sound changes), mostly depending on context-sensitive varieties in different phonological occurrences of sound changes, including consonant dropping in consonant cluster, without reference to any sensitivities of neighboring sounds. The essential aim of this paper is to investigate the mechanism of consonant sound dropping in normal English utterances.

Speech sounds do not consist simply of strings of target sound articulations of individual sound segments, since each sound segment is definitely influenced, in some way or another, by the neighboring sounds, as mentioned before, often to a considerable overlapping of articulatory activities when speaking in normal situations, as in /?iNstint /; when the articulation of the Nasal starts with anticipation of the on-set , its off-set will never take place , and its on-set will and the nasality feature will nasalize the preceding vowel sound in /?iNstint / . Here, the tongue, its shapes and heights, should be empirically studied, as it is the main contributor to speech production, in particular consonant and vowel sounds in different phonological patterns. This tongue participation is also accompanied by physiological activities of the pharyngeal walls and the relative down movement of the velum, while speaking (cf. Ali and Daniloff, in particular Fig -1- and - 2- in their study). Timing is essential in any portion of the tongue movement activities when target anticipation is provoked to participate in the production of sound sequences in natural speech.

For the time being, we assume that all consonant dropping in phonology can be handled by phonological or morpho-phonological rules to account for most sound change in actual utterances. We know that Nasals are homo-organic with the following stop (cf. Ladefoged 4th ed . , 2001); and we add that nasals also behave in a very complex way when followed by any fricative consonant sound , as shown with the sound sequence of the word " infant " / ?iNf nt / ----- [?im nt] and " instent" / ?iNsti nt / ----- [? i st i nt] , and "gun shot" / g N s t / ----- [g s t] , etc.... In cases like these the onset of the /N/ will spread over the preceding vowel as a result of the nasalization process, then its offset will not take place; that is, there will be no occlusion for its offset .

In British received pronunciation the /r/ articulation can be handled by postulating, at least, two phonological rules with some minor ones; either it is pronounced trill [r], when followed by a vowel sound, or dropped in the other contexts; then and only then, the vowel before it becomes long-, as in "port" /pɔ:rt/ [pɔ:t], and "water" /wɔ:tə/ [wɔ:tə]

The above phonological cases, and similar activities, like the British /L/, the light and dark ones, are context-sensitive, (or some other kinds of assimilation), and in most cases the rules should be ordered, as shown above with /r/. It is encouraged in situations like this, we apply the process of "economy of description", in particular with "formulas". But when it comes to consonant clusters as /-skt#/ in words like "asked" /?skt/, the problem of consonant deletion can be treated differently. That is, we adopt the process of "ease of articulation", which should be discussed relative to places of articulation, space, time, and energy. In other words, "ease of articulation" can be illustrated by showing why the fast flexible activities of the tongue and its variable shapes and movements may reject or resist producing sequences of consonant clusters as in "asked" and "asks" represented phonetically by most conventional approaches as [?skt], and [?sks] which are impossible to produce in normal and natural utterances; and thus, should be phonetically represented as [?st] and [?s] respectively.

The Complex Motor System of Ease of Articulation

One of the laws that governs human bodies is the principle of minimum effect of (saving time, space and energy) muscle activities, when speaking; that is, to minimize any difficulties facing articulators in particular tongue movements in utterance production (cf. Lindblom 1989, P. 413). This point explains that motor system tends to default to low-cost form of the tongue behavior. It is noteworthy that tongue behavior and consonant deletion occur within lexical items or across word boundaries when articulators are involved in speech production activities; that depends on "very rapid and highly coarticulated articulatory movements", and it is doubtful whether we could achieve anything like the articulation rates of normal running speech (cf. Clack and Yallop, P. 88). It is claimed that the tip of tongue is the fastest of the articulators, that is controlled by muscles and can produce 12 to 18 segments per second in normal speech rate (cf. Daniloff, R. 1973). In sequences of consonant sounds, we notice, that the more significant the change is (in the places of articulation from one segment to the next, as chains of speech, the more difficult it is to articulate; as would be seen with the final cluster /-skt#/ in "asked" and /-Nds/ in "hands" [hez]). The phonological system of English is such that each of these sounds may vary considerably in articulation. To avoid confusion about consonant deletion in the process of articulation, we should stress on that it is actually not one system, but many can be activated as needed. My view is that the /-skt/, or /-sks/ is more difficult to produce than /-st/, or even in /-sk/, shown in "trust" and "asks", respectively. That is to say, here, the movement of the tip of tongue requires more efforts to move from alveolar place of articulation, to velar, and then back to alveolar. This kind of tongue movements is very costly, when time, space and muscle efforts are significantly investigated. We notice that after dropping the /-k- / in /?sks/, the suffix -s will also be dropped as a next morpho-phonological step.

As a consequence to the above assumption the notational term "ideal way" of articulating specific consonant clusters is subject to modification in normal speech production, depending on the nature of these sounds and their production; as shown below:

1- The mechanism in which the parts of tongue can move fast in different directions in a very flexible way; as mentioned earlier in this paper.

2-The effects of the biomechanical performance of the organs of speech with reference to the accompanied activities of the vocal folds and their rates of vibration, besides the up and down activities of the velum, and left to right movements of the posterior pharyngeal wall, while talking.

But, what is noticeable here is that both above points may reflect the level of the articulatory performance with reference to "ease of articulation". This may seem inapplicable to cases where /-Nt/ cluster when followed by a word starting with /k-/ in /d uNtki r/, the /t/ is dropped to be phonetically represented as [d u ki /, though the /N/ and the /t/ have the same place of articulation.

The articulatory sequences (articulated in chains of speech sounds) of a deliberate attention to what is to be said can not always be easily perceived with intelligibility. Definitely, the emotional and states of mind affect the rates of sound production and their qualities. This means that paralinguistic or nonlinguistic knowledge (cognitive situations) contributes a lot to variability in speech sound production. John and Yallop state that the articulatory system is partially based on "mass" and "size" of muscles and subject to "inertia", they resist being set in motion; the greater the mass is, the greater the inertia will be, and have the greater delay, (cf. P.86). This delay may cause, fully or partially, any kind of sound changes including sound deletion without reference to context – sensitive factor.

But this may not be the case when the reverse of tongue movement from /N/ to /t/, then to /k/, the offset of the /N/ overlaps over the onset of the /t/, then switching to /k/ to enable us automatically to delete the /t/ which is the immediate neighbor to the /N/, and goes back to the same place of articulation; that is "alveolar". This process can be exemplified by the linguistic structure "I don't care.", phonemically can be represented as /?aid unt ki r/ to be phonetically represented as [?aid uki]. The simple explanation of this dropping of the /t/ might theoretically be related to the traditional term "plus-juncture" after it which makes it final in utterance production. A similar case can be found in the words "advantage" and "costly", /? dva ntij / ---- [? dva nij], /k stli / ---- [k sli], and "investment" /?iNvestm nt / ---- [?mvesm nt]. This classification is a bit complicated relative to the natural distinction between the terms "dynamic" and "stable" articulators. A stop like /t/ or /d/ is necessarily dynamic: it is characterized by the actions of forming and releasing the stoppage of that consonant, (cf. Clark and Yallop, p. 44); where no one can prolong stops of the kind, other than by maintaining the closure in which no sound is heard during this closure.

The dynamic /t/ production system in most American dialects, phonologically, behaves according to the "ease of articulation" assumption, in most production of this consonant; depending on its different occurrences in normal speech activities. This /t/ is dropped in some occurrences like in words when it takes place after /N/ followed by a vowel sound, as in 'internet' /?int rnet/, [?in net], but not in words like "enter", phonemically transcribed as /?ent r/, and phonetically transcribed as [?ent]. In some other occurrences, it changes to a flap consonant [ɾ], as in "butter" phonemically /b t r/ and phonetically it is [bɾ], that sounds like a syllabic consonant stop, (which is not). The process of this change is not due to context sensitive or non-sensitive, then, why, the /t/ in other occurrences should be articulated, either aspirated or not aspirated depending on context sensitive. Any sound changes of the above type should be labeled under "optional deletion", since it is a regional feature, not a general phonological and linguistic fact about the English phonological system. But when talking about the [t] in "asked", the final sequence /-skt/, it is, almost, always impossible to articulate /t/ as a segment in that sequence; all because of the swift tongue movements from one place of articulation to another; plus time and energy saving, which is due to the term used above; namely "ease of articulation".

Conclusion

The systems of sound distinction in speech perception are both specific in natural language, and unique to the human race, partly because of the unique anatomy of the vocal tract, and the neurological basis involved in actual speech production (cf. Glieman, J. , p. 1) , very little is known about. So caution is necessary in reaching claims with conclusions by going back to some improper assumptions related to context – sensitive and context – free to drop specific consonants in normal speech with inadequate justification, as proved in this paper. Meanwhile, we found that the above two contexts may not apply to a number of consonants when used in final positions in natural articulation when spoken.

Also little enough is known about the complex systems of a number the dropping of specific consonants in speaking particularly when occurring in clusters used in final positions. In this study we found that in some cases of consonant deletion in final clusters are related to the assumption of "ease of articulation", as explained earlier with reference to biological muscular activities while speaking.

We also noticed that the dynamic organs of speech, besides the tongue portions and their fast movements, with the involvement of the uvula, the velum, the interior pharyngeal wall, and the vocal folds, all form a biomechanical system subjects to the domain of the brain that governs all human mechanical activities including speech sound production in communication.

The application of "ease of articulation" procedure, when speaking, could be optionally applied, as the /t/ deletion in specific cluster sequences in most American dialects, or obligatorily used in some other contexts; the first /t/ in "internet " [ʔin net], and the / k / in " asked" [ʔ st]. Also, we noticed that the different shapes and height of the tongue relative to the size of the mouth chamber should empirically be investigated, at least using cinefluorographic studies. Finally , the assumption of "ease of articulation" should seriously be taken when research concerning articulatory problems in phonetics, facing linguistic investigators, having in mind that context sensitive approach may not adequately result in acceptable out-put, without regard to free- context cases or ease of articulation.

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