[s] Under the influence of alcohol

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1. Introduction

This paper discusses the behavior of the segment [s] when native speakers of English are under the influence of alcohol. It is widely known that the speech pattern of an individual changes with the consumption of alcohol, leading to the production of what is commonly referred to as slurred speech. A salient feature of slurred speech is the production of the voiceless post-alveolar fricative. Indeed, when English speakers desire to imitate or mock drunken speech, they inject the sound 'sh' in the discourse at regular intervals. There is evidence in the literature to support the claim that production of the voiceless post-alveolar fricative in intoxicated speech occurs as a result of palatalization of the segment [s]. Based on the data presented in the literature, I propose that the palatalization of [s] is not random. I believe that generalizations can be drawn about the environment where palatalization is most likely to occur. I consider some behaviors of [s] and the voiceless post-alveolar fricative in sober speech. Using what is known about [s] and the voiceless post-alveolar fricative in sober speech, I attempt to explain their behavior in intoxicated speech in terms of phonological theory.

2. Background

Adults speaking in their native language exhibit disordered speaking patterns when they are under the influence of alcohol. Alcohol presents the speaker with a host of challenges to all aspects of language production. Any or all of the lexical, syntactic, morphological, and phonological processes may become degraded.

Sentence-level / gross effects

When intoxicated, speakers may have difficulty retrieving words from memory, leading to pauses and false-starts as sentences are formed (Chin & Pisoni, 1997, p.143). Speakers may reverse or substitute words within a sentence to form 'slips of the tongue', or 'spoonerisms' (Cutler, 2004).

Supra-segmental effects

The drunken speaker may also experience supra-segmental changes to speech. The supra-segmental effects include changes in speaking rate, fundamental frequencies, and pitch variability (Johnson & Pisoni, 1990).

Because alcohol adversely affects an individual's motor skills, the ability to control the active articulators is impaired. The amount of time required to complete some articulations may increase. Other articulations may be cut short prematurely, resulting in only a partial articulation. Intoxication results in an overall decreased rate of syllable production (Chin & Pisoni, 1997, p. 245). Several studies indicate that the time duration of consonants is affected more than the time duration of vowels. Lester and Skousen (1974) state, "lengthening is found for the most part in consonantal segments" (p. 233). Pisoni (Chin & Pisoni, 1997) concluded, "the increased

sentence duration was due largely to increased durations for voiceless segments as opposed to voiced segments" (p. 180). Because the time required to produce some segments changes, but remains nearly the same as in sober speech for other segments, the overall result is syllable distortion. Drunken speech does not sound the same as slow sober speech (Lester & Skousen, 1974).

Alcohol intoxication also affects formant frequencies and pitch variation (Chin & Pisoni, 1997). The average frequency of the second and third formants becomes lowered in intoxicated speech (Chin & Pisoni, 1997, p. 212). Alcohol also can cause a wider variation in fundamental frequency than during sober speech (Johnson & Pisoni, 1990). The consequence of these two effects is speech that sounds lower in pitch overall, and that appears less stable.

Segmental effects

In addition to sentence and syllabic level issues, the speaker may also make errors at the segmental level. The types of segmental errors that have been observed include: deaffrication, spirantization of stops, incomplete production and deletion of liquids, final-consonant devoicing, and palatalization of the fricative [s].

Stops, affricates, and nasals

Production of stops and the stop portion of affricates requires a momentary complete blockage of airflow. The failure to achieve complete closure during stop production in drunken speech results in a fricative-like production (Chin & Pisoni, 1997, p. 181). In a study performed by Lester & Skousen (1974), both the voiced and voiceless English affricates were realized as fricatives. Pisoni provides evidence that misarticulation of stop consonants can also occur across word boundaries in connected speech (Chin & Pisoni, 1997). Pisoni cites an example involving production of the phrase "garbage cans" by an intoxicated speaker. The phrase contains a voiced affricate in the coda of one word immediately followed by the voiceless velar stop in the onset of the second word. The speaker failed to achieve complete closure for either segment (Chin & Pisoni, 1997, p. 181).

Liquids

Errors or complete deletion of liquids [l] and [ɹ] may occur (Chin & Pisoni, 1997, p. 177). The effect on [l] is less pronounced when [l] occurs as the single segment in the word-initial onset, and is more likely to occur when [l] is located non-initially or in unstressed syllables (Chin & Pisoni, 1997, p.264).

Final consonant de-voicing

Word-final obstruents become devoiced in intoxicated speech (Lester & Skousen, 1974). Pisoni observed speakers failing to achieve voicing for word-final fricatives (Chin & Pisoni, 1997, p. 184).

Palatalization of [s]

Lester and Skousen (1974) first reported an alcohol-induced palatalization of the segment [s] in native speakers of English. In 1985, Pisoni also reported having seen instances of productions of [s] as [ʃ] in intoxicated speech (Chin & Pisoni, 1997, p. 184). In 1993, a more detailed study of the environment in which [s] becomes palatalized was conducted by Johnson et al. (1993). The Johnson study utilized a data word list containing instances of the segment [s] occurring singularly in an onset, singularly inter-vocalic, and in contact with stops and affricates. Details of each of these studies are provided in the next section.

3. Literature Review

The data relevant to the discussion of palatalization of [s] comes from three distinct periods of investigation into the nature of alcohol's effect on speech. The first set of data comes from Lester and Skousen (1974), who first documented an alcohol effect on the segment [s]. The second set comes from the investigation of the Exxon Valdez accident, in which Pisoni and Johnson analyzed voice recordings of the ship's captain, Joseph Hazelwood, looking for possible indications of intoxication (Johnson, Pisoni & Bernacki, 1990; Tanford, Pisoni & Johnson, 1992). Among the features that they searched for in the voice recordings was the palatalization of [s]. The third data set results from laboratory research that was conducted by Johnson et al.(1993), with the purpose of isolating the environment in which palatalization occurs.

Lester and Skousen (1974)

The intoxicated subject was asked to read words from a prepared list, and then engage in a few minutes of impromptu monologue or dialog with one of the test administrators. The prepared word list that was presented to the subjects is as follows:

(1) shrimp, Sue, shoe, light, bed, bread, rabbit, church, judge, spin, pin, sing, witch, which, mom, none, pray, play, right, refrigerator, leisure, garage, cut, dog, yes, happy, historical, first, tough, this, thin, either, ether, zoo, tease, keen, bait, bought, book, locomotive, joy, house, kill, hand, mush, lust, stress, bet, tooth, bin

The authors report that [s] was realized as the voiceless post-alveolar fricative in the following words:

(2) yes, spin, first, lust, stress*, historical

** In the case of the word 'stress', the [s] occurring in the onset was palatalized. The [s] occurring in the coda was not palatalized*.

Note that there are other words in the list that contain the segment [s] for which the authors do not mention observing palatalization. These words are the following:

(3) Sue, sing, this, house

Note that words containing the voiceless post-alveolar fricative appear in the list in (1). They are as follows:

(4) shrimp, shoe, mush

Of the three words in (4), the authors confirm that the first word, *shrimp*, was correctly produced. No information is given about production of [ʃ] in the remaining words in (4).

The Exxon Valdez Accident

The data comes from the investigation of the Exxon Valdez accident that occurred on March 24, 1989. Audio tapes of the voice of the ship's captain were obtained by the National Transportation and Safety Board (NTSB). At the request of the NTSB, linguists lead by David Pisoni and Keith Johnson analyzed the tapes for indications of alcohol intoxication in the captain's speech. The results of the investigation were published in several reports. I present information from two of the reports below. Following the data from the reports, I also provide a transcript of the Exxon Valdez's captain's words at the time of the incident.

Accident Report (Johnson et al., 1990)

The data from the voice recordings made on board the Exxon Valdez contained a great deal of background noise. Performing transcriptions manually proved to be difficult. Therefore, acoustic analyses were performed to examine the supra-segmental characteristics of the captain's speech and his production of the segment [s] in the word 'sea'.

The researchers sampled the data at five time periods, with the goal of comparing the captain's speech before, during, and after the grounding of the ship. They chose the time points of -33 hours, -1 hour, time of the accident, +1 hour, and +9 hours. Negative time represents points in the tape before the accident. The data from the samples is shown below in Table 1.

Table 1. Indications of [s] palatalization and supra-segmental effects in samples from Exxon Valdez tapes

	-33 hours	-1 hour	time of the accident	+1 hour	+9 hours
sea [si]	[s]	[s]	[ʃ]	[ʃ]	[s]
Exxon [ɛksɑn] or [ɛksən]	[s]	no data	[ʃ]	no data	no data
supra-segmental effects	none	yes	yes	yes	none

Five occurrences of the word *sea* were identified in the tapes corresponding to the five time references. The two occurrences of the segment [s] for the time periods prior to the accident did not show evidence of palatalization. The samples at the time of the accident and at 1 hour afterward showed evidence of palatalization. The final sample, taken at a point 9 hours after the accident, did not show evidence of palatalization.

Supra-segmental changes were found at the time intervals 1 hour prior to the accident, time-of-accident, and 1 hour after the accident. These supra-segmental effects included a slower speaking rate, lower fundamental frequency, and greater variation in pitch (p. 225). The authors provided arguments against the possibility that the supra-segmental changes could have been due to fatigue or emotion. The authors concluded that the supra-segmental effects were most likely due to intoxication.

What gave the researchers difficulty was explaining why data at the time interval 1 hour prior to the accident showed supra-segmental changes, but no palatalization of [s] in the word *sea*. The authors concluded their report by stating that, based on the supra-segmental evidence, the captain was likely to have been intoxicated at the time of the accident. However, establishing the captain's state of intoxication with complete certainty was not possible due to the absence of palatalization of [s] in the word *sea* at the time 1 hour before the accident (p.236).

Accident Report (Tanford et al.,1992)

This report regarding the Exxon Valdez accident contains an interesting comment regarding palatalization of [s] in the word *Exxon*. The researchers state that they paid particular attention to the [s] production in the phrase 'Exxon Valdez'. They noted that, although the captain pronounced *Exxon* correctly the day before the accident (-33 hours), he produced it as [ʃ] at a point in the tape around the time of the accident. They state that the production of the voiceless post-alveolar fricative was perceived audibly and was also confirmed by spectral analysis.

Data (Exxon Valdez Audio Archives and Transcript)

Archives containing excerpts of the voice recording and a transcript of the captain's call to the Valdez traffic center to report the incident are available online. A copy can be found at the Anchorage Daily News website at http://www.adn.com/evos/pgs/intro.html. A copy is also available at The Whole Truth, located at http://www.wholetruth.net/history.htm. Below, I present the transcript of Captain Hazelwood's words spoken just after the grounding of the ship.

> Hazelwood: "Yeah. Ah, It's Valdez back. Ah, we've- ah, should be on your radar there- we've fetched up, ah, hard aground, north of Goose Island, off Bligh Reef, and, ah, evidently, ah, leaking some oil and, ah, we're gonna be here for a while and, ah, if you want, ah, so you're notified."

Note that the captain's words contain four occurrences of the segment [s].

(5) It's, Goose, some, so

Johnson et al., 1993

Words were chosen with [s] located in different word positions, word-prosodic environments, and sentence-prosodic environments. The set of words consisted of three subsets: s-words, s-ch words, and sh-words. The speakers were asked to read the sentences as their blood alcohol levels were increased during the test.

(6) s-words: saw, possible, possibility, posterior

(7) s-ch words: postulate, posturing, postulatable

(8) sh-words: shah, posh

Words in (6) and (7) differ in that all of the [s] segments in (7) are followed by the voiceless affricate. The words in (8), containing [ʃ], were chosen as a control group for comparison purposes. All test words were contained in sentences. To examine effects of sentence prosody, pairs of sentences were constructed in which emphatic stress fell either on the test word or on a word preceding the test word. The speaker's productions were measured using acoustic equipment.

The results showed that the words in (6) and the words in (8) were produced faithfully. However alcohol did affect the s-ch words in (7). Measurement of the production of the segments [stʃ] in the word *postulate* showed that the speakers failed to achieve full stop closures.

4. Analysis of Data

Lester and Skousen (1974) reported seeing palatalization of [s] in the words in (2). Among the words in (2), one word, *yes*, contains a single [s] segment in the coda position. Two words, *spin* and *stress*, contain [s] in an onset cluster. Two words, *first* and *lust*, contain [s] in a consonant cluster in the coda. The final word, *historical*, contains [s] appearing as a single segment coda immediately followed by a stop consonant in the onset of the following syllable.

Lester and Skousen (1974) did not explicitly state how the words listed in (3) were realized by the speakers. However, the fact that the authors did not mention palatalization for these words leads one to the assumption that there was nothing remarkable about their production. A lack of evidence to the contrary indicates that the speakers faithfully produced the segment [s] in these words. Therefore, the data in (3) is evidence that [s] can be produced faithfully by intoxicated individuals.

By looking at (3), some interesting observations can be made. Note that each of the words in (3) contains [s] as a single segment. In (3), [s] appears twice in the onset, *Sue* and *sing*, and twice in the coda, *this* and *house*. The word *stress* listed in (2) also contains an example of the segment [s] which was not palatalized. In *stress*, the first [s], located in the onset cluster, became palatalized. The second [s], occurring as a single segment in the coda, was not palatalized. Lester and Skousen (1974) provided a transcription for the word *stress*, clearly showing production of the voiceless post-alveolar fricative in the onset, but not in the coda.

Of the data listed in (2), one can see that there were five occurrences of [s] in a cluster or next to an adjacent stop consonant. All five of these occurrences underwent palatalization. However, the behavior of [s] as a single segment is not as clear. There are six occurrences of [s] as a single segment in the word list in (1). Only one occurrence, in the word *yes*, became palatalized. The remaining five of the six cases did not.

Lester and Skousen (1974) did not draw any generalizations regarding the environment where [s] is realized as the voiceless post-alveolar fricative. From looking at the data in (2), the claim that palatalization of [s] occurs exclusively in the environment of adjacent consonants is prevented by the existence of palatalization in the word *yes*.

It is curious that the single segment [s] in *yes* was affected, but the single segments in *Sue*, *sing*, *this*, *house,* and *stress* were not. If an explanation for the palatalization in *yes* could be found, perhaps a generalization of the behavior of [s] in intoxicated speech could be made from the Lester and Skousen data.

One possible cause for palatalization in the word *yes* might be found by examining the onset of the following word in the list. Looking at the data in (1), we find that *yes* is followed by the word *happy*.

(9) *yes, happy*

The onset of *happy* contains the glottal fricative [h] in the onset. Although the segment [h] is considered a fricative, it has qualities that are sonorant-like. It is difficult to justify palatalization of [s] in the word *yes* by the existence of a consonant cluster formed across the word boundary with *happy*. The realization of the segment [s] as the voiceless post-alveolar fricative in the word *yes* is an anomaly in the Lester and Skousen (1974) data set.

More than a decade later, Johnson et al. (1990) attempted to apply what was known about alcohol's effect on the production of [s] to solve a real-world question. Was the captain of the Exxon Valdez under the influence of alcohol at the time of the accident?

Johnson et al. (1990) measured the production of the single segment [s] in the onset of

the word *sea* at various points in the recording. Through acoustic analysis, they found evidence that some of the productions of the segment [s] in *sea* had frequency profiles characteristic of the voiceless post-alveolar fricative. However, not all instances of the segment [s] in *sea* showed evidence of palatalization.

Johnson et al. (1990) found supra-segmental indication of intoxication in the captain's speech at the time of the accident. The transcript of the captain's call to report the accident, made at approximately the same time that supra-segmental effects of intoxication were evident, contains four words containing the segment [s] (see (5)). When the captain reported the accident, he spoke two words containing [s] in the onset: *some* and *so*. Two words contained [s] in the coda: *it's* and *goose*. Johnson et al. (1990) do not report observing palatalization of any of these words.

The only audible palatalization of [s] that the investigators report was the captain's production of [s] in the word *Exxon*. In the word *Exxon*, [s] occurs immediately after the voiceless velar stop as the onset of an unstressed syllable. The authors state that their subjective observation of the palatalization of [s] in *Exxon* was confirmed by spectral analysis (Tanford et al., 1992, p. 583). However, they do not specifically state that the palatalization of [s] in *sea* was audible to the human ear. The subjective evidence seems to indicate a stronger post-alveolar production in the word *Exxon* than in the word *sea*.

Approximately one year after the final reports on the Exxon Valdez accident were published, members of the investigating team, Johnson, Southwood, and Schmidt, performed research on the production of [s] by intoxicated speakers. Under controlled laboratory conditions, they examined production of [s] in various phonological environments. Johnson et al. (1993) found that only the words in (7), where [s] is followed by the voiceless affricate, underwent palatalization. The words in (6) did not.

Of the words in (6) that were produced faithfully by the intoxicated speakers, [s] occurs as a single segment, either in the onset or between vowels. The word *posterior* also is listed in (6). In *posterior*, [s] is located at a syllable boundary to an adjacent stop.

The lack of palatalization in the word *posterior* seems to contradict the observations that Lester and Skousen (1974) found in the word *historical*. Both *posterior* and *historical* have similar environments for [s]. [s] appears in the coda of an unstressed syllable and is adjacent to a stressed syllable beginning with the voiceless alveolar stop consonant [t].

However, the data from Johnson et al. (1993) does confirm in a general way what was observed in the Lester and Skousen (1974) data and in the Exxon Valdez voice recordings. The first conclusion that can be drawn is that alcohol intoxication may indeed cause the realization of [s] as the voiceless post-alveolar fricative. However, palatalization of [s] is not obligatory. It is possible for an intoxicated speaker to produce [s] faithfully. In this sense, palatalization of [s] due to intoxication is not a predictable process in English, as is the process of voice matching in the realization of the /-s/ suffix in the third person singular and plural morphology, for example. The fact that intoxication may produce, but does not entail, palatalization of [s] has consequences for anyone attempting to use this research in a legal setting to prove a state of intoxication or sobriety in a given speaker.

Second, it is likely that palatalization is a function of the proximity of [s] to adjacent consonants. It is unlikely that palatalization will occur for single [s] segments, whether they are located word-initially in the onset, word-terminally in the coda, or between vowels. Palatalization is likely to occur when [s] is located in a cluster or next to a consonant in an adjacent syllable and highly likely if [s] is adjacent to an affricate.

5. Discussion

Tanford et al. (1992) write that "Although some segmental effects may accompany any kind of loss of motor control, the substitution of an /sh/ sound for /s/ seems to be unique to loss of control caused by alcohol" (p. 582). Reading this statement, one may get the impression that palatalization of [s] is a bizarre phenomenon only seen in persons under the influence of alcohol. In fact, palatalization of [s] to [ʃ] happens regularly in English among sober speakers.

One readily observable palatalization of [s] as [ʃ] occurs when morphology is applied to words ending in [s]. Adding a suffix of the form [i+vowel] to a word ending in [s] will result in the palatalization of the [s] (Roca & Johnson, 1999, p. 557). Examples of suffixes of this type have the following English spellings: *-ion, -ial, -ious*. Appending any of these suffixes to a word ending in [s] will cause [s] to be produced as [ʃ]. *Impress* [ɪmpɹɛs] becomes *impression* [ɪmpɹɛʃən], *race* [ɹeɪs] becomes *racial* [ɹeɪʃəl], and *grace* [gɹeɪs] becomes *gracious* [gɹeɪʃəs].

Palatalization of [s] also occurs in connected speech when a word ending in [s] is unstressed and the glide [j] immediately follows in the onset of the next word (Avery, 1992, p. 88). Although palatalization of [s] in this situation does not occur with the same frequency as palatalization due to added morphology, the effect is just as predictable. Example sentences are: "*This young man is a linguistics student*." and "*Pass your plate over here*." When spoken casually by a native speaker of English, "*this young*" becomes [θɪʃɑŋg] and "*pass your*" becomes [pæʃɚ].

[s] and [ʃ] are in complementary distribution in English onset clusters. In English, onset clusters containing [s] can be formed as follows: [sl], [sk], [sp], [st], [sn], [sm], and [sw] (Nilsen, 1973). Although [s] can form a valid onset with the liquid [l], the same does not hold true for the liquid [ɹ]. [s] appears in onset clusters with [ɹ], but only in the three-consonant clusters. It seems like [sɹ] is missing from the list. However, the cluster [ʃɹ], which is the only onset cluster in English containing [ʃ], is valid. The fact that [sɹ] is missing, and that [ʃɹ] is the only valid onset cluster containing [ʃ] suggests that [ʃ] is an allophone of /s/ in English onset clusters.

Knowing that there is a relationship between [s] and [ʃ] in English doesn't fully explain why intoxicated speakers palatalize [s]. It is also necessary to consider the environment where palatalization occurs. Table 2 below summarizes the observations provided in the literature.

Table 2. Behavior of [s] and [ʃ] in intoxicated speech

[s]	[ʃ]	syllable structure	markedness	likeliness of [ʃ]
Sue,sing,this,house, sea, saw, possible, possibility	sea,yes	CV, CVC, CVC + V	relatively unmarked	unlikely
posterior	spin, first, lust, historical	CCVC, CVC+C	marked	likely
	Exxon	VC + C		
	stress postulatable, posturing, postulate	CCCVC CVC +CC	most marked	highly likely

The results of the research show that palatalization is least likely to occur for the syllable structures CV, CVC, and CVCV. The data in the literature show that words with these structures were often produced correctly by intoxicated speakers. These structures are relatively unmarked. The likelihood of palatalization increases when [s] is located in a cluster or adjacent to a consonant: CCVC, CVCC, and VCC. These structures are more marked. In the case where [s] is located adjacent to an affricate, the likelihood of palatalization is greatest, and the structure is also most marked, CVCCC. There is no data available in the literature to indicate that an intoxicated speaker can faithfully produce [s] when it occurs adjacent to an affricate.

It seems that alcohol intoxication degrades the active articulators to the point where the speaker is incapable of producing the more marked syllable structures involving [s]. It makes intuitive sense that marked structures would be more problematic than unmarked structures, but why is palatalization of [s] the mechanism that is employed? After all, intoxicated individuals are not the only speakers who have difficulty in producing marked structures. Children and second language learners also face challenges. Why don't intoxicated speakers employ some of the means that members of those groups use, such as epenthesis or deletion, to deal with [s] in marked environments?

In children, deletion is typically employed in [s] cluster production (Barlow, 1998, p. 4). On the other hand, second language learners usually epenthesize to reduce [s] clusters (Carlisle, 1992,). For native speakers of Spanish, epenthesis in English words occurs when [s] is adjacent to stop consonants (Carlisle, 1992, p. 71).

Optimality theory provides an explanation of why the surface form of speech produced by children and second language learners differs from the underlying lexical form. The language learner ranks adherence to an unmarked output higher than faithfulness to marked structures. For both children and second language learners, language acquisition is a process of re-ranking constraints to gradually permit marked structures. The fact that language learners employ strategies such as epenthesis and deletion demonstrates that their ranking system does not permit marked structures. However, this is not the case for adult native speakers of the language.

According to optimality theory, a sober, adult native speaker of a language possesses a mature ranking system that allows for the marked structures.

If an individual's ranking system is such that faithfulness to marked structures outranks all other constraints, what happens when that person becomes intoxicated? Is the influence of alcohol sufficient to alter an individual's markedness constraints?

The temporary effects of alcohol do not re-order an adult's ranking system (Hale, 1998). Lester and Skousen (1974) write "perceptually, the drunken speaker is very much aware of his mispronunciations of s's, but finds it nonetheless very difficult to pronounce them correctly" (p. 238). Because the intoxicated speaker does not view the marked structures in English as violations of the ranking system, a coping strategy, such as deletion or epenthesis, designed to decrease markedness is not employed. The intoxicated speaker has every intention of producing a surface form that is faithful to the underlying form.

In the data listed in (2), the coronal voiceless stop [t] immediately follows the [s] in four of the six words: *first*, *lust*, *stress* and *historical*. In these cases, the speaker must successfully move the tongue forward to create the restricted airflow for the [s], and then immediately move it upward to form a stop closure. The intoxicated individuals in the study attempted to do these two movements. However, in anticipation of positioning the tongue to form the coronal stop [t], the formation of [s] became degraded. The tongue fell slightly farther back in the mouth, in a slightly more relaxed state, and allowed greater airflow. The words in (7) present the intoxicated speaker with a similar challenge of raising the tongue to produce a stop immediately after [s]. In (7), the speaker must restrict airflow to form [s] and then raise the tongue to the palate and completely stop airflow to form the affricate [tʃ].

In the case of the word *Exxon*, [s] is preceded by a stop consonant. The speaker is required to place the tongue in the back position to produce the stop [k], and then immediately move it forward to restrict the airflow to form [s]. In the literature, these two successive movements proved to be difficult for the speaker. The diminished control of the active articulator resulted in a production of [s] which fell short of the front position, and did not restrict airflow sufficiently, resulting in something closer to [ʃ].

An alcohol effect is less visible when [s] occurs adjacent to a vowel. In simple CV words, such as *sea*, or *Sue*, the speaker is not required to make rapid successive tongue movements. The tongue is held in the same position throughout the duration of the vowel. Even in a diminished state, the speakers under the influence often managed to move the tongue forward, maintain it there, and restrict air tightly enough for proper production of [s].

6. Conclusion

The literature indicates that palatalization of [s] due to alcohol intoxication is possible, but not guaranteed. [s] is likely to be produced as [ʃ] when [s] occurs adjacent to stops and affricates. The production of [s] as [ʃ] can be explained as an attempt to honor faithfulness constraints in marked structures when the articulatory skills are in a degraded condition.

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