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The use of linking by native and non-native speakers of American English

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ABSTRACT

This study examines the evidence for the use of the phenomenon of linking, or connected speech modifications, for native speakers of American English (NS) and non-native speakers (NNS) of English. In a speech production experiment which seeks to replicate and examine in more detail the set of experiments reported in Hieke (1984) and Anderson-Hsieh, Riney & Koehler (1994), reading and spontaneous speech performance from two groups of beginning-proficiency (BP) and intermediate-proficiency (IP) non-native speakers of English is compared to that of five NSs of American English. Results indicate that, while BP and IP participants link their words significantly less often than NS participants do, their linking rates are similar despite the difference in proficiency level. In addition to the frequency of two types of linking, consonant-to-vowel (C-V) and vowel-to-vowel (V-V), the study investigates the effect that style shifting and syntactic structure have on the frequency of linking.
CHAPTER 1. OVERVIEW

The opening chapter of my thesis explains in general terms the concepts and hypotheses used in the study. A definition of the phenomenon of linking is given together with a summary of the standing of the topic in recent research. A pilot study conducted earlier is outlined to show significance of the research. The chapter concludes with the research questions that the study will answer followed by an overview of the thesis organization.

1.1 Introduction

The term linking is used in two different ways. It is occasionally synonymous with what is otherwise called connected speech phenomena or modifications, which are the changes that a word undergoes in running speech when combined with other words, as opposed to its pronunciation in isolation (Hieke, 1987). Changes as such can be noticed when the final /t/ in last is omitted between two consonants, a process known as elision, (example 1), or when the final /n/ in ten is changed into /m/ before boys moving its place of articulation to a position closer to that of the following sound (example 2), known as assimilation. A variant of International Phonetic Alphabet is used for the transcription, where [] represents a link between two sounds,

(1) The last king [ðə lɑs kɪŋ] (Elision)
(2) Ten boys [tɛm boɪz] (Assimilation)

A more common definition applies the term 'linking' more specifically to what happens at word-boundaries where two sounds combine while keeping their phonetic qualities, example (3), or where another consonant is inserted between them, /j/ in example (4), in order to produce a smoother flow of speech that does not sound choppy or disconnected (Celce-Murcia, Brinton & Goodwin, 1996).

(3) Give up [gɪv ʌp]
Empirical studies are essential to improving our understanding of the relationship between linking and pronunciation teaching. However, the study of linking – and connected speech phenomena in general – has been marginalized within the field of applied linguistics. Linking is considered a common occurrence in English running speech and has therefore received some attention in phonology literature (Gimson, 1989; Trammell, 1993; Allerton, 2000). Occasionally, linking appears as a topic with a clearly pedagogic orientation (Hieke, 1984; Temperley, 1987; Anderson-Hsieh, Riney & Koehler, 1994; Kelly, 2000). However, phonetics research in general takes little notice of the actual occurrence of linking, so traditional phonetic transcriptions do not reflect linking in particular, while representing other connected speech modifications, such as elision. As a result, teachers are often left to rely on their own intuitions, which leads to high dependency on citation forms with little help from research. Although some instructors can assist their students to a certain extent under these conditions, many others are reluctant to teach such aspects of pronunciation.

Two researchers are pivotal in the field of linking (Hieke, 1984, 1987; Anderson-Hsieh et al., 1994). Aside from these, linking has been dealt with briefly and peripherally in research. Hieke and Anderson-Hsieh investigated aspects of connected speech modification of American English including linking and compared them to those of non-native speakers of English. Hieke's paper (1984) appears to be the first and only study in the literature solely dedicated to the topic of linking. Anderson-Hsieh's study was more comprehensive in the sense that, in contrast to Hieke's, it examined features of connected speech for intermediate- and advanced-proficiency English learners in different modes of speech, namely sentence reading and spontaneous speech.
1.2 Pilot Study

Anderson-Hsieh et al. (1994) research on connected speech simplifications has been the impetus of the present study, where I want to compare the way NS and NNS of English link their words in connected speech. Before setting my research questions and collecting data, I ran a small pilot study examining an extract from spontaneous running speech discourse to inspect the different types of linking that I might encounter in my study and possible factors affecting them. The extract was taken from a recorded informal lecture on computer networking by a native American English male speaker. The extract was approximately a minute in length with 241 words and 39 pauses. It was analyzed for types and frequencies of linking, looking at both potential links which speakers may perform at word boundaries in the extract, and actual links which the speaker actually made. A percentage of the ratio of actual and potential links was then calculated together with the frequency of each type of linking per 100 words to estimate the prevalence of each type (Table 1).

Two types of linking depending on the two linked sounds at word boundaries, consonant-to-vowel (C-V) and vowel-to-vowel (V-V), were found to be consistently recurrent, and were, therefore, investigated in more detail. Consonant-to-consonant (C-C) linking was also recurrent throughout the recording; however, it displayed a great variety of linking sub-types, whose study will be beyond the limit of the present research. Hence, the analysis will focus only on the first two types of liking.

<table>
<thead>
<tr>
<th>Linking type</th>
<th>Potential links</th>
<th>Actual links</th>
<th>Percentage of actual links</th>
<th>Linking per 100 words</th>
<th>Function words in extract</th>
<th>Function words in actual links</th>
</tr>
</thead>
<tbody>
<tr>
<td>C – V</td>
<td>53</td>
<td>47</td>
<td>88%</td>
<td>19</td>
<td>52%</td>
<td>74%</td>
</tr>
<tr>
<td>V – V</td>
<td>10</td>
<td>10</td>
<td>100%</td>
<td>0.3</td>
<td></td>
<td>40%</td>
</tr>
</tbody>
</table>
Results revealed that 88% of the potential C-V links were performed, while all potential V-V links were actualized. The high frequency and prevalence of C-V and V-V linking made me focus my study on these two types. Furthermore, when the syntactic structure of actual links was analyzed, 74% of the words in the second slot of a C-V linking were found to be function words, although only 52% of the total words of the extract were function words. This finding caused me to include another variable affecting the frequency of linking in my study, in addition to style, which is syntactic structure.

1.3 Research Questions

This study has a primary focus of examining the frequency of linking for native and non-native speakers of American English. However, it also addresses the effect of two factors on the process of linking: style and syntactic structure.

1.3.1 Primary Research Questions

The main purpose of this study is twofold: to confirm findings of Hieke (1984) and Anderson-Hsieh et al. (1994) concerning the frequency of C-V and V-V linking in American English and in the language of beginning- and intermediate-proficiency non-native learners of English. The second concern is to see whether English language learners' linking frequency increases when their proficiency level increases. In other words, do intermediate learners link more often than beginners? Does progress in general speaking skills mean progress in their mastery of linking? This leads to two research questions:

- To what extent do beginning- and intermediate-proficiency learners of English differ from native speakers of American English in their use of linking?
- To what extent do beginning- and intermediate-proficiency learners of English differ from each other in their use of linking?
1.3.2 Secondary Research Questions

Along with the primary research questions which deal mainly with the frequency of performed links, this study is also concerned with the variables that may change linking frequency for native and non-native speakers of American English. Previous research (Lass, 1984; Anderson-Hsieh et al., 1994) showed that the change of speech style plays a role in determining the frequency of connected speech modifications. The study will attempt to confirm their finding that speakers link their words more in spontaneous speech in contrast to sentence reading style. I will also investigate the impact of syntactic categories on the frequency of linking. Do native speakers of American English link more frequently when a word is linked to a function word, in contrast to linking it to a content word? The secondary research questions are:

- Do native speakers of American English and beginning- and intermediate-proficiency learners of English link their words in spontaneous speech more than in careful reading?
- Is linking a syntactically-influenced phenomenon? Do native speakers link more when the link involves a function word than when it does not?

1.4 Organization of the Study

In order to answer the questions, I first contextualize this study with relevant literature and studies in Chapter 2. Chapter 3 specifies the study’s participants, the materials used and procedure followed. Furthermore, the chapter outlines the analysis methods used. In Chapter 4, I detail the findings for each research question and discuss them in relation to past research. Finally, Chapter 5 offers research and pedagogical implications for teachers and researchers.
CHAPTER 2. LITERATURE REVIEW

This chapter will contextualize the present study within relevant literature on connected speech phenomena, definitions of linking, its types, and the linguistic environments that causes it to happen. The factors that might influence linking are then reviewed with special focus on the effect of style shifting and syntactic categories. Additionally, the chapter will look at previous academic research conducted on linking, how the topic is researched in English as a Second language (ESL) studies and how it is dealt with in ESL textbooks and materials. Finally, the chapter explains the significance of the study of linking in American English.

2.1 Connected Speech Phenomena

In the past, pronunciation instruction has focused on teaching segmental features to ESL/ EFL students, that is, features of spoken language which are easily identified as discrete segments of sounds (traditionally consonants and vowels). After the rise of Communicative Language Teaching, proponents of the teaching of suprasegmental or prosodic features, i.e. features such as stress, rhythm and reduced forms which are more likely to extend over longer stretches of sounds, stressed the need for fluency rather than accuracy (Goodwin, 2001). It has also been argued that the most important area of nonnative pronunciation for intelligibility is prosody (Anderson-Hsieh, Johnson & Koehler, 1992). One of the most recurrent arguments is that prosody forms the framework for utterances and directs the listeners for the new and important information. In addition, prosody is claimed to have the greatest impact on the comprehensibility of the learner's English and the fastest effect (McNerney & Mendelsohn, 1992).

The pronunciation of consonant and vowel sounds in running speech often differs from the pronunciation of the sounds when words are said in isolation, that is, in citation form (Lass, 1984). Citation form pronunciations occur in isolated words under heavy stress.
or in sentences delivered in a slow, careful style. By contrast, connected speech forms often undergo a variety of simplifications which can not always be predicted by applying phonological rules (Brown, 1977; Lass, 1984; Dalby, 1986; Hieke, 1987; Temperley, 1987; Anderson-Hsieh, Riney & Koehler, 1994). Connected speech simplifications (examples 1 & 2 in Chapter 1), or what Hieke (1987) terms as *absorption*, are "the changes which conventional word forms undergo due to the temporal and articulatory constraints upon spontaneous, casual speech" (p. 41). In other words, they are the changes in pronunciation that occur to words due to blending their border sounds with neighboring sounds. The primary function of these adjustments is to promote the regularity of English rhythm by compressing syllables between stressed elements and facilitating their articulation so that regular running speech timing can be maintained (Clark & Yallop, 1995). Several studies have investigated an array of connected speech phenomena, such as assimilation, dissimilation, elision, epenthesis and linking (Brown 1977; Lass, 1984; Gimson, 1989; Dalby 1986; Trammell, 1993; Allerton, 2000). While a few studies have examined the acquisition of some connected speech simplification processes in non-native speakers of English (Brown, 1977; Tarone, 1980; Eckmann, 1991), no study exists that examines how native or non-native speakers of English acquire linking. A study as such can help us understand the nature of linking for NNSs of English, explain some of the results of linking frequency studies, and establish better methods to teach linking to NNSs.

2.2 Linking in American English

The term *linking* has been used in two different ways. It can refer to connected *speech phenomena* in general because they all link words forming units larger than the single word where word boundaries seem to disappear. The other definition, which will be adopted in this study, is more specific: *it is what happens to sounds at word boundaries in one thought group when two words are joined by connecting the last sound of one word to the
first sound of the following word. The two connected sounds can keep their phonetic qualities as in example (3), be combined in one longer sound as in (4), or have an extra consonant inserted in between them as in (5) where is a visual representation of a link, and a period [.] stands for syllable boundaries,

(3) face it [feɪ.ʃɪt]
(4) can name [kæ.nəɪm]
(5) pay a lot [peɪ.ʃə.lɒt]

2.2.1 Types of Linking

According to the sounds that meet at word boundaries (i.e. consonants and vowels), linking can be categorized into three main types.

1- Consonant-to-vowel linking (C-V) takes place when the final consonant of a word is followed by a vowel in the same thought group. It is often pronounced as a medial consonant, i.e. a consonant occurring in the middle of a word, such as [s] in example (3) above. When the final consonant is a part of a consonant cluster, it is usually pronounced as though it belonged to the following word. Linking in this case helps to break up and simplify the cluster (Hewings & Goldstein, 1998), as in what happens in example (6) where the consonant that is moved over /t/ is weakly released and not aspirated.

(6) Salt and pepper [sɒl.tʃəm.pe.ˈpɜːr]

Trammell (1993) discusses in much detail the process of ambisyllabicicy, which occurs when a consonant cannot be assigned exclusively to one syllable or another but is shared by both, as in example (7). The present study will, however, treat all ambisyllabic segments at word boundaries as incidents of C-V linking since, regardless to which syllable the ambisyllabic consonant is assigned, the link can still take place between the two border sounds.
Vowel-to-vowel linking (V-V) occurs when a word that ends in a high and mid-tense vowel is followed by a word that begins with a vowel. Speakers, thereafter, insert a very short /w/ or /j/ sound to link the two vowels together and avoid a gap between the sounds. The choice of the linking glide depends on the vowel at the end of the first word. If the first word ends with a high front vowel, such as /i:/, then the linking sound will be /j/ as in example (5). However, if the word ends with a high back vowel, such as /u:/, then the two words are linked with /w/ as in example (8). Other vowels are usually smoothly linked without a linking sound (Hewings & Goldstein, 1998). The majority of pronunciation research and textbooks examine only the V-V linking with glide insertion. In the present study, any incident with two vowels following the correct environment will be considered a V-V linking.

In non-rhotic British English dialects, word final post-vocalic /r/ is retained as a linking form when the following word begins with a vowel (Gimson, 1989). Intrusive /r/ is sometimes used in places where a linking glide is otherwise used in American English, cf.,

Consonant-to-consonant linking (C-C) can take place when two identical consonants meet at word boundaries and pronounced as one slightly prolonged sound, see example (4). When the two border consonants are otherwise different, the final consonant of a word is then released at the beginning of the following word, such as /t/ in example (11),

(7)  left out  [lɛf. tɹaut]/[left.ɹaut]

2- Vowel-to-vowel linking (V-V) occurs when a word that ends in a high and mid-tense vowel is followed by a word that begins with a vowel. Speakers, thereafter, insert a very short /w/ or /j/ sound to link the two vowels together and avoid a gap between the sounds. The choice of the linking glide depends on the vowel at the end of the first word. If the first word ends with a high front vowel, such as /i:/, then the linking sound will be /j/ as in example (5). However, if the word ends with a high back vowel, such as /u:/, then the two words are linked with /w/ as in example (8). Other vowels are usually smoothly linked without a linking sound (Hewings & Goldstein, 1998). The majority of pronunciation research and textbooks examine only the V-V linking with glide insertion. In the present study, any incident with two vowels following the correct environment will be considered a V-V linking.

(8)  Now I  [nɔu ɹəɪ]

In non-rhotic British English dialects, word final post-vocalic /r/ is retained as a linking form when the following word begins with a vowel (Gimson, 1989). Intrusive /r/ is sometimes used in places where a linking glide is otherwise used in American English, cf.,

(9)  law and order  [lɔɹˈə. nɔɹ. dəɹ], in British English
(10)  law and order  [lɔɹə. nɔɹ. dəɹ], in American English

3- Consonant-to-consonant linking (C-C) can take place when two identical consonants meet at word boundaries and pronounced as one slightly prolonged sound, see example (4). When the two border consonants are otherwise different, the final consonant of a word is then released at the beginning of the following word, such as /t/ in example (11),

(11)  what she  [wə. tʃi]
The present study will only examine the first two types of linking in more detail. C-C linking is more complex and can be tricky to identify and categorize; therefore, its study is beyond the scope of this thesis.

2.2.2 Why Do Speakers Link?

Hieke (1984) argues that motivation for linking processes can be attributed to ease-of-effort principles in order to generate more fluid and less articulatory-complex speech. Other factors may provide an impetus for linking, such as the pacing of the speech and the formality of register used. Above all, avoidance of hiatus, in other words, the avoidance of leaving sounds at word boundaries as they are without a transition between them, is the main factor thought to urge speakers to link words (Hieke, 1984; Anderson-Hsieh et al., 1994; Allerton 2000).

Since initial vowels are preceded by glottal onset (Hieke, 1984), such a "pitch-interruptive" feature becomes a primary motivation for linking. In order to avoid this interruption and arrive at a non-initial vowel structure, syllabic restructuring (or resyllabification) takes place in casual speech. Initial vowels may sometimes be kept and produced with a slight glottal onset under certain conditions, such as special stress assignment and after silence (Hieke, 1984). In addition, Rudes (1976) claims that resyllabification normally occurs towards the stronger stress. In other words, the stress has to be on the initial syllable of the second word for C-V linking to occur. This condition did not prove to be obligatory in my data, as, for example, native speakers linked the two words in (12), where the link occurs towards an unstressed syllable.

(12) picked it \[pɪk \cdot ɪt] \)

Allerton (2000) provides a reason as to why speakers perform V-V linking in British English. He believes that a glide or /r/ is usually inserted to maintain the preferred canonical structure of morphemes including vowel sequences. Since vowel sequences with a short
vowel as the first vowel, such as /æ/, do not occur morpheme-medially, they can hinder the fluent flow of phrases. Because many British English words have a final /ə/ and a good number have an initial vowel (example 13), the two vowels are linked with a consonant, such as /r/ or /j/, or reduced to a vowel glide.

(13) bitter end [bɪtər end]

Allerton's observations, however, cannot be totally applied to the linking phenomenon in the rhotic American English, which will consequently have less final /ə/. Nevertheless, we can say that a glide inserted to link two vowels works as a transition stage between them, bringing their edge phonetic qualities closer to each other.

Finally, Allerton notes that for standardized accents of British English, a trend towards less V-V using linking consonants is taking place with the purpose of simplifying the phonemic system. Such a phenomenon seems to be attributed to the force of the system, "Systemzwang," which is the force that urges speakers to have one stable form of each morpheme to help in word identification and aid intelligibility. Although no studies have investigated the effect of linking on intelligibility, preserving word boundaries by performing less linking might be seen as a strategy to enhance intelligibility, especially in NS-NNS contexts or in those where English emerges as an international language.

2.2.3 Influencing Factors

Few studies have investigated the factors that affect connected speech modification (Lass, 1984; Anderson-Hsieh et al., 1994), focusing in the greater part on the effect of shifting speech style from formal to casual. For example, Lass (1984) attributes connected speech modifications to the immediate phonemic environment, speech rate, the formality of the speech situation and other social factors, such as social distance. While the previous studies examined various factors that may affect the frequency of linking, none has looked
into the effect of pausing and syntactic structure. The present study will take these variables into consideration.

2.2.3.1 Style shifting

Hieke (1984) distinguished two styles of speech: casual everyday style and careful speech used for certain formal occasions, such as presentations. In casual spontaneous speech, speakers pay less attention to fully articulating their words, hence reducing the distinctive features of sounds while connecting them (Lass, 1984). Other social factors, such as social distance, play a role in determining the frequency with which such simplifications happen (Anderson-Hsieh et al., 1994). When the speaker and the listener both belong to the same social group and share similar speech conventions, the comprehension load on the listeners will be reduced, allowing them to pay less attention to distinctive articulation. When examining the phenomenon of linking for NS and NNS of English, Anderson-Hsieh et al (1994) found that style shifting and level of proficiency influence the manner in which speakers link their words. NS and NNS performed more linking in spontaneous speech tasks than those involving more formal sentence reading.

2.2.3.2 Phrasing

Phrasing speech into thought groups is yet another factor that seems to affect speech rate, fluency and, to an extent, connected speech modifications. In spoken English, people do not pronounce words one at a time. Instead, they organize their thoughts in phrases, called thought groups, making a smooth connection between words by linking the final sound of one word to the initial sound of the next one. These groups are signaled by the use of a pause and/or a slight drop in pitch to mark the end of a thought groups (example 14). Slashes (/) are used to divide utterance to thought groups.

(14) In the morning / the sun was up / and the tent was starting to get hot/
As for reading, Zutell and Rasinski (1991) differentiated three aspects of fluency: pace, smoothness and phrasing, yet they gave priority to reading words quickly and to phrasing grammatical structures appropriately. Phrasing on their scale ranged from word-by-word reading, to improper stress and intonation, to reasonable stress and intonation, to generally well-phrased reading. The word-by-word phrasing, which is most frequent with NS children starting to learn how to read and with beginner NNS, is not only slow and hesitant, but it also suspends the usual prosody, and thereby linking, of spoken speech. Pauses are used in running speech to divide it into manageable chunks called thought groups (Frazier, Clifton & Carlson, 2004). Different terms have been coined to refer to these chunks, such as intonational domains, intonational phrases, tone units, pause units and tone groups. I will use the term 'thought group', which is defined as a stretch of speech bordered by pauses and covered by a single perceptually coherent intonation contour. Phrasing was found in my data to be an important variable that affects the frequency of linking. Therefore, a survey of related phrasing research and how it interacts with other factors can help understand its role in linking.

The occurrence of pauses is constrained by a number of factors: prosody, syntax, speech style, the length of a thought group, speaker and speaking task, and speech rate. Goldman Eisler (1968) shows that pause occurrence depends on speech style; therefore, read speech pauses occur only at grammatical junctures, whereas spontaneous speech pauses take place in other places in the utterance as well. It has been shown in a number of studies (Goldman Eisler, 1968; Lane & Grosjean, 1973; Fletcher, 1987) that the slower the speech, the more frequent the pauses; yet Trouvain & Grice (1999) found that the increase of speech rate does not necessarily decrease pause frequency for all speakers. In read and spontaneous speech, speakers have individual differences and fewer pauses in well-learned material (Goldman Eisler, 1968).
Nonetheless, most of the factors have only been investigated in reading speech tasks, since variables can more easily be controlled in read speech. In terms of prosodic structure, pauses can take place between coherent intonation contours and do not occur elsewhere (Nespor & Vogel, 1986; Selkirk, 1981). The length of a phrase constitutes another factor in determining pause occurrence (Grosjean, Grosjean & Lane, 1979; Krivokapic’, 2007). In spontaneous speech, speakers tend to pause in the middle of long sentences and in the middle of syntactic constituents, even if syntactic rules predict that the pause should occur at another place.

Research on the effects of syntax on pause occurrence has shown that pauses often occur at major syntactic junctures and that the more complex the syntactic structure, the more likely that pauses will occur (Cooper & Paccia-Cooper, 1980; Grosjean et al., 1980). However, phrasings that do not break up a syntactic phrase are favored over prosodic phrasings that do, unless breaking up a syntactic phrase is required for some reason, such as satisfying a higher-ranked constraint (Truckenbrodt, 1995). Certain syntactic structures are known to coincide with a pause at the end of the intonational phrase (Selkirk, 1995), namely, vocatives, appositives, nonrestrictive relative clauses, and parenthetical expressions; while other structures will never permit a pause to break the syntactic bond between words in a phrase (Liberman, 1975). Example (16), adopted from Liberman, shows an impossible phrasing situation, where a pause breaks the subject noun phrase and groups the second part with the verb, cf.

(15) Eight students in ten / go to bed early.

(16) *Eight students / in ten go to bed early.

Since most of these studies have been concerned with read speech and prescribed rules of grammar, they failed to account for the different factors that govern phrasing in spontaneous speech.
2.2.3.3 Syntactic categories

Most words in English are assigned to two categories according to their syntactic function: content and function words. Function words usually perform a grammatical function in sentences, indicate meaning relationships and help people process units containing content words, by showing how the units are related to each other (Conrad, Biber & Leech, 2002). They belong to the closed class of words which has a limited and fixed membership; for example English has only four coordinators: and, or, but and nor. In this respect, they contrast with content words (namely nouns, verbs, adjectives and adverbs) that refer to things, events, actions and qualities and belong to the open class of words (Weber, 2006). In traditional terms, function words mainly include determiners, auxiliary verbs, prepositions, conjunctions, particles and pronouns.

Function words vary greatly in their frequency within different types of English genres. For instance, pronouns are the most frequent function words in conversation, while determiners have the highest frequency in academic prose. Nevertheless, although the number of function words is limited, they are among the most frequent in the language. In the million-word sample of contemporary printed English known as the Brown corpus, the 50 most frequent words are all function words. Furthermore, function words constitute at least 41% of the words of any genre (Morgan, Shi & Allopenna, 1996). The high frequency of a limited number of words, in contrast to thousands of lower-frequency content words, suggests that their prosodic features might have a wide-range effect on speech in general. For instance, Segalowitz and Lane (2000) found that lexical access for function words is indeed faster than for content words, but that this difference can be attributed to word predictability and word familiarity.

Function words play a distinct role in the prosody of English from that of content words. In continuous speech, function words generally take weak stress and reduced vowels – with some exceptions – a feature that NS of English may use to easily understand the flow
of continuous speech (Cutler & McQueen, 1995). Investigators have shown how children acquiring their first language in their first year of life may use the weak stress to discover where the boundaries of words in English occur (Morgan, Shi & Allopenna, 1996). Such a feature could also be used to help maintain the rhythm of speech. The weak stress of function words in running speech may not be apparent to learners of English because when function words are taught and studied, they are often pronounced in their citation form. Another quality of the weak stress in function words is the weakening and even disappearance of consonants in casual speech that are specific to some function words, such as saying 'im for him, and an' for and.

Furthermore, Selkirk (1995) observes that function words "may exhibit an extremely close phonological connection with an adjacent word – usually to the word that follows them, but sometimes to one that precedes" (p. 336). This is evident by the great likelihood that phonological rules of connected speech, including linking, will operate between a function word and an adjacent word, given the appropriate syntactic circumstances. Selkirk, however, did not identify the syntactic circumstance appropriate for connecting function words with their immediate neighboring sounds. Nevertheless, this observation helps us to see and examine the close connection that function words have with words preceding them, which is the focus of the fourth research question of this study that investigates whether NS link more when the link involves a function word than when it does not.

### 2.3 French Liaison

The phenomenon of liaison in French is the closest parallel to linking in English. Although they differ significantly, examining liaison may help us see certain hidden aspects of linking, especially due to the shared history of the two languages, and because much research has been conducted on liaison (e.g., Tranel, 1995; Bybee, 2001; Durand, 2001; Gaskell, Spinelli & Meunier, 2002; Tseng, 2003) in contrast to linking.
Bybee (2001) defines liaison as "the name for the appearance of a word-final consonant before a vowel-initial word in words that in other contexts end in a vowel" (p. 167). For instance, the 3rd person singular copula *est* is pronounced [ɛt] in example (17) and as [ɛ] in example (18) – examples taken from Bybee, p. 167.

(17) Le climat est [t] également très différent.
    'The climate is also very different.'

(18) C'e(st) le meurtre.
    'It's murder.'

Hence, the primary difference between liaison in French and linking in English is that while they both involve the smooth connection of sounds at word boundaries, the former adds a 'dormant' sound to the end of the first word. Pre-generative descriptions of French assume that we can distinguish three grammatical types of liaison context: (a) obligatory; (b) optional; (c) forbidden (Durand, 2001). Where liaison is optional, its frequency is dependent upon a variety of stylistic factors, for example, spontaneous vs. formal styles of speech. Liaison is not a purely phonological phenomenon, however. It is subject to a wide range of lexical, syntactic, sociolinguistics and stylistic conditions (Tseng, 2003). Bybee (2001) argues that the morphosyntactic and lexical contexts in which liaison became established occurred with high frequency and were thus sequences that were stored in memory. Furthermore, Bybee observes that liaison incidents do not involve purely content words. They, rather, include at least one grammatical morpheme ranging from inflectional suffixes to function words. Since these forms are relatively high in frequency, especially in the phrases in which liaison occurs, it is not surprising that they are the ones which do not tend to lose liaison. In a nutshell, the conditions for the appearance of the liaison are both phonological, and adhere to certain morphosyntactic and lexical conditions. The previous research urged me to inspect English speech samples for similar features (see the pilot study in Chapter one), and examine the role played by syntax in determining the frequency of
linking in American English. Namely, I looked at whether NS perform more links towards function words than to content words.

2.4 Linking in ESL Pronunciation

2.4.1 Academic Research

One cannot but notice the disparity that the phenomenon of linking is treated with in ESL research and teaching materials. While there are very few studies on the nature of linking for non-native speakers of English, almost every pronunciation teaching textbook treats this process in some detail. Only two major studies have examined linking from a research perspective (Hieke, 1984; Anderson-Hsieh et al., 1994). In a two-dimensional, speech dynamic analysis of natural casual speech, Hieke (1984) identifies linking as a prominent phenomenon at the phonetic syllabic level. His study investigates the frequency and distribution of consonant attraction, his term for C-V linking, because it is highly prevalent in casual English speech, and relatively uncomplicated. Samples of spontaneous, casual speech were collected from NS (n =12) and NNS (n =29) participants according to the paraphrase mode, that is, they retold a story heard just once. The results showed that C-V in casual speech is present at the rate of 12 links per 100 syllables, which proved that linking can be considered as a rule not a tendency in English. In native speech, 80% of the potential link points turn into actualized links, while in non-native speech only 54% of the instances. Heike concluded that linking can be used as a parameter of fluency to differentiate NS from NNS speech. Hieke studied C-V as a representative for other types of linking. He, however, did not investigate other types of linking, nor did he account for the effect of style change on this phenomenon. In addition, his NNS group was comprised solely of intermediate-proficiency learners of English; hence, his results are limited to this group and do not show whether NNS's linking improves when their level of proficiency increases.
Building on Hieke's research, Anderson-Hsieh et al. (1994) investigated connected speech modifications in the English of Japanese ESL learners comparing them to native speakers of American English. The study investigates the frequency of C-V and V-V linking in spontaneous and sentence reading tasks for five intermediate-proficiency (IP) and five high-proficiency (HP) Japanese ESL learners, and compares their performance to that of five NSs. Results show that while HP group approximated the performance of the native speaker group in both categories, the IP group often lagged far behind. All three groups produced significantly more modifications during the spontaneous task than during the sentence reading task. The researchers concluded that language proficiency, native language and style shifting are important factors that affect Japanese ESL learners' connected speech. Because this study was designed to examine a range of connected speech simplifications, linking was only briefly treated without much detail on how it took place. Materials used for the reading task were isolated sentences. Furthermore, while the study accounted for style change, it did not consider other possible variables that can influence the nature and frequency of linking, and other connected speech phenomena, such as phrasing and syntactic structure.

2.4.2 Pronunciation Teaching Materials

Whether and how linking should be taught has received contradicting opinions over the past two decades. Some believe that connected speech simplifications should be ignored because their lack does not affect intelligibility, students will naturally incorporate them into their language (Grant, 1993), or they are hard for the students to master (Hagen and Grogan, 1992). On the other hand, some teach linking from the start of oral work and integrate it in the study of all aspects of pronunciation (Gilbert, 2001; Reed & Michaud, 2005). Nonetheless, all these opinions remain of uncertain effectiveness because of the lack of studies that estimate the impact of linking on intelligibility and second language learners' acquisition of this process.
In a comprehensive study of linking and deletion in final consonant clusters, Temperley (1987) argues that teachers can help improve both comprehension and production by making clear to students what happens to a word in running speech. When students understand how words are linked, they may comprehend a greater portion of connected speech. An intermediate-proficiency student asked me about the meaning of 'firsteble', a word he heard repeatedly and could not find in a dictionary. It was not until I explained how multiple words might sound as one when linked at word boundaries, that he realized how 'first of all' could be pronounced as such. Linking is also a powerful tool in helping students to produce a more acceptable pronunciation of English and facing their tendency to learn English as individual isolated words with one pronunciation for each word, and should, therefore, be emphasized from the beginning of oral work. Temperley recommends a more "pervasive, comprehensive and explicit use of linked forms, i.e., the use of phrases and more consistent and systematic emphasis on the pronunciation of contextualized forms from the beginning of English instruction" (p. 78). Linking is also thought to be useful to draw attention to the word endings, a difficult yet essential part of language to master for ESL learners (Temperley, 1982).

Almost all ESL pronunciation teaching materials address the issue of linking, and except for few textbooks, they appear to agree on how to teach it. This can be attributed to the lack of complete knowledge of the nature of linking, and impracticality and inadequacy of existent rules that fail to predict regular linking patterns in running speech. Some teaching materials (Sheeler & Markley, 1991; Grant, 1993; Lane, 1993; Orion, 1997; Miller, 2001) mention linking briefly as a secondary feature of other processes. The majority of textbooks, however, assign from one to several pages to teach linking to students (e.g., Dauer, 1993; Hewings & Goldstein, 1999). These pages are generally within chapters concerned with teaching connected speech modifications. In addition, they explain different types of linking (C-C, C-V, and V-V) providing examples and drills focused on repeating or identifying
instances of linking. For instance, in *Pronouncing American English* (Orion, 1997), linking and phrasing are dealt with in four exercises in which students get acquainted with how words are linked together, and then asked to listen and repeat some sentences or phrases that are accompanied with visual representation of linking (example 19)

(19) Buy a bóok / for my ESL class. (Buyabóok / formyESL class)

The authors attempt to define linking in simple terms, saying that words should be joined smoothly to each other without adding extra sounds or omitting final consonants; otherwise, speech will sound choppy and difficult to comprehend. However, they make the assumption that learners can easily understand and apply linking regularities, following the phonetic rules outlined. To be able to apply such linking rules – that depend on the immediate phonetic environment of the linked sounds – in the way most authors propose, learners will have to be able to easily identify the final sound of a word, the phonetic category of the final sound and that of the first sound of the next word. They also need to quickly retrieve the rules and apply them as they speak. Due to cognitive processing considerations, it is very difficult, if not in some cases impossible, for non-native speakers to remember and apply these rules while thinking of what to say and maintaining a natural flow of speech. In the same way, native speakers of English are assumed to consciously follow similar processes.

A few recently published ESL pronunciation textbooks (Gilbert, 2001; Reed & Michaud, 2005) integrate linking repeatedly and consistently throughout the course of the book in almost every chapter, but mostly in chapters dealing with the pronunciation of stops and continuants. Reed & Michaud consider linking to be their first and most important sound concept, an indispensable feature required to practice the other sound concepts, such as reduced, deleted and contacted sounds. Linking is especially recycled through endings (-ed), and reduced forms of function words. For example, linking is recycled in an exercise on third person singular present tense endings (-s), where students are asked to listen and fill in the
missing word or words. The missing words contain a verb with an (-s) ending that is linked to the following word (example 20). Linking the final consonant (-s) to the next initial vowel will make it easier to identify, reviewing, at the same time, how words are linked. Words between brackets are the missing words in the exercise,

(20) So he (gets on the) bus, …

2.5 Significance of the Present Study

Linking has been assumed to be an important feature of running speech as it helps enhance overall fluency and comprehension (Reed & Michaud, 2006), works as a crucial element in imitating correct word-stress – which is required for native-like rhythm and intonation patters at the phrase level, stands as an aspect of correct pronunciation at the allophonic level (Trammell, 1993), and is a marker of native-like speech (Hieke, 1987). Except for Hieke's conclusion, all assumptions regarding the significance and nature of linking have not been empirically tested. Linking is an area of pronunciation that lacks clear guidelines. It seems to represent an area that everybody plays lip service to without quite having established how important it is.

Although the research of Hieke (1984) and Anderson-Hsieh et al. (1994) represent important contributions to connected speech studies in general, and linking phenomenon in particular, many questions remain unanswered. Anderson-Hsieh et al.’s study is macro-analytical in its concern with broad categories of connected speech modifications; however, a micro-analysis of what happens at word boundaries during linking and factors affecting the frequency and nature of linking is needed to understand each linking type. The purpose of the present study is to examine the evidence and frequency of the phenomenon of linking in English comparing native and non-native speakers' use of C-V and V-V linking in two tasks. Different factors that may affect how speakers link their words will be investigated, namely those pertaining to speech style, phrasing and syntactic structure.
CHAPTER 3. METHODS AND PROCEDURES

This chapter outlines resources and processes used to conduct this study. It begins by describing the participants, followed by the materials used in this study as well as a description of the procedures. To conclude, analysis of the data to answer each of the research questions posed in Chapter One will be explained.

3.1 Participants

The study has fifteen participants divided into three groups: native speakers of American English (NS), beginning-proficiency non-native speakers of English (BP), and intermediate-proficiency (IP) non-native speakers of English. Of the 15 participants, four were females and eleven were males. The NS participants (N = 5) are graduate students at Iowa State University, a major research university in the United States. Their age range is 25-50. The non-native participants are students at the Intensive English and Orientation Program (IEOP) at Iowa State University with the BP group (N = 5) in the upper-beginner Listening and Speaking class (levels 2-3 out of 6), and IP group (N = 5) in the intermediate Listening and Speaking class (levels 4-5). The non-native speakers' age range is 18-25 and they come from Korean and Arabic language backgrounds. Both non-native groups had between 5-12 years of traditional English instruction in their home countries. The BP group are recent arrivals to the USA, while the IP group has been in the USA for 8-16 months. ESL students' selection was based upon results from an English Placement test taken upon entrance into IEOP and the judgment by their listening and speaking teacher of their speaking proficiency. The resulting groups can be seen in Table 2. Advanced-proficiency NNSs from IEOP (level 6 out of 6) were not considered for participation in this study because of the difficulty in defining their level. Many of them had comparable proficiency levels with other IP students in the study. Therefore, the present study will examine the linking phenomenon for upper-beginner and upper-intermediate-proficiency ESL students as two distinctive levels.
The phenomenon of linking is not common or taught in Korean or in Arabic. The Korean syllable structure is much simpler than that of English: V, CV or CVC. It does not permit consonant clusters word-initially or -finally (Ahn, 1988). Hijazi Arabic, the vernacular dialect that the Saudi Arabian participants speak, has two kinds of syllables: open syllables (CV) and (CVV) - and closed syllables (CVC), (CVVC) and (CVCC). Its syllables may only begin with a consonant, or borrow one from the previous word to conform to the syllable

<table>
<thead>
<tr>
<th>Group</th>
<th>Nick</th>
<th>Sex</th>
<th>Language</th>
<th>Time in USA (months)</th>
<th>English training (years)</th>
<th>Proficiency level (1-6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native</td>
<td>Erik</td>
<td>M</td>
<td>English</td>
<td>1</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Jim</td>
<td>M</td>
<td>English</td>
<td>9</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Sapphire</td>
<td>F</td>
<td>English</td>
<td>1</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Kay</td>
<td>F</td>
<td>English</td>
<td>1</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Superwoman</td>
<td>F</td>
<td>English</td>
<td>1</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Beginner</td>
<td>Gonny</td>
<td>M</td>
<td>Korean</td>
<td>1</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>James</td>
<td>M</td>
<td>Korean</td>
<td>9</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Chris</td>
<td>M</td>
<td>Korean</td>
<td>3</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Haul</td>
<td>M</td>
<td>Korean</td>
<td>1</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td>M</td>
<td>Korean</td>
<td>1</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Freshman</td>
<td>M</td>
<td>Arabic</td>
<td>12</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Dynasor</td>
<td>M</td>
<td>Arabic</td>
<td>16</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>David</td>
<td>M</td>
<td>Korean</td>
<td>9</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Kim</td>
<td>M</td>
<td>Korean</td>
<td>8</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Claire</td>
<td>F</td>
<td>Korean</td>
<td>12</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>

N = 15
structure rules (Watson, 2002). Since linking is not a common phenomenon in both languages, the variable of first language interference in the participants' awareness of the phenomenon of linking will not be accounted for in this study. For a language in which linking is salient, such as French, results may be affected by the participants' first language.

3.2 Materials

To elicit linking, participants were asked to perform a text reading task and a spontaneous speech task. The text reading task was used to control for vocabulary, grammar, and sounds, thereby providing many opportunities for linking. An essay written by a middle-school native speaker on 're-gifting' was the source of the reading task text. For the spontaneous speech task, a children's authentic story was chosen from the Boy Scout Trail website. The purpose of the spontaneous task was to elicit a less formal speech style in order to compare the linking incidents of spontaneous production with those of reading. The texts are available in Appendix A. A native speaker of American English recorded the story in a normal reading voice.

The two texts were adapted to be appropriate for upper-beginning-proficiency ESL students and for the purposes of the experiment. Hence, most of the words used were from the 1000 word level. For this purpose, Cobb's Web Vocabulary Profiler English v.2.6 (http://www.lex tutor.ca/vp) was utilized to break the texts down by word frequencies in the language at large. It is based on Heatley and Nation's (1994) Lexical Frequency Profiler, and divides the words of texts into first and second thousand levels, academic words, and the remainder or 'offlist.' The Flesch-Kincaid readability statistics were also calculated for each text using Microsoft Word, which is based on the lengths of words and sentences in a text. Both the researcher and course instructor considered the resulting texts of an appropriate level for the ESL participants. Readability statistics can be seen in Table 3.
Table 3. Text readability

<table>
<thead>
<tr>
<th></th>
<th>Number of words</th>
<th>K1 words %</th>
<th>K2 words</th>
<th>Flesch Reading Ease</th>
<th>Flesch-Kincaid Grade Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>169</td>
<td>94.7%</td>
<td>4.6%</td>
<td>78.6</td>
<td>6.9</td>
</tr>
<tr>
<td>Story</td>
<td>182</td>
<td>90.6%</td>
<td>7.6%</td>
<td>95</td>
<td>2.6</td>
</tr>
</tbody>
</table>

The story was intended to be easier and to have a lower grade level than the reading text because in the spontaneous speech task participants had to remember and retell the story. In addition, a picture was provided with a view of a 'sunset' and a 'snake', since the two words were identified by the Vocabulary Profiler as 'offlist' and k2 word level words respectively. None of the participants expressed unfamiliarity with any of the words in the texts. The two texts appeared on two separate pages, taking into consideration that all linked words appear on the same line in order to eliminate the factor of breaking the link due to the time it takes the readers to move their eyes to the beginning of the following line. Minor modifications were also made to guarantee that the texts include sufficient incidents of both types of linking investigated, C-V and V-V (see Appendix B for potential linking and phrasing pattern of the two texts). Table 4 displays the potential links in the two texts, together with the percentage of the expected pauses. It also shows the total percentage of function words in the texts and the percentage of the potential linking incidents that involve a function word.

3.3 Procedures

After all participants signed the informed consent forms for the study, the researcher met individually with every participant in a sound-proof room where the experiment took place. First, participants filled out a background information survey. They were then provided with a headphone and a high quality microphone attached to it. These were connected to a laptop using Audacity 1.2.6, audio editing and recording software
Table 4. Potential linking and phrasing in study materials

<table>
<thead>
<tr>
<th></th>
<th>C·V</th>
<th>V·V</th>
<th>Pauses</th>
<th>Function words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>18.9</td>
<td>6.5</td>
<td>11.8</td>
<td>52.6%</td>
</tr>
<tr>
<td>Story</td>
<td>20.3</td>
<td>6</td>
<td>15.3</td>
<td>59.8%</td>
</tr>
</tbody>
</table>

used to play the story and record the participants' reading and narration. Directions were clearly stated at the beginning of each task. Students were able to get instant answers for any question they might have from the researcher.

For the first task, participants read the selected reading text to elicit careful speech data. All participants were asked to read the text twice; however, only the second reading was considered for analysis purposes to make certain that any pauses or hesitation made while reading are not due to novelty of the material. The participants were asked to read the text aloud in their normal reading style. For the second task, participants heard a story once while reading it in order to ensure maximum remembrance of the content. Then, they retold the story in their own words in the space of two minutes. They were not allowed to stop the audio while listening, take notes, or re-record the story. This was used to elicit the spontaneous speech data of the study. The recordings were made at a 44,100 Hz sampling rate.

In approximately 39 minutes of recordings, a total of 14,832 words were produced. The data was afterwards analyzed using Audacity, which displays the audio in a waveform, and helps in removing any unwanted noise. A tempo reduction of 10%, changing the speed of the audio without changing the pitch, made it possible to clearly identify linking incidents and word boundaries. A parallel transcription was entered alongside the display using Transana 2.12, a computer program that facilitates the transcription and qualitative analysis of video and audio data. It provides a way to listen to audio, while displaying their
waveforms and allowing the user to create transcripts and identify analytically interesting points in the audio. Transcripts of the recordings were coded for pauses, instances of C-V and V-V linking, and potential links of both types that were not performed, except when they occurred at a pause unit boundary. A second rater was deemed unnecessary since the primary investigator transcribed the data twice to check for errors and was experienced in phonetic transcription.

3.4 Analysis

The independent variables of the study are: Language (NS vs. NNS of English), level of proficiency (BP vs. IP), speech style (careful vs. spontaneous), and syntactic structure (function words vs. content words); while the dependent variable is the frequency of linking. In order to address the first two research questions, inferential analysis of the potential and actual C-V and V-V linking was conducted, excluding those potential links located at pause unit boundaries. Research questions three and four required additional analysis of phrasing and function words. Since participants paused at different places, each had a different number of potential links; therefore, a ratio based on the count of potential and actual linking of words for each participant was calculated yielding a percentage of C-V and V-V linking. The probability value (p-value) for each research question was set at p< .05. 3.4.1 Research Questions 1 & 2

To address the first research question examining how beginning- and intermediate-proficiency non-native speakers of English differ from native speakers of American English in their use of C-V and V-V linking, a one-way Analysis of Variance (ANOVA) procedure using Tukey's Studentized Range (HSD) Test for Percentage, developed with SAS version 9.1, was conducted. This test was used to examine the differences among the three groups on each variable. A ratio of potential and actual linked words from both tasks rendered a percentage of C-V and V-V linking. This procedure also yielded results that answered the
second research question comparing linking for beginning- and intermediate-proficiency non-native speakers of English.

### 3.4.2 Research Question 3

In order to answer the third research question, which examines the effect of style shifting on linking, an ANOVA model was developed to model students’ performance in the text reading task that elicited formal speech style and the spontaneous speech task that elicited less formal speech. The output from the test predicted learner performance based on group, i.e. results demonstrated the effect of style shifting within each of the NS, BP and IP groups. Again a percentage of ratios of potential and actual links was used to compare the two styles where both C-V and V-V linking results were combined for this analysis.

### 3.4.3 Research Questions 4

For the fourth research question, which investigates whether linking is syntactically-influenced, only linking counts from the NS group were used in the analysis. The participants' performance on the two tasks was combined, and analyzed using an ANOVA model with one variable. An additional count had to be made to estimate the number of potential links (both C-V and V-V) that included a function word in the second-word slot, and the number of the corresponding actualized links. Having these counted, I was able to see whether native speakers link more when the link involves a function word than when it does not. A percentage of the ratio of potential and actual links was calculated for each participant for the two categories of function words and content words, and used in the analysis of variance. The test results showed the effect that syntactic structure had on linking frequency in American English.
CHAPTER 4. RESULTS AND DISCUSSION

The four research questions were addressed using an HSD model of the Analysis of Variance and a deeper microanalysis of the data. This chapter will address each research question in turn, reporting findings from the data analysis and discussing them in the light of past research findings.

4.1 Research Question #1

To answer the first research question as to what extent beginning- and intermediate-proficiency learners of English differ from native speakers of American English in their use of C-V and V-V linking, an ANOVA test was used to examine the differences among the three groups with one independent variable at a time (p<.05). For C-V linking, the analysis was statistically significant for both NS and BP groups, and NS and IP groups. This indicates that a significant amount of potential C-V links in the speech of native speakers is turned into actual links, when compared to that produced by non-native BP and IP speakers. The same result occurred for V-V linking, where NSs linked significantly more than the other two groups. Table 5 summarizes the group mean percentages of actual C-V and V-V links for the three groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Number</th>
<th>C-V Percentage</th>
<th>SD</th>
<th>P&lt;.05</th>
<th>V-V Percentage</th>
<th>SD</th>
<th>P&lt;.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native</td>
<td>5</td>
<td>0.86</td>
<td>0.06</td>
<td></td>
<td>0.87</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>5</td>
<td>0.47</td>
<td>0.13</td>
<td>P&lt;.05</td>
<td>0.29</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>Beginner</td>
<td>5</td>
<td>0.54</td>
<td>0.15</td>
<td></td>
<td>0.41</td>
<td>0.17</td>
<td></td>
</tr>
</tbody>
</table>
The results from the first research question affirmed the findings of Hieke (1984) and Anderson-Hsieh et al. (1994) that IP learners linked much less NSs, although the two studies did not examine BP learners. Hieke established the status of C-V linking as a regular rule in English, since it was present in his data at the rate of about 12 links per 100 syllables. Applying this rule, NS participants in my study linked the majority of the potential C-V and V-V links, with almost 86% linked. The high frequency makes linking a parameter of normal spoken English. In contrast, only 47% of links were performed by the IP group and 54% by the BP, with an even smaller percentage attained in V-V. With such a difference, linking can be considered a parameter to distinguish NS from BP and IP speech (Hieke, 1984). The bar graph in Figure 1 presents the mean percentage of C-V and V-V linking in the spoken data of all three groups.

![Figure 1. C-V and V-V linking means percentages for NS, BP, and IP groups](image-url)
Looking more closely at the data to understand the results, it seems that NNSs tend to insert a glottal stop before vowel-initial words, where the link should take place. Native speakers occasionally produced a less audible glottal stop when they did not link, which was however much less frequent than NNS. Analysis of NS unlinked instances showed that several had their second word stressed for prosodic or pragmatic purposes. In example (21), four out of five NS participants stressed the word *easily* initiating it with a glottal stop and breaking the link with the previous word *can*. *(underlined* words are stressed).

(21) but you can *easily* stay under the ten dollar mark.

More importantly, the factor that seems to have contributed to the significantly smaller amount of linking for the BP and IP groups is their high rate of pausing, that is, the shortness of their thought groups. Table 6 shows the pausing rate for each group and the mean length of their thought groups. Comparing the NS group results with those of the other two groups reveals that, in the reading task, IP learners paused almost twice as much as NSs and BP learners paused three times more than NSs. Pausing works against linking since speakers do not link words over a pause; that means, the more speakers pause, the less linking they can perform.

Table 6. Pausing rate for all groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Reading</th>
<th>Spontaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pause rate</td>
<td>Words Per thought group</td>
</tr>
<tr>
<td></td>
<td>(per 100 words)</td>
<td></td>
</tr>
<tr>
<td>Native</td>
<td>12.4</td>
<td>8</td>
</tr>
<tr>
<td>Intermediate</td>
<td>21</td>
<td>4.7</td>
</tr>
<tr>
<td>Beginner</td>
<td>35.5</td>
<td>2.8</td>
</tr>
</tbody>
</table>
Both Hieke and Anderson-Hsieh et al. did not count potential links that coincided with a pause, neither did they account for the relationship between linking and pausing. For instance, Haul, a beginning-proficiency learner, paused approximately every two words in the spontaneous speech task, overriding all potential links with pauses, resulting in no actual links. Because many learners of English have learned English through the eye rather than through the ear, they falsely believe that words should be pronounced the same way they look on the page, separated by the blank spaces (Wong 1987). This burdens their speech with many unnecessary pauses, almost one after every word.

4.2 Research Question #2

The results in Table 5 can be used to address the second research question which examines how beginning- and intermediate-proficiency learners of English differ in their use of C-V and V-V linking. The two groups did not have a statistically significant difference in linking. This means that the IP group's mastery of linking was not reflected in the progress of their general speaking skills. Table 5 further shows that IP's mean percentage is even lower than that of BP's, especially in V-V linking. This can be accounted for by looking at the scatter plot that compares the three groups' V-V linking in Figure 2. We can see that two of the IP participants actually linked less frequently than all BP. One BP participant had a high rate of linking that set him away from other group members. The results of those three participants might have affected the overall results of IP and BP groups, which can be attributed to individual differences among speakers.

One reason why no significant difference was found between the performances of the two groups might be the lack of sufficient practice of linking in the instruction of IP group. The teaching materials (Ferree & Sanabria, 2003) used for the IP group's English Listening and Speaking classes at the Intensive English Program contained little concentration on linking and other connected speech phenomena. Consequently, it can be expected that their
linking skills do not improve significantly over the time of their English instruction. Most of the IP participants seem to have retained the same level of linking frequency from their BP learning stage. Any improvement in their linking skills can then be attributed to their personal efforts of learning connected speech properly, or unconscious acquisition of the phenomenon.

Figure 2. V-V linking percentages for all participants by group
In another observation, I noticed that Korean speakers frequently insert a schwa /ə/ sound after final consonants, as in example (22). The feature of adding an extra final vowel in Korean and Chinese learners' speech has been studied recently (Deterding, 2006). It arises because these languages have certain constraints against having some consonants word-finally. Nevertheless, Deterding found that none of the speakers adds a schwa to the end of such a word in a sentence-final position, which suggests that the addition of a schwa at the end of a word is a linking phenomenon.

(22)  I / was (ə) old

This is supported by Broselow's (1987) Syllable Structure Transfer Hypothesis, which proposes that "when target language permits syllable structures which are not permitted in the native language, learners will make errors which involve altering these structures to those which would be permitted in the native language" (p. 302). This suggests that one possible reason for not performing the links is first language interference that urges Korean learners to link their final consonants to an inserted schwa instead of the following vowel.

4.3 Research Question #3

Research questions 3 and 4 are concerned with the factors that may influence linking frequency for native and non-native speakers of American English. To answer whether native speakers of American English and beginning- and intermediate-proficiency learners of English link their words in spontaneous speech more than in careful reading, I compared the groups' linking frequencies in the two speech tasks.

Results of the ANOVA tests performed separately on each group showed that none of them had significant differences between their linking performance in text reading and spontaneous speech tasks, which means that a change in speech style does not entail a change in linking frequency. Table 7 and Figure 3 display group mean percentages of actual links performed in the two tasks.
Table 7. Mean percentages of linking in reading and spontaneous speech tasks for all groups

<table>
<thead>
<tr>
<th></th>
<th>Native</th>
<th>Intermediate</th>
<th>Beginner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reading</td>
<td>Spontaneous</td>
<td>Reading</td>
</tr>
<tr>
<td>Percentage</td>
<td>0.86</td>
<td>0.85</td>
<td>0.45</td>
</tr>
<tr>
<td>SD</td>
<td>0.06</td>
<td>0.08</td>
<td>0.21</td>
</tr>
<tr>
<td>Pr &gt; F</td>
<td>0.4243</td>
<td>0.7752</td>
<td>0.3312</td>
</tr>
</tbody>
</table>

This finding contradicts with Anderson-Hsieh et al. whose NS and NNS participants linked significantly more in the spontaneous speech task. It also contradicts the results of previous research in second language style shifting (Beebe, 1980; Major, 1987) which concluded that casual and more spontaneous speech is smoother and more fluent than read speech. One possible reason for this discrepancy is that Anderson-Hsieh et al. used isolated sentences for the reading task which created less natural reading rhythm and pausing pattern, while I used a coherent text for the same task that eliminated such variables.

Another possible explanation for this result is the higher pausing rate of the spontaneous speech data, which consequently entails less linking (see Table 6). This is especially the case for non-native speakers who paused in spontaneous speech considerably more than they did when they read the written text. In this case, the high pausing rates in spontaneous speech due to hesitation phenomenon or other thinking process not required in reading rendered less linking, even though the speech was smoother and more fluent (Beebe, 1980; Major, 1987). Comparing the pausing rates of the present study's groups with Anderson-Hsieh et al's was not accessible since they did not account for the variable of pausing.
Other factors can affect the linking rate in spontaneous speech, such as speaker's attempt to transfer meaning messages. An example of this condition can be seen in (23) where Superwoman from the NS group, seemed to link more words to heighten the dramatic effect in that part of the story,

(23) and he / picked im up and took im to the top of the mountain

In contrast, Sapphire, another native speaker, broke more links when she wanted to express the dramatic effect of surprise in the second thought group of example (24), where an asterisk indicates a potential link not realized,

(24) just as he was about to put im back * on the ground / that snake turned * and bit him

The overall outcome indicates that linking was not sensitive to style change.
4.4 Research Question #4

The final research question investigated the impact of syntactic categories on the frequency of linking. Do native speakers link more often when the link involves a function word than when it does not? Results indicate that NS participants linked significantly more when words were linked to a function word rather than when they were linked to a content word. Table 8 shows the NS group mean percentage of actual links performed towards function and content words. This finding confirms Selkirk's (1995) observation that function words may exhibit an extremely close phonological connection with an adjacent word.

One reason that the NSs did not link as much towards content words is that these words are usually assigned a higher stress than function words; hence speakers break more links towards them (see section 4.1 for more details on the relationship between stress and linking). Syllable-initial vowels – and hence glottal onset – are usually retained when special stress assignment overrides linking (Hieke, 1984; Gimson, 1989).

Another observation is that NS, but especially NNS participants linked more when the potential links involved such constructions as “give away, it’s ok, forget about it”. It seems that since learners acquire certain constructions as chunks, they tend to have fewer pauses (Goldman Eisler, 1968) and keep them well-connected. This view is further supported by Bybee and Thomson's (2000) conclusion that the strength of the link between the two words is determined by their syntactic cohesion, in other words, their frequency of co-occurrence. These connections are stored in memory and reinforced by frequent use.

Table 8. Mean percentage of linking to different syntactic categories

<table>
<thead>
<tr>
<th></th>
<th>Linking to function words</th>
<th>Linking to content words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>0.89</td>
<td>0.76</td>
</tr>
<tr>
<td>SD</td>
<td>0.06</td>
<td>0.05</td>
</tr>
</tbody>
</table>
The higher the frequency of a construction, the more likely that its linking (or sometimes non-linking) pattern will be preserved. It is not surprising, then, that certain linking contexts are more frequently performed, such as those of phrasal verbs. The link between the verb and its particle in *give away* and *looked up* was performed by all NSs in the present study. These constructions can be regarded as having tighter syntactic cohesion. Another factor that helps learners in this respect is the faster lexical access to function words, in contrast to content words, that allows them to remember these words with more ease (Segalowitz, 2000). All the findings confirm that the phenomenon of linking is syntactically-influenced.
CHAPTER 5. CONCLUSION

The nature of linking in running speech has not been widely investigated. However, the present study provides a foundation for future research into the significance of linking in teaching English as a Second Language. This study was able to reveal a statistically significant difference between native and non-native speakers of English, supporting past research findings on linking frequency, while it contradicted past research results in terms of finding no significant difference between spontaneous and reading speech styles. It was also able to find that native speakers link more frequently towards function words than to content words. These findings are informative for future research. This chapter also presents pedagogical implications for teachers and textbooks developers, and points out limitations observed in this study.

5.1 Pedagogical Implications

Based on the results that indicate much less linking frequencies in NNS speech when compared to NS speech, teachers and textbook developers should pay more attention to this feature of connected speech. Although the IP learners have received between 2-3 semesters of ESL instruction since they arrived to the U.S., results indicate that their linking skills did not improve with the progress in their proficiency level. Furthermore, since high-proficiency learners have approximated the performance of NS group in both categories of linking in Anderson-Hsieh et al.’s (1994) study, it seems that the major gap in teaching linking is between the beginning and intermediate level of English proficiency.

A possible reason for this deficiency is the lack of attention for paid to connected speech phenomena in general, and to linking in particular in some textbooks (Sheeler & Markley, 1991; Grant, 1993; Lane, 1993; Orion, 1997; Miller, 2001). Even when other teaching materials dedicate more space to linking (e.g., Dauer, 1993; Hewings & Goldstein, 1999), it is dealt with in one part and never mentioned again in the book. In addition, the
majority of textbooks present the rules of linking depending on phonetic description of the words link, providing examples of the rules discussed. Here is an extract from *Focus on Pronunciation* (Lane, 1993) that represents how linking is introduced in the majority of textbooks,

> When a word that ends with a consonant is followed by a word that begins with a vowel, in the same thought group, join the consonant to the vowel.

> North_America, one_at_a_time

> When a word ends in [iy, ey, ow, uw, ay, oy] and the next word begins with a vowel, join the [y] or [w] to the vowel.

> How_are_you?, very_anger, go_away

Rules of linking are followed by a few exercises that ask the learner to listen to recorded sentences and mark the thought groups and the C-V linking inside them, and then practice reading them to a partner. Learners will not come across linking elsewhere in the textbook.

Although the sound system has been traditionally described and taught in a building block fashion: sounds – syllables – thought groups – longer stretches of discourse, learners do not experience language in a similar way. Neither NS nor NNS have usually the time or ability to think about what they are saying sound by sound, otherwise communication breaks down and speech is loaded with pauses, as apparent from the data and results of this study. The bottom-up approach used in Lane's (1993) and other textbooks that depends on composing language sound by sound and eventually stringing them all together produces choppy and disconnected utterances. It should be replaced by a more top-down approach to teaching pronunciation, in which the sound system is addressed as it naturally occurs in running speech (Goodwin, 2001).

In spite of the accuracy of the phonetic criteria which have been traditionally used in teaching linking and depends upon identifying the type of linking and the linked sounds
phonetic environment before actually linking the words, this method is impractical because of the considerable amount of thinking processes needed to accomplish it. Based on Lane's (1993) rules of linking, for instance, learners need to identify the category of the final sound of a word and that of the first sound of the next word before they can decide which type of linking applies and actually join them. The time speakers have in normal running speech to process words is usually not enough to apply this phonetic method.

A morpho-syntactic criterion that can be more quickly identifiable to learners should prove more effective in teaching linking, and probably other connected speech modifications. This method depends on the finding of the present research that NSs link more frequently to a function word, and on the high frequency of such words in any spoken discourse. Because function words are very limited in number, yet more frequent in speech, they are easy to identify, especially for NNSs who are usually taught many function words in the early stages of learning English. Using these characteristics, teachers and textbook developers can create teaching materials that use function words' close connections with adjacent sounds to introduce and teach linking. This method of teaching linking can be integrated into the teaching of other skills, such as teaching phrasal verbs, which students may acquire as chunks retaining the appropriate links at word boundaries. It also should be recycled throughout the entire textbook whenever there is a chance to link it to other materials.

For instance, a teacher who uses the morpho-syntactic method can explain to learners that grammatical words, such as prepositions, articles, pronouns, etc., are often linked to the word next to them, providing examples from the unit or the concept being taught in class. Learners, then, are involved in a cloze exercise where they have to listen to an excerpt, from the unit they are dealing with, and fill in the gaps with the linked words. Gaps should have two linked words with at least one function word, as in example (25). Missing words are enclosed in brackets,
(25) The old (city of) Damascus still preserves its spatial and historical aspects. It is enclosed by the city walls, and (lies on) the south bank of the river Barada. These walls, which have survived from many generations, were built to protect the city (from its) enemies. Damascus is surrounded (by a) large oasis, and watered by the river. The oasis has been (decreasing in) size with the rapid expansion of housing and industry in the city.

Integrating the teaching of linking with that of function words will give learners more opportunity to practice linking in context throughout the course, instead of having to apply rules on isolated sentences. In addition, they will be able to relate various aspects of connected speech to each other, such as linking, reduced forms of function words, rhythm and phrasing.

Additionally, certain linking activities may benefit students on yet another level. Since many languages do not allow syllable-final consonants, such as Korean and Chinese, English learners from such language backgrounds will have difficulties in articulating final consonants. This constitutes a serious problem when those consonants perform specific grammatical functions, such as plural markers and past tense markers. C-V linking causes the final consonants to be restructured with the initial syllable of the following word which makes them easier for learners to pronounce and eliminates the need to insert an additional schwa after final consonants (see example 20).

5.2 Further Research

Although the present study revealed the extent of differences between NS and NNS use of linking, it does not entail that such a deficiency in NNS speech constrains communication. Further research is needed to determine whether perceptual and production problems related to linking affect intelligibility. The degree to which those features contribute to 'intelligibility' is a possible measure of their significance in teaching English as
a second language. Research in studies of listening comprehension will benefit from the results of such a study.

In addition, the field of connected speech phenomena could also benefit from a study that investigates the effectiveness of the previously proposed method of teaching linking, and other connected speech modifications, using morph-syntactic criteria in comparison to phonetic criteria. Such a study can be done longitudinally on two groups of learners, each being taught using a different method. Results can reveal not only which method is more effective in teaching linking, but also how learners acquire this feature.

The present study has also called attention to the connection between frequency of linking and pausing rate. For example, all three groups linked less frequently when their pausing rate increased. However, although IP group had smaller pausing rate in both reading and spontaneous than BP, they linked less frequently. More research is needed to determine how this connection works, which may, in turn, contribute to the field of fluency. Since phrasing is an important aspect of fluency (Zutell & Rasinski, 1991) together with speech rate and smoothness, does an increase in linking frequency lead to an improvement of phrasing and an increase in speech rate, the thing that ultimately improves learners' fluency?

5.3 Limitations

The fact that the number of participants in the present study is relatively small, limits to some extent the generalisability of its findings. In addition, most of the non-native participants were Korean which may have affected the results due to first language interference of one major group of participants. A more balanced group of participants would have probably yielded more generalizable results. Furthermore, the limited scope and time of the study allowed for the investigation of two types of linking, leaving one type – consonant-to-consonant liking – unexamined.
5.4 Conclusion

Despite the above limitations, the findings from this study provide a starting point in the field of linking. With only two studies on linking in the past three decades, a need emerges to conduct research that investigates this phenomenon in particular, and other connected speech processes in general, and strives to find new methods to teach it, since the traditional ones are not always easily applicable. A morpho-syntactic method of teaching linking was proposed to replace the traditional bottom-up phonetic method used in the majority of ESL textbooks. Non-native learners of English seemed to lag far behind native speakers in their linking frequency and pausing rate. With such a difference, linking can be considered as a parameter to differentiate native from non-native speech (Hieke, 1984). Findings of this study will also help research in intelligibility and fluency, which has been gaining a growing interest in the past few years.
APPENDIX A. STUDY TASK MATERIALS

Reading Task Text

(Text resource: an essay on re-gifting written by a NS middle-school student)

Do you often spend too much time in parties and pay a lot to buy presents? Let's face it, one of the reasons we spend more money on buying presents is shopping at the last moment. But you can easily stay under the ten dollar mark and still give everyone a birthday smile while keeping your own. Don't buy a new toy every time you go to a party. Keep a few ready gifts and cards for all ages on hand, and you will always be on time. It's OK to give away gifts you have around that would suit someone else much better. Just remember to note on the box or bag the name of the person who gave it to you before you store and forget about it. If you don't, you may end up giving it to the same person again. At the end of the season, you will have more money in your pocket and a little more space for your things at home.

Spontaneous Task Text

(Text resource: http://www.boyscouttrail.com)

A little boy was walking down a road, when he came across a snake. The snake asked “Take me to the top of the mountain please. I hope to see the sunset before I die.” The little boy answered “No. If I pick you up, you will bite me and I will die.” The snake asked him not to be afraid. He agreed and carried it up to the top of the mountain. They sat under a tree and watched the sunset. Then after sunset, the snake asked “Can I go home now. I am tired and I am old.” The little boy felt he was safe all this time with the snake, so he would take it home. He picked it up and carried it back to its home.
Before he put it on the ground, it turned and bit him. The boy cried out and threw it away.
He asked “Mr. Snake, why did you do that? Now I will surely die.”
The snake looked up at him and answered “You knew what I was when you picked me up.”
APPENDIX B. POTENTIAL LINKING AND PHRASING FOR TASKS

**Reading Task Text**

(A slash represents a potential pause, stands for a link)

Do you often spend too much time in parties and pay a lot to buy presents / let's face it / one of the reasons we spend more money on buying presents / is shopping at the last moment / but you can easily stay under the ten dollar mark and still give everyone a birthday smile / while keeping your own / Don't buy a new toy every time you go to a party / keep a few ready gifts and cards for all ages on hand / and you will always be on time / it's OK to give away gifts you have around that would suit someone else much better / just remember to note on the box or bag / the name of the person who gave it to you / before you store and forget about it / if you don't / you may end up giving it to the same person again / at the end of the season / you will have more money in your pocket / and a little more space for your things at home

**Spontaneous Task Text**

A little boy was walking down a road / when he came across a snake / the snake asked / take me to the top of the mountain please / I hope to see the sunset before I die / the little boy answered / no / if I pick you up / you will bite me and I will die / the snake asked him not to be afraid / he agreed and carried it up to the top of the mountain / they sat under a tree and watched the sunset / then after sunset / the snake asked / can I go home now / I'm tired and I'm old / the little boy felt he was safe all this time with the snake / so he would take it home / he picked it up and carried it back to its home / before he put it on the ground / it turned and bit him / the boy cried out and threw it away / he asked / Mr. Snake / why did you do that / now I will surely die / the snake looked up at him and answered / you knew what I was when you picked me up /
REFERENCES


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