UiA University of Agder

Master

Bilingual Spoken Word Comprehension: Effects of Sentence Context

A comparison of Norwegian-English bilinguals' speech recognition in Norwegian and in English as a second language

ELLINOR SKJERLI

SUPERVISORS
Linda R. Wheeldon
Allison L. Wetterlin

University of Agder, 2021
Faculty of Humanities and Education
Department of Foreign Languages and Translation

Table of contents

List of Tables

List of Figures

Acknowledgements

First of all, I would like to thank my two supervisors, professors Linda R. Wheeldon and Allison L. Wetterlin, for introducing me to the world of experimental linguistics and letting me be a part of this master's project. When deciding to take some time off from my translation work to finish a master's degree, I never dreamed of finding such a perfect project for my master's thesis. The last year has been challenging in many ways due to the Covid-19 situation with lock-downs and Teams meetings instead of being able to meet at the university. Nevertheless, the two of you have provided me with all the knowledge I needed to be able to finish this thesis, and with the reassurance and inspiration I needed in times where it all felt slightly overwhelming.

Thank you to Karethe Nilsen for being the best study partner through the last two years and for all your support and encouragement through endless hours of work on the comprehension experiment. I would also like to thank everyone at the linguistics lab who have contributed to this project. Thank you to Renate Gjetnes for the great cooperation on running the production/comprehension experiments. Thank you to Jan Zandhuis for helping us by setting up and programming the test material, for teaching us how to run the experiments and making sure everything ran smoothly, and for providing us with all kinds of necessary technical information about the experiments and the testing. Thank you to Eunice Fernandez for helping us analyse the data collected from our experiments. Thank you to Mikael Albrecht for taking the time to teach us how to use the NoWac and SUBTLEX databases to calculate word frequencies. In addition, I would like to thank all participants who took the time to come to the laboratory to be tested.

Last, but definitely not least, I would like to thank my family for your support and encouragement, specifically Frode and Magnus. Without the help and support from both of you from start to finish, I would never have been able to do this.

Abstract

This master thesis is part of a bigger master project aiming to expand our understanding of speech processing. In three sub-projects – speech production, speech comprehension, and word finding – six master students investigated the relationship between an individual's language background and proficiency and their use of English as a second language. This thesis covers the comprehension part of the study, which investigated Norwegian-English bilinguals' ability to use sentence contextual information when processing spoken language both in their native Norwegian and in English as a second language, and whether this ability was modulated by aspects of participants' language background, proficiency, and use.

The comprehension study was based on the classic study of Marslen-Wilson and Tyler (1980) who investigated speech processing in monolinguals listening to sentences with different levels of contextual information and found that a higher context level facilitates word recognition. The present study extends this to a situation where more than one language is represented, by investigating bilinguals listening both in Norwegian and in English as a second language. Many Norwegians are multilinguals and know several languages, so a requirement for participation was not to be proficient in any other languages to a degree where they could hold a conversation in that language.

The comprehension study consisted of a word monitoring task where participants listened for a given target word in sentences of three different constraint levels: high-constraint sentences which gave much context information, low-constraint sentences which gave little context information, and mixed constraint sentences which were scrambled versions of low-constraint sentences where words appeared in a random order and gave neither context nor syntactic information which could aid in the word recognition process.

Results revealed that our participants responded faster in Norwegian than in English, as expected. In both languages, results revealed an advantage of high-constraint sentences over low-constraint sentences, indicating that even if our highly proficient participants were more proficient and faster in Norwegian, as expected, they seemed to listen in the same pattern in both Norwegian and in English as a second language.

Introduction

The intriguing process of speech comprehension is performed in our minds every time we hear a speech sound, and despite sounding trivial and easy, it involves several complex mental tasks executed with enormous speed and efficiency (Cutler, Weber, Smits, & Cooper, 2004). The process starts when a sound, which may be both noisy and ambiguous, is heard and perceived as a speech sound and not just as random noise. Next, the speech flow is segmented into words, and the words are mapped to meaning and combined into a meaningful utterance (e.g., Brothers, Dave, Hoversten, Traxler, & Swaab, 2019; Marslen-Wilson & Tyler, 1980). The aim of the present study was to extend our understanding of speech processing to a situation where more than one language is represented. The focus is bilingual language processing and specifically how bilinguals process words in sentence contexts in each of their languages. Earlier research strongly indicates that monolinguals use context and pragmatic information to ease comprehension when listening to speech in a sentence context (e.g., Marslen-Wilson & Tyler, 1980). The present study investigated whether the same applies for bilinguals both when listening in their native Norwegian language and in English as a second language.

Being bilingual has become a standard in a globalized world where estimates indicate that more than half the population speak more than one language (Grosjean, 2010). In Norway, English has a privileged position with an estimated more than 80 % of the population speaking English in addition to Norwegian (Rindal & Piercy, 2013). Since becoming a compulsory subject in Norwegian schools in 1969 (Rindal, 2014), English has developed a central position in the Norwegian educational system, compared to other foreign languages. This, combined with the high exposure to English in the Norwegian society, ensures that most younger Norwegians are highly proficient and confident speakers of English (The Norwegian Directorate for Education and Training, (n.d.)). Nevertheless, Norwegian-English bilinguals' language background, language proficiency and language use vary, hence we wanted to investigate whether such variations may influence their ability to use contextual information when processing sentences.

Two concepts are vital to understand how speech comprehension processes work. The first is bilingualism, and the second is speech comprehension. At first glance, the two concepts may seem both familiar and easy to understand, but a closer look reveals important complexities. In the first part of this introduction, I will start by discussing different aspects of being bilingual and look into theories of how language is represented in our brains. Next, I will discuss how these language representations are accessed in our minds during language processing, specifically whether only one language at a time or both/all languages are active either in full or to some degree. I will also briefly discuss advantages and disadvantages of being bilingual, and finish this part with a discussion of

bilingual proficiency and how to measure this to be able to compare research participants. The second concept is speech comprehension. Of specific interest for our study are theories of how we recognize words in a sentence context and how we use preceding contextual information in sentences to recognize a word more efficiently. Hence, in the second part of this introduction, I will look into and discuss theories and models of speech comprehension, both in terms of single word recognition and word recognition in a sentence context, and in terms of monolinguals listening in their native language and bilinguals listening in their second language. The participants tested in our study are Norwegian-English bilinguals. In the third section of this introduction, I will discuss what characterizes Norwegian-English bilinguals, and compare the English and Norwegian language, before ending this introduction with a presentation of the present study.

Bilingualism

Many attempts have been made to find a good definition of bilingualism (e.g., Carlson & Meltzoff, 2008; Costumero et al., 2020; Grosjean & Byers-Heinlein, 2018). One suggestion is that bilingualism is to know or be able to use more than one language. But how well do you have to know your second language to be considered bilingual? A famous definition by Bloomfield (1933) stipulates that bilingualism involves a native-like control of two languages. Haugen (1969), however, later acknowledged that bilinguals are rarely equally proficient in both their languages and defined bilinguals as speakers who are able to produce complete, meaningful utterances in their second language (referenced in Grosjean & Byers-Heinlein, 2018). Grosjean (1989) argued against the view that bilinguals are two monolinguals in one and suggested that the presence of two languages in a bilingual's mind produces a "unique and specific speaker-hearer". He claimed that viewing bilinguals as two monolinguals in one will incorrectly weight factors such as fluency and balance between the two languages and lead to a view where true or ideal bilinguals should be equally fluent in both languages and all others are "less bilingual". Later research (e.g., Marian & Hayakawa, 2020) has confirmed that being fluent in a language is not the best indication of proficiency, since bilinguals are a very heterogenous group varying on a continuum from monolingual to bilingual, where some bilinguals may be highly proficient readers and writers despite of having a strong accent, and others may have a small vocabulary despite of having a native-like accent.

People become bilingual in various ways. Bialystok and Hakuta (1994) distinguish between *simultaneous* and *sequential* bilinguals, where simultaneous bilinguals learn two languages simultaneously from birth because each parent speaks a different language, and sequential bilinguals first learn one language from birth and then learn another language later. Sequential bilinguals can be further separated into *early sequential bilinguals* and *late bilinguals*, where early

sequential bilinguals learn their second language during childhood and late bilinguals learn their second language in adolescence or later in life (Bialystok & Hakuta, 1994).

Bilingualism has become widespread and is found all over the globe, both in regions of the world where two languages are used regularly within a society, e.g., Welsh and English in North Wales, French and English in Canada, Spanish and English in parts of the US, Spanish and Catalan in parts of Spain (Harley, 2014), and in regions where one language is dominant. In Europe, for instance, more than half the population are assumed to be able to communicate confidently in two or more languages. Multilingualism is even regulated by the European Council through Council Resolution of 21 November 2008 on a European strategy for multilingualism (2008/C 320/01) to secure linguistic and cultural diversity. In Norway, the educational system ensures that children learn English in school from 1st grade, and some as early as kindergarten, with the aim of providing the children with enough knowledge of English to be able to use it productively (e.g., Rindal & Piercy, 2013; The Norwegian Directorate for Education and Training, (n.d.)). In fact, most Norwegians learn more than one foreign language and are multilingual, not bilingual. For the present study, however, we wanted to study native Norwegian bilinguals who had English as their only dominant foreign language. Hence, none of our participants spoke any other languages well enough to hold a conversation, which meant that they could be defined as bilinguals and not multilinguals.

The Mental Lexicon

To be able to understand both bilingualism and speech comprehension, it is useful to look into theories of how language is represented, organized, and categorized in our *mental lexicon*, i.e., the internal storage of words in our minds. Exactly how many words this mental lexicon may contain is debated, but some calculations indicate that educated adults may know more than 150,000 words and may actively be able to use approximately 90 percent of these (Aitchison, 2012, p. 6). With so many words stored, relevant questions are what is represented in the mental lexicon, how is it represented, and how are we able to map words to meaning. In speech comprehension specifically, an important question is how we manage to map speech signals, i.e., *surface forms*, onto the representations in our mental lexicon, i.e., *underlying forms* (e.g., Lahiri & Reetz, 2010; Pierrehumbert, 2001). Different models of lexical representation assume different storage, ranging from *abstractionist* models arguing for sparse representation with one representation only for a word or feature (Lahiri & Reetz, 2010), to *exemplar-based* models which assume that every version of every word you have ever heard is stored in word clouds in the lexicon together with relevant acoustic, lexical, social, contextual information, and even personal information about the speaker (Pierrehumbert, 2001). The two types of models have different assumptions of where in the speech

recognition process contextual information may influence word recognition. Whereas exemplar-based representation would assume that context is stored together with information about the word, and is thus able to influence the recognition process from a very early stage, or even before the word is heard, abstractionist models of representation would assume that context cannot influence word recognition until later in the process, after the audible input is heard.

For bilingualism, an additional and highly debated issue is how each of a bilingual's languages are stored in the mental lexicon. Two different views have emerged, where one assumes that words are stored in separate lexicons for each language and the other assumes one shared storage for both/all languages. To understand this discussion, it is useful to look at theories of how the relationship between conceptual representations and form representations is assumed to be represented in the mental lexicon, i.e., the relationship between meanings and words. The view that words and concepts are separate entities can be traced back to Saussurian structuralism, which is based on a main idea of binary oppositions, i.e., two directly opposed ideas. Ferdinand de Saussure distinguished between *langue* (utterances, or words) and *parole* (structure, or meaning) and described the arbitrary relationship between them. It is, for instance, completely arbitrary that the concept of "tree" is linked to the word "arbre" in French and to the word "tree" in English (Tyson, 2015, pp. 201-202). In a model in line with such structuralist ideas, Weinreich (1968) describes three alternative organizations of representations in the mental lexicon where he assumes that **coordinative bilinguals** have separate representations for both concept and form, **compound bilinguals** have separate representations for form, but common representation for concept, and **subordinative bilinguals** have common representations for form and an organization of the concept representation where a word maps onto a second language concept via a first language representation, see fig. 1 (Grosjean & Li, 2013, p. 173).

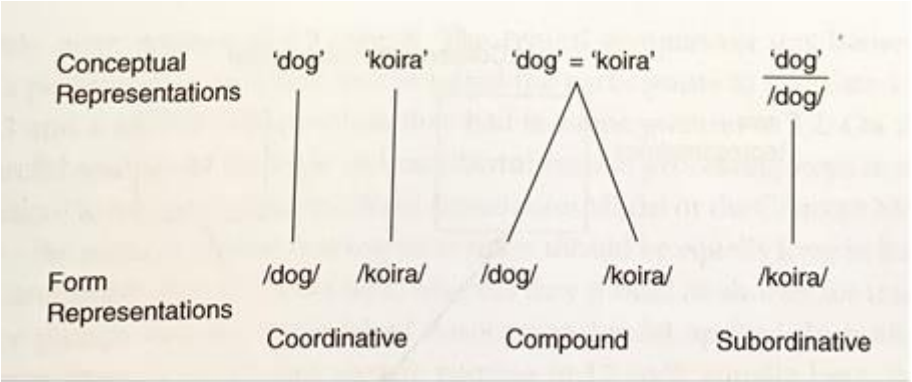

Figure 1. *Alternative conceptual and form representations in a bilingual's mental lexicon (Weinreich (1968), as referenced in Grosjean & Li, 2013, p. 173)*

But how do humans select the correct words from the mental lexicon when listening or speaking, i.e., how are we able to activate the relevant potential target words and ultimately select the intended word? For bilingual listeners, there is also a need to select the intended language and suppress the unintended language(s) when speaking or listening. In other words, are both languages always active when bilinguals process language, or can the bilingual turn off one language and only access the other? Bilinguals who know more than one language need a control system to prevent them from involuntarily switching between languages or experiencing intrusions from one language to another (Kroll, Gullifer, McClain, Rossi, & Martín, 2015). Kroll (2008) refers to this switching which bilinguals must perform to access and use the intended language when producing or listening to speech, as *mental juggling* and argues that it leads to a fundamental reorganization of bilinguals' language systems. Thus, bilingual language processing has been seen to differ from monolingual processing, supporting the view that bilinguals are not two monolinguals in one (Grosjean, 1989).

Selective or Non-Selective Activation

We have seen that words are assumed to be stored in the mental lexicon. The next question is how active each of the bilingual's languages, or lexicons, are during speech processing. Can a bilingual who hears a speech sound activate only the relevant language when trying to map the sound to meaning, or are both or all their languages activated in parallel? I will discuss the issue of lexical activation in detail later, but a brief explanation is that both in monolingual and bilingual speech processing, the lexical access process starts with an initial audible input activating potential target words in both languages before continuing through a process of inhibition and facilitation where eventually one word ends up having the highest activation and is chosen as the target word. In bilinguals, however, this process involves more than one language, and amazingly, bilinguals do this all the time without errors or mixing in words from the unintended language. Two alternative theories of language activation exist, where one claims that language activation is selective, i.e., items from only one language is activated at one time, and the other claims that language activation is non-selective, i.e., items from both languages are activated and compete for selection. Early studies suggested that language activation was selective, e.g., Levelt (1989), who argued that if both languages were activated, this would lead to blend errors where phonological information from two different items would become mixed in one utterance. Nevertheless, proficient bilinguals switch between languages effortlessly and without blend errors (e.g., Costa & Santesteban, 2004), and more recent evidence strongly suggests that language activation is non-selective (e.g., Dijkstra, 2005; Lagrou, Hartsuiker, & Duyck, 2013).

Strong evidence of non-selectivity has been found in studies of the processing of *cognates* and *homophones*. In historical linguistics, cognates are defined as words which share the same etymological origin. For this study, however, we use the psycholinguistic definition where cognates are defined as words which have the same or similar spelling and the same meaning in both languages (Sunderman & Schwartz, 2008), e.g., the word *piano*, which has the same form and meaning in both English and Norwegian. Homophones, on the other hand, have the same form but different meaning (Kroll, 2008), e.g., the word pronounced [ba:k], which means "bark" in English, but "behind" in Norwegian. Since cognates are similar in two languages they are assumed to be listed in the mental lexicon for both languages, which is assumed to facilitate the word recognition process. Hence, non-selective processing where both languages are assumed to be active should give a *cognate effect* with faster response times for cognates than for non-cognates, since cognates are activated from both languages. Costa, Caramazza, and Sebastian-Galles (2000) tested this cognate effect, hypothesizing that if both languages were activated when hearing cognates (e.g., Spanish *gato* and Catalan *gat*, which means "cat" in English) and homographs (e.g., Spanish *mesa* and Catalan *taula*, which means "table" in English), similar phonological nodes would be activated in both languages and create a cognate effect with faster responses for cognates than for non-cognates. No cognate effect would mean that only the target language was activated, and the bilingual would function like a monolingual. Non-cognates, on the other hand, have fewer common phonological nodes, hence would produce no cognate effect and no facilitation. Another assumption was that activation would be greater in the dominant than in the nondominant language, hence greater cognate facilitation when naming in the non-dominant language. Results confirmed that bilinguals are faster when naming cognates, and that the cognate facilitation effect is larger in the non-dominant language, which is evidence for parallel activation of both languages, i.e., non-selectivity (Costa et al., 2000).

In a recent study, however, Costa, Pannunzi, Deco, and Pickering (2017) disputed the traditional selective/nonselective view and described a model where native language phonological relationships may be mapped to the non-native language through a learning process. Activation has been seen to become selective when a bilingual reaches a certain proficiency level, which Costa and colleagues explained with learning strengthening connections both between translation words and between words which are seemingly unrelated in the two languages. By simulating the results of Thierry and Wu (2007), they described how two unrelated words in one language may turn out related in another. E.g., in English-Chinese bilinguals, the target word *train* (*huo che*) could activate the word *ham* (*huo tui*) because the two words are form-related in Chinese. Their explanation was that activation spreads from *ham* to its translation equivalent *huo che*, and then between the

Chinese form- related words *huo che* and *huo tui*. As proficiency grows, the links between the translation equivalents *train* and *huo che* strengthen, resulting in spreading activation both between translations and between words that may seem unrelated (Costa et al., 2017).

Competition and Inhibition Between a Bilingual's Two Languages

When a person knows more than one language and these languages compete for activation, a need to control the languages arises. This is particularly important in the production of speech, where the bilingual depends on selecting the correct language to be understood. But also in the comprehension of speech, there is an obvious need to figure out which language is heard or read, to map meanings to the correct set of words and prevent interruptions from the unintended language (Kroll, 2008). In their Adaptive Control Hypothesis, Green and Abutalebi (2013), explain how different language contexts require different levels of inhibition and activation of the bilingual's languages and defines three different contexts. The first is a single-language context, in which the bilingual is required to use only one language at the time, meaning that the other language needs to be strongly inhibited to avoid interruptions. The second is a dual-language context, where the speaker may change language during a conversation, e.g., if speaking to one person who knows one language when another person who only speaks another language joins the conversation. Such switching only occurs between different speakers, however, and not within an utterance. Hence, there is still a need to inhibit the unintended language, but this need is reduced to keep the other language activated to a degree where it is still accessible if a language switch should become necessary. The third is a code-switching context, where utterances consist of a mix of words from each language and both languages are active and available all the time (Green & Abutalebi, 2013). Examples of code-switching can be heard regularly in Norway, where most people are proficient bilinguals and able to communicate in both Norwegian and English, depending on who they are talking to. Consequently, many Norwegians are seen to regularly mix English words into Norwegian when speaking and can often be defined to be in a code-switching context.

Another aspect which may influence competition and activation between languages is language mode. Language mode can be described as the activation state which a bilingual's languages and language processing mechanisms are in at the time of language processing. Language mode varies on a continuum between monolingual mode, where only one language is used and activation is assumed to be selective, to bilingual mode, where both languages are used and activation is assumed to be non-selective (Grosjean & Byers-Heinlein, 2018). Indications are that bilinguals' perception of speech sounds depends on which language they think they are hearing (Gonzales, Byers-Heinlein, & Lotto, 2019). Marian and Spivey (2003) investigated activation and

influence between languages in a speech perception study while considering the issue of language mode. In two eye-tracking experiments, they studied parallel access during listening in highly proficient Russian-English bilinguals who were full-time university students in the US. To control for language mode during testing, only one language was used at the time, with no switching between languages and no reference to the language not used. To strengthen the monolingual language mode, stimuli were recorded by monolingual speakers and experimenters were monolingual. The first experiment was in English, and participants were not informed that their knowledge of Russian would be relevant for the study. Participants saw stimuli sets consisting of three objects: an English target object (e.g., *shovel*), a competitor object with an English name matching the English target object (e.g., *shark*), and a competitor object with a Russian name matching the English target object (e.g., *sharik* 'balloon'). The second experiment, with a different set of participants, was in Russian, with stimuli sets consisting of a Russian target object (e.g., *marka* 'stamp'), a competitor object with a Russian name matching the Russian target object (e.g., *morkov* 'carrot'), and a competitor object with an English name matching the Russian target object (e.g., *marker*). Both groups experienced within-language competition and showed support for parallel access, but the competition between the languages varied. Only the group tested in their L2 showed interference from the other language, indicating that L1 interfered with L2 processing, but not the opposite.

The discussion of whether activation is selective or non-selective is still on-going, however. Although early research supported non-selectivity (e.g., Dijkstra, 2005; Marian & Spivey, 2003), later research has shown that in very high-constraining sentences with a high level of contextual information, cross-language interaction from the unintended language is reduced and activation becomes more selective. One example is Lagrou et al. (2013), who investigated three questions: whether there was parallel language activation when listening to sentences in L2, whether semantic constraint influenced lexical access when listening to sentences in L2, and whether sub-phonetic cues provided by the speaker restricted lexical access when listening to sentences in L2. Participants were Dutch bilingual university students who had English as their L2. They were given an English lexical decision task where they should indicate whether the last word of spoken sentences was a word or a nonword. Stimuli consisted of 240 last-position target words, including 30 interlingual homophones (e.g., *lief* "sweet" – *leaf* /li:f/) and 30 control words matched for phoneme length and frequency, plus 60 English filler words, and 120 nonwords. For each target word, a pair of sentences was constructed consisting of one high-constraint and one low-constraint sentence, i.e., 480 test sentences in total. To test whether native accent would give cues to language, sentences were pronounced by either a native English speaker or a native Dutch speaker who spoke English fluently

but with a clear Dutch accent. The participants were not informed that native language knowledge would be relevant for the study.

33 participants listened to sentences pronounced by the native Dutch speaker, and 31 participants listened to sentences pronounced by the native English speaker. After hearing a sentence, they were asked to indicate whether the last word was a word or a nonword by clicking either the right (for word) or left (for nonword) button on a response box with either their right or left index finger. If their answer was correct, "OK" appeared on screen, and if it was wrong, the screen turned red, and then the next trial started after a 500ms pause.

Results showed a significant effect of sentence constraint, with faster responses to targets preceded by high-constraint than by low-constraint sentence context. There was a main effect of speaker, with faster responses when listening to sentences pronounced by the native English speaker than by the native Dutch speaker. In addition, there was a significant interaction between sentence constraint and target word type, with a larger homophone effect for low-constraint sentences. Response times were significantly slower for interlingual homophones (e.g., lief "sweet" – leaf /li:f/) than for matched control words, indicating that both L1 and L2 representations of the homophones were activated, hence supporting a nonselective activation theory. This also indicated that sub-phonemic cues from speakers' accents did not restrict lexical access to one lexicon only.

For the present study, to prevent unwanted cognate effects we avoided using cognates for target words. We also aimed to control for language mode by giving all instructions in the same language that participants were tested in, i.e., Norwegian instructions when testing in Norwegian, and English instructions when testing in English. In addition, our Norwegian test sentences were recorded by a native speaker of Norwegian, and our English test sentences were recorded by a native speaker of English.

Advantages and Disadvantages of Being Bilingual

As mentioned earlier in this introduction, being bilingual is highly encouraged today both in Norway and in the EU. This has not always been the situation, however, and attitudes towards bilingualism have not always been as favourable. In many cultures, growing up bilingual was often assumed to be very confusing for children, and a language learning strategy of "one person – one language" was usually advised. This meant that if a child's mother and father had different native languages, they should only speak to the child in their native language and not in the other language to avoid confusion. Even today, with plenty of evidence that children are able to separate two languages from a very early age without difficulties, this view still holds to some degree (Grosjean & Byers-Heinlein, 2018).

Some studies have indicated that bilinguals suffer certain disadvantages from using two languages. For instance, bilinguals seem to experience more word finding problems, also known as **Tip of the Tongue (ToT) states**, than monolinguals. ToT states are situations where you cannot recall the word you want to say, even if you strongly feel that you know it. This is a highly different situation from not knowing the word at all. It is a universal problem which is not linked to conditions like aphasia or lesions, and it occurs regularly in healthy persons, and even in children as young as two years old (Brown & McNeill, 1966).

Other studies have different explanations, e.g., indicating that regular use of more than one language means that bilinguals in sum use each of their languages relatively less than monolinguals who use only one language all the time (e.g., Oller, Pearson, & Cobo-Lewis, 2007). Gollan, Montoya, Cera, and Sandoval (2008) presented their **Weaker Links Hypothesis**, which explained the bilingual disadvantage with effects of frequency of use, which means that words you hear often (e.g., *cups*) are recognized faster than words you hear less frequently (e.g., *carafes*). Bilinguals are assumed to know many more words in total for their languages than monolinguals who only know one language. However, since bilinguals split their time between speaking in their native language and in their second language, they use each language relatively less than monolinguals, which should give larger frequency effects for bilinguals than for monolinguals. To test the weaker links hypothesis, Gollan et al. (2008) compared **frequency effects** in younger and older English-Spanish bilinguals versus English monolinguals by asking them to name pictures of high- and low-frequency words in their dominant and nondominant language. Their assumptions were that word frequency would modulate the degree of bilingual disadvantage, such that the frequency effects should be larger for bilinguals than for monolinguals who speak in one language all the time; larger in the nondominant than in the dominant language since bilinguals spend more time speaking in their dominant language; and larger for younger adults than for older adults since younger adults have had less time to be exposed to the language compared to older adults. The results confirmed these assumptions and clearly showed that less use was associated with higher frequency effects, with monolinguals having the smallest frequency effect (9%), followed by bilinguals in their English dominant language (14%), and with bilinguals in their Spanish non-dominant language having the largest frequency effects (29%) (Gollan et al., 2008).

When investigating frequency effects, it is necessary to know the usage counts for words. Usage counts can be found by using corpuses, which are huge databases where samples of texts have been collected. For the present study, Norwegian word frequencies were found using the NoWac corpus (Guevara, 2010) and English word frequencies were found using the SUBTLEX-UK corpus (van Heuven, Mandera, Keuleers, & Brysbaert, 2018). NoWac is web-based and consists of

texts downloaded from web documents of Norwegian websites (i.e., within the *.no* top-level domain) during a short period between November 2009 and January 2010. SUBTLEX-UK, on the other hand, is based on subtitles extracted from British television programmes and are consequently more informal and oral in style, which van Heuven, Mandera, Keuleers, and Brysbaert (2014) argued would give a better impression of word processing times than texts from books and other types of written sources.

Different languages use different basic lexical units when counting the usage of words. Both language structure and conventions govern which basic lexical units each language count when calculating frequencies. As we will see in the discussion of structural differences between Norwegian and English later in this introduction, both use spaces to separate words. Hence, the word has become the most natural basic lexical unit in both these languages. In other languages, e.g., Vietnamese, spaces are used to separate syllables and not whole words, which makes the syllable the basic lexical unit. When comparing frequency counts, it is important to be aware of these differences to ensure that similar lexical units are counted when comparing two languages (Baayen, Milin, & Ramscar, 2016). Nevertheless, even if both Norwegian and English separate words with spaces, which makes the word the basic lexical unit in both languages, this does not mean that a word is exactly the same in Norwegian and an English. Structural differences will be discussed in greater detail later, but two examples of different typographical and grammatical conventions in English and Norwegian which may give different word counts in the two languages are compound nouns, e.g., where the Norwegian single word *sommerferie* translates to the two English words *summer holiday*, and definite nouns, where the Norwegian definite noun *boken* translates to the two English words *the book*. In some languages the differences may be even bigger, e.g., the German word *anrufen*, which translates to three English words, *to ring up* (Baayen et al., 2016). This illustrates the importance of ensuring a careful selection of well matched target words to avoid unwanted frequency effects due to different frequency measures produced by different language structures.

Bialystok, Peets, Yang, and Luk (2010), however, offered a different explanation than frequency effects to why bilinguals seem to have a smaller vocabulary in each of their languages than a monolingual has in the same language. After testing English vocabulary sizes of a large number of monolingual and bilingual children, results showed that when testing in only one language, monolingual children outperformed bilinguals. A more thorough examination of the results revealed an important implication, however. The bilingual children used English at school and their other language at home, which made them less familiar with English terminology used at home. Thus, Bialystok et al. decided to re-test using only school domain vocabulary. This time they

found similar vocabulary sizes for both groups, indicating that bilinguals have at least the same vocabulary as monolinguals, and often the combined vocabulary in both their languages is in fact bigger. This theory goes as far back as to Weinreich (1968), who observed that bilinguals tend to discuss certain topics in only one of their languages, thus develop different vocabularies in each of their languages. Grosjean (1997) presented the **Complementarity Principle** to account for how different domains of life demand different languages, and how different languages are often used for different purposes, and for speaking with different people, see Figure 2.

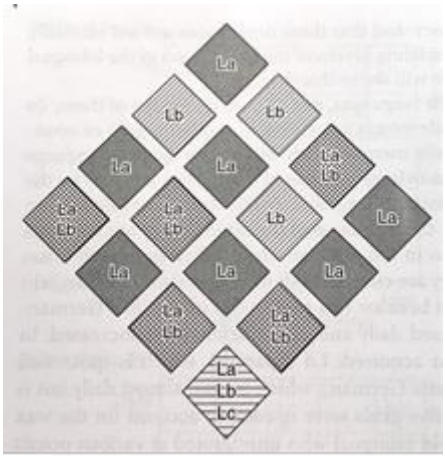

Figure 2. *Illustration of one bilingual's three languages (La, Lb, Lc) covering different domains (different patterns and shades of grey) (Grosjean & Byers-Heinlein, 2018, p. 8)*

Such information about how and when each language is used, the amount of exposure to each language, the specific language background, and other aspects that may contribute to a bilingual's proficiency is important to consider when comparing bilinguals. Different cultures have different amounts and types of exposure to second languages. In some cultures, second language learners seem to be more exposed to written language through reading and writing, and not so much through listening and speaking (Batel, 2019). Inhabitants of English-speaking countries, e.g., Great Britain, have less exposure to second languages in their daily lives, whereas countries with languages that few other people speak, often have huge exposure to English through music, TV, streaming, etc. Nevertheless, exposure to and use of English as a second language still varies from person to person in these countries as well. In the present study, we looked specifically at Norwegian bilinguals and how they process words in a sentence context in both Norwegian and in English as a second language. To investigate whether different language experiences influenced the results, we set up bilingual profiles by asking our participants to fill in a LEAP-Q questionnaire with questions about their language background, use, and proficiency, e.g., how old they were when learning each language, when and where they use each language, and the degree to which they are

exposed to each language (see a detailed description of the use of LEAP-Q for bilingual profiling later in this introduction).

Even if bilingualism has been seen to have some disadvantages, during the last couple of decades increasing attention has been given to possible advantages of being bilingual, and specifically to whether being bilingual can contribute to building cognitive reserve which may preserve a person's brain integrity and cognitive health during aging. Evidence of the effect of bilingualism on cognitive functioning and as a measure to delay brain deterioration is inconsistent, however, and bilinguals constitute a varied group which may be difficult to compare (Bialystok, Anderson, & Grundy, 2018). Nevertheless, a study by Klein, Christie, and Parkvall (2016) which investigated and compared Alzheimer's rates in 93 countries, discovered that in countries with an increasing rate of bilinguals, Alzheimer's rates fell significantly. Del Maschio et al. (2019) compared three main quantifiable variables of bilinguals, i.e., age of acquisition, proficiency and use of a second language, and found evidence suggesting that use of a second language, rather than age or acquisition or proficiency, alters the brain's white matter in bilinguals. Another study by Costumero et al. (2020) combined brain measures and cognitive measures in a study which concluded that at the same measured level of brain deterioration, bilinguals manage better than monolinguals, which may explain the delay in the onset of dementia which is often seen in bilinguals compared with monolinguals. Another theory of this delay is The Bilingual Anterior to Posterior and Subcortical Shift (BAPSS) framework (Grundy, Anderson, & Bialystok, 2017), which suggests that bilinguals rely less on frontal brain regions which monolinguals use for language, and instead seem to use anterior regions associated with cognitive abilities and subcortical/posterior regions associated with motor/sensory/perceptual regions. Resources in frontal regions are necessary to solve more difficult cognitive tasks. If bilinguals can move more language processes to subcortical/posterior regions, more frontal region resources will be available for these difficult cognitive tasks. This may explain why bilinguals often show delayed cognitive decay compared to monolinguals. Delayed cognitive decay would mean that individuals can manage on their own for longer before needing help, which will benefit both the individual bilingual and society.

Bilingual Proficiency

When studying bilinguals, it is important to be able to compare them in some way, e.g., to investigate whether factors such as language background, language use, and proficiency level affect the study results. Comparing bilinguals is not easy, however. Bilinguals vary hugely both in their proficiency level, how often they use or are exposed to each language, and what they use their language for, and this diversity makes it difficult to find a common basis for comparison. Different

approaches have been used. Earlier, native-like speech with as little foreign accent as possible was a goal of proficiency for bilinguals, but today most researchers agree that bilinguals' actual use of their languages is more important than achieving native-like speech (Grosjean & Byers-Heinlein, 2018).

Bilinguals vary in how well they know their languages, from unbalanced second language learners who has a strong and dominant native language and a weak and nondominant second language, to highly balanced bilinguals with a more equal strength between the two languages. To explain how the relationship between a bilingual's two languages develops as proficiency increases, Kroll and Stewart (1994) presented **The Revised Hierarchical Model (RHM)**, see Figure 3. The RHM model combines the Concept Mediation Model and the Word Association Model by Potter, So, Eckardt, and Feldman (1984) into one model which could account for both concept mediation and word associations and the relationships between them.

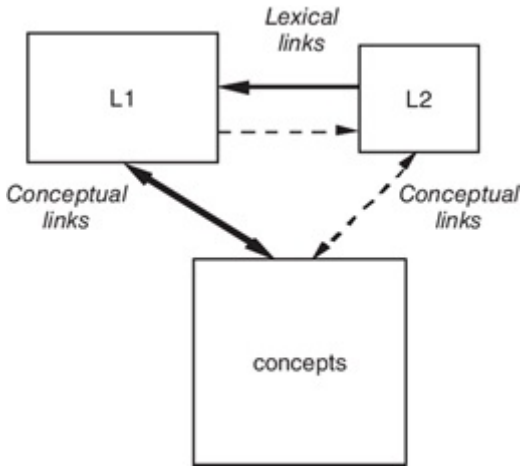

Figure 3. *The Revised Hierarchical Model (Kroll & Stewart, 1994)*

The RHM model assumes that when someone starts learning a new language, there is an *asymmetry* between the languages between the familiar and dominant first language (L1) and the still quite unfamiliar and weaker second language (L2). This asymmetry reduces as second language knowledge and proficiency increases and the bilingual gradually becomes more balanced as both languages are mastered better. Very few people become completely balanced bilinguals, however, and with the exception of a small number of simultaneous bilinguals who have been exposed to two languages from birth, most will always have one dominant and one weaker language (Bialystok & Hakuta, 1994). According to the RHM model, the process of translation between the bilingual's L1 and L2 may explain this imbalance (see Figure 3). Whereas translation from L2 to L1 goes via *lexical links*, i.e., from word to word, translation from L1 to L2 is *concept mediated*, i.e., via a concept level shared between the languages, which results in an extra step before the L2 word can be identified. Consequently, translation from L1 to L2 is slightly slower than the direct word-to-word route from L2

to L1. In Figure 3, this asymmetry is shown in dotted and solid arrows, with strong links between L1 and L2 in solid line arrows and weaker links in dotted lines. The dotted lines grow stronger when the bilingual's proficiency increases, but they rarely become as strong as the solid lines because bilinguals seldom become as proficient in their L2 as they are in their L1. The different sizes of the L1 and L2 boxes illustrate that L1 is more dominant than L1.

Kroll and Stewart (1994) tested the revised hierarchical model by looking for a category interference effect in three experiments; the first experiment involved picture naming in semantically categorized lists (e.g., clothing, body parts, musical instruments, kitchen items, transportation, tools, buildings, household objects, fruits, toys, animals, and food) or randomly mixed lists which alternated between different semantical categories; the second experiment alternated between picture and word naming; and the third experiment was a combined naming and translation task with categorized and randomized lists, where each participant translated and named words from both English and Dutch categorized and randomized lists. Results indicated category interference when pictures were named in semantically categorized lists, but elimination of the category interference when picture naming alternated with word naming, and category interference in a bilingual translation task from L1 to L2, where links between words and concepts are stronger than links between L1 words and L2 words so that processing becomes similar to picture naming processing. The opposite was seen in translations from L2 to L1, where links between concepts and L2 words were assumed to be weaker than word-to-word links between L2 and L1. In sum, these results confirmed the assumptions of the RHM model and provided an explanation for the asymmetry seen in relatively fluent but unbalanced bilinguals which reduces as proficiency increases.

Brysbaert and Duyck (2010), however, questioned the relevance of the RHM model. Among their arguments were that there is little evidence for separate storage of the two languages in the mind, that L2 words and their meanings are more strongly connected than the RHM model proposes, and that the model cannot account for the distinction between language-dependent and language-independent semantic features, e.g., it cannot account for semantic nuances which rules that you cannot say *a large sister* instead of *a big sister*, even if you may perfectly well say both *a large book* and *a big book* (Paradis, 1997). In their opinion, the RHM cannot easily be adapted to account for such issues. Without giving any solution, they suggest trying to find existing computational monolingual models which could be successfully adapted to bilingual processing, like the BIA+ model was (see a discussion of the BIA+ model later in this introduction).

The LEAP-Q Questionnaire

As discussed earlier in this introduction, how to measure bilingual proficiency is highly debated, and the issue is further complicated by the huge variation in bilinguals' language backgrounds, language use, and language proficiencies. Marian and Hayakawa (2020) recently discussed possible alternatives for comparing bilinguals and launched the idea of a "Bilingual quotient", similar to the intelligence quotient (Marian & Hayakawa, 2020) Finding one number which may indicate just how bilingual a person is might seem like a good idea, but with all the differences between bilinguals it seems far from achievable.

For the present study, we have chosen to use an amended version of the LEAP-Q – Language Experience and Proficiency Questionnaire (Marian, Blumenfeld, & Kaushanskaya, 2007). The LEAP-Q was designed as a self-reporting tool for assessment of research participants and consists of meticulously selected questions which may help set up a language profile for a bilingual research participant. Many factors contribute to a person's bilingual status, e.g., proficiency, each language's dominance level, preferred language when speaking, age and mode of acquisition of the different languages, and exposure to and use of each language (de Bruin, 2019). Marian et al. (2007) had observed that research on bilinguals often resulted in inconsistent findings due to a lack of unified methods of assessing bilinguals which makes it difficult to compare across variables. In addition, many assessment methods were targeted at a specific language combination and might not be suitable for other language combinations. Thus, Marian and colleagues developed a uniform method for assessing linguistic profiles of neurologically healthy bilingual research participants who had a sufficient proficiency level in the required language to complete such a questionnaire. This method should enable a more comprehensive and reliable assessment, and it should work not only for a specific language combination, but across the bilingual population.

In two studies, Marian et al. (2007) tested the efficiency and validity of the LEAP-Q questionnaire. The first study tested the internal validity of the questionnaire, in other words, whether the questions led to sensible answers. 52 participants provided self-reported data which were analysed. In the second study, both standardized language tests and self-reported measures from a different participant group of 50 adult Spanish-English bilinguals were used to investigate whether the self-reported measures corresponded with the results of the standardized language tests. Analyses and results confirmed that the LEAP-Q provides a valid, reliable, and efficient assessment of bilinguals' language proficiency, language background, and language use. Hence, the LEAP-Q questionnaire gives a good overview of a bilingual's linguistic experience and current use of their language and may reveal differences between bilingual research participants which could potentially explain differences in their responses.

For the present study, numerical data from the LEAP-Q questionnaire was submitted to factor analysis to identify whether there were variables which shared variance patterns. The factor analysis clusters such variables together in factor groups which then can be analysed to reveal underlying constructs Marian et al. (2007), e.g., in the present study, we analysed the factor groups to look for underlying constructs which could indicate why our bilinguals behaved in the way they did when listening in their L2.

To summarize, it is clear that bilinguals are a very varied group with highly different backgrounds and proficiencies, who speak a varying number of languages, and who use their languages in very varying degrees. Being bilingual is assumed to have both disadvantages and advantages, and next, we will explore how being bilingual affects speech comprehension.

Speech Comprehension

Speech comprehension involves relating sound to meaning (Marslen-Wilson, 1987). The ultimate goal of language processing is to enable communication by deriving meaning from a stream of speech sounds (Harley, 2014). Spoken language seems to have a privileged position compared to reading, since while spoken communication is a part of all cultures, not all cultures have a written language (Biber, 1988). Hence, speech comprehension and production are usually regarded as more fundamental human skills than reading (Hulstijn, 2019). Important differences exist between written and spoken language processing, however. While written language unfolds in space in the form of permanent texts, spoken language unfolds in time and is transitory, i.e., consists of temporarily available words which vanish as soon as they are uttered. Consequently, written language may be consulted repeatedly, while speech must be interpreted and processed in real-time as it unfolds. Weber and Scharenborg (2012) mention three aspects which complicate speech comprehension. First, words sound similar (e.g., *sun*, *sum*, *suck*, *such*). Second, speech is highly variable and varies according to speaker, speaking style, speaking rate, and context. Sounds may assimilate when the vocal tract is adapting from one position to the next. If for instance the word *sun* is followed by a word starting with the voiced bilabial stop *b*, e.g., *sun began*, co-articulation effects will cause the *n* to be pronounced as *m* instead, i.e., [sʌm bɪˈgæn]. Third, speech is transitory and continuous with no clear boundaries between each word. The listener needs to know the rules for where one word ends and the next begins and must often deal with possible embedded words which may occur within another word or even span boundaries of words, e.g., the word *ant* which can be heard embedded in *began to* (Weber & Scharenborg, 2012). Despite of the highly complex tasks involved in speech processing, humans are able to perform this type of processing rapidly and without being aware of doing it (Grosjean & Li, 2013).

Speech processing involves many steps, from identifying acoustic signals and recognizing them as speech sounds, to segmenting the flow of speech sounds into words and mapping the words to meaning so that the utterance can be understood and communication may function as intended. Frauenfelder and Tyler (1987) describe three identification phases in word recognition. The first phase is **initial contact**, where the sound is identified as speech and potential word candidates start activating and competing for selection. The second phase is **lexical selection**, where activation for the best fit candidates accumulates until one target item is selected. The third phase is **word recognition**, which marks the end of the selection process. When the listener knows exactly which word they hear, the **recognition point** is reached. In fact, this point is usually reached before the whole word is heard. The recognition point does not necessarily correspond with the word's **uniqueness point**, which is the point where there are no other words which start with the same initial sequence. If context is strongly biasing, a word may even be recognized before the uniqueness point, at the **isolation point**, which is when the listener identifies the word correctly even if they have not heard enough to rule out all other options (Harley, 2014).

The present study investigated bilingual word recognition in a sentence context. In the following sections, I will discuss theories and models which aim to account for both the recognition of single words and the recognition of words in a sentence context. I will start by looking at basic monolingual models and theories before investigating relevant bilingual models and theories. Although models of speech processing represent different views of how information is assumed to flow between different processing levels, and of how words are assumed to be stored in the mental lexicon, there seems to be consensus that hearing a speech sound initiates the activation of multiple words in parallel, that the degree of match between the speech signal and representations stored in the mental lexicon influence the activation of candidates, and that all activated word candidates compete for selection (Weber & Scharenborg, 2012).

Lexical Activation – Bottom-Up vs. Top-Down Input

In the first phase of word recognition, lexical candidates are activated and start competing for selection. During this phase, two aspects are assumed to influence word recognition. The first is **bottom-up** information, which is the audible input or speech sounds we hear. The second is **top-down** information, which is all kinds of information which is not part of the sound signal, such as semantic and pragmatic information which may provide a context for the utterance (see Figure 4).

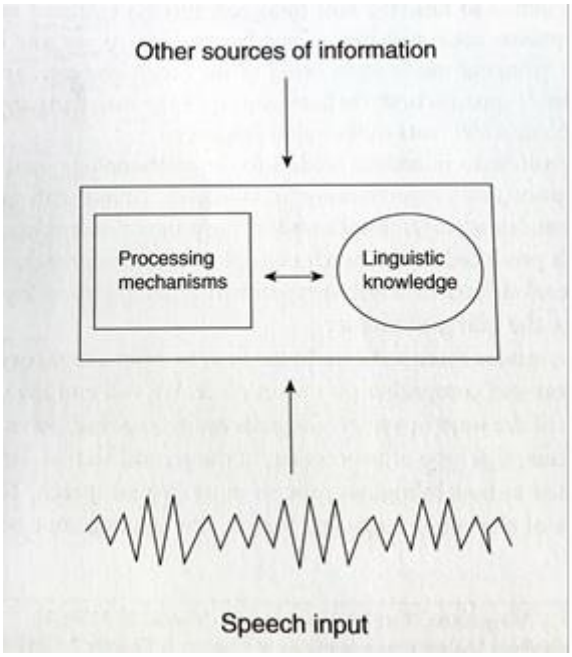

Figure 4: *Bottom-up vs. top-down input in monolingual speech where only one language is processed (Grosjean & Li, 2013, p. 30)*

A highly debated issue within speech processing is whether comprehension may be driven by semantic and pragmatic knowledge (top-down information) in a pre-access model (Batel, 2019) where context may activate potential target words even before the start of the audible input, or if comprehension is driven by the sounds we hear (bottom-up information) in a post-access model (Batel, 2019) where audible input needs to be heard before semantic context can influence comprehension.

The bottom-up or top-down discussion can be illustrated by two opposing models: **serial** models and **interactive** models. Their main difference is the assumption of how information may flow between processing levels. Serial models can be traced back to the distinct analytic levels of the 1960's transformational generative linguistics (e.g., Levelt, 1974; Miller & Chomsky, 1963) and assume separate, autonomous processing levels, bottom-up activation, and competition between potential word candidates within levels only. Hence, information may only flow between stages in one direction, upwards to the next level. Consequently, context may only influence the process after a best fit word has been selected from the speech signal (Forster, 1981). Interactive models, on the other hand, assume that both bottom-up and top-down information may flow in a cascading manner in both directions between all stages and impact processing at all levels (e.g., Marslen-Wilson, 1987; Morton, 1969).

Modelling Bottom-up vs. Top-down Processing – Cohort vs. TRACE

Models of speech processing must be able to account for the bottom-up vs. top-down discussion. Two models have come to constitute the basis of word comprehension models – the bottom-up based **Cohort model** (Marslen-Wilson, 1984; Marslen-Wilson, 1987; Marslen-Wilson & Welsh, 1978) and the top-down based **TRACE model** (McClelland & Elman, 1986). The Cohort model (Marslen-Wilson & Welsh, 1978) was the first psycholinguistic model of spoken word recognition. The model is monolingual and describes recognition of single words in one language. The temporal aspect of spoken language is central, i.e., that spoken words become available to the listener over time and disappear after being spoken. Working memory plays a part in the processing, since the more you can remember, the easier the speech processing should be. The model assumes a three-stage recognition process where the first two stages are prelexical and the third is post-lexical. The first stage is **access**, where a speech signal is heard and all words that start with the same sound (i.e., have the same *onset*) are activated simultaneously and constitute the initial *cohort*. The second stage is **selection**, where candidate words mismatching with more than one single feature are removed from the cohort. The third stage is **integration**, where the chosen word is integrated into a complete representation of the whole sentence by using semantic and syntactic properties (Weber & Scharenborg, 2012). Hence, context can dispose, but not propose, i.e., only bottom-up information may activate potential candidates, but top-down information comes into the process at the earliest possible time to help dispose of irrelevant words (Harley, 2014). This ensures a general objective of language processing, which is optimal efficiency and speed (Marslen-Wilson & Tyler, 1980).

Challenges to the Cohort model are firstly, that human listeners are clearly able to recognize words that mismatch acoustically or contextually. The Cohort model removes mismatched words from the cohort, which means that the model cannot recover words from mismatches. Secondly, the model cannot account for word frequency effects, i.e., that human listeners recognize frequent words more easily than infrequent words. A later model, the Cohort II (Marslen-Wilson, 1987), adjusted for this by assigning higher resting activation values for frequent than for infrequent words, to account for frequent words reaching their recognition threshold faster. In addition, Cohort II introduced a goodness-of-fit activation level and a gradual decay of candidates rather than immediate elimination. The main challenge of the Cohort model is that relatively few words can be uniquely identified before word offset, i.e., before the word is fully heard. Thus, it is necessary to allow for activation of candidates which match not only onset, but also later parts of the word. In addition, the Cohort model lacks an explicit mechanism for finding the start of words, which is a necessity for processing multiple-word speech flows (Harley, 2014).

The second model, TRACE (McClelland & Elman, 1986), was the first computational model of spoken word recognition. It is highly interactive and describes how context may influence word recognition through top-down processing (Harley, 2014). The model was the first to account for activation of many lexical candidates which match any part of the speech signal, not just word onset. TRACE has three layers of nodes: **features**, **phonemes**, and **words**. Speech input activates feature nodes, which in turn spreads activation to matching phoneme nodes, and then to word nodes, e.g., when hearing the word *sun*, overlapping words like *under* and *run* are activated in parallel (Weber & Scharenborg, 2012). Competition starts between candidate words, where higher activation words inhibit lower activation words until a best fit is selected. Across levels, there may be both excitatory and inhibitory connections between units (Harley, 2014). To account for the temporal aspect of speech, TRACE duplicates phoneme and word nodes for every time slice. This process generates a large number of duplicates, which causes the main issue with TRACE and strongly limits the model, i.e., the inability to handle lexicons which are larger than just a few hundred words (Weber & Scharenborg, 2012).

TRACE's interactive properties enable it to handle context effects well, and they enable the model to account for how lexical knowledge can aid categorical perception, i.e., how we treat variations of speech sounds and always categorize sounds as either one sound or another. One phoneme may be pronounced in many ways, depending on the context it is pronounced in, but when hearing a phoneme, we always classify it as either one phoneme or another, with no half-way solutions. This is done by using lexical knowledge which hint about acceptable options, e.g., the knowledge that /p/ and not /b/ is an appropriate onset to -LUG, because "plug" is an English word and "blug" is not (Harley, 2014).

The biggest difference between Cohort and TRACE is that whereas Cohort activates words from the onset, TRACE assumes that the whole word may influence the activation and can easier account for why misheard or mispronounced words are still recognized by the listener. A problem with TRACE is that its behaviour is different from normal human behaviour. Even if TRACE accounts for the influence of lexical knowledge, humans use such knowledge to make goodness-of-fit evaluations in a way which computers have not been able to imitate (Harley, 2014). McClelland tried to adjust this in a revised edition of the model, but without success (McClelland, 1991). Another controversial issue is that TRACE assumes that top-down information may influence the activation stage of word recognition, which lacks firm evidence (e.g., Klimovich-Gray et al., 2019).

Evidence for serial models with autonomous stages would be if context was seen to influence the process only after a word has emerged as a best fit to the speech input. Even if some early studies support this view (e.g., Forster, 1981), general agreement seems to be that there is

little evidence for serial models, and that the comprehension process is incremental, i.e., listeners start interpreting the input even before all is heard (Weber & Scharenborg, 2012). Hence, contextual information is likely to influence the word recognition process at some level, but a relevant question is at which point in the process this happens. Could context contribute to propose target word candidates even before the processing of the auditory input has started (Morton, 1969), or may it only take effect after the initial cohort has been set up (Marslen-Wilson, 1987)?

In their classic study, Marslen-Wilson and Tyler (1980) tested the assumptions of the Cohort model by investigating the time-course of spoken language processing. In two experiments, they looked for context effects which could indicate where in the process context (top-down information) may affect the process. Evidence from speech shadowing studies has indicated that listeners have access to syntactic and semantic information which help them interpret an utterance. Speech shadowing is a fast process where participants listen to speech and repeat what was said as quickly as possible. Measurements from speech shadowing studies have revealed that words were repeated before they are fully uttered, within as little as 200–250 msec after word onset, which indicates that more information than only the audible input is influencing the recognition process (Marslen-Wilson, 1973; Marslen-Wilson, Tyler, & Seidenberg, 1978).

The Marslen-Wilson and Tyler (1980) study included two word-monitoring experiments where participants listened for given target words within sentences of different conditions. Participants were instructed to respond by pressing a telegraph key as soon as they knew that they heard the target word. 81 target words were inserted into sentences of three conditions, i.e., a total of 243 test sentences. The three conditions were **normal prose**, i.e., syntactically and semantically normal sentences, e.g., "The church was broken into last night. Some thieves stole most of the lead off the roof"; **syntactic prose**, i.e., sentences are still interpretable syntactically, but semantically uncoherent, e.g., "The power was located into great water. No buns puzzle some in the lead off the text", where sentences were based on the Normal Prose sentences, but content-words (except target words) were pseudo-randomly replaced with same form-class and word frequency words; and **random word order**, i.e., neither syntactically nor semantically interpretable, e.g., "Into was power water the great located. Some the no puzzle buns in lead text the off", where the Syntactic Prose sentences were scrambled into a random word order, except for the pre-target and target word.

Three different monitoring tasks were used: **identical**, where subjects were informed of the exact word to listen for in advance, e.g., *lead*; **rhyme**, where subjects were given a cue-word rhyming with the target, e.g., *lead – bread*; and **category**, where subjects were given a description of the semantic category, e.g., *a kind of metal*. In addition, target word position was varied pseudo-randomly between sentence position 2 and 10 to analyse whether amount of available context

before the target word would influence reaction time. Hence, each participant heard 27 test sentences of each prose type, with three sentences of each target word position each, i.e., a total of 81 sentences. In experiment 1, participants heard two sentences – a lead-in sentence providing extra context, and the test sentence. Test sentences in experiment 2 were identical to experiment 1, but the lead-in sentence was removed to measure the effect of less context. In addition, participants were different from the first experiment.

The time from word onset to word recognition (indicated with a key press) may indicate where in the process different information types may affect recognition and how early context may start having a facilitative effect. Assumptions were that responses in normal prose, where both syntactic and semantic information were available should be faster; responses in syntactic prose, where only syntactic information was available should be slower; and responses in random word order, where neither syntactic nor semantic information was available should be even slower.

Results from experiment 1 indicated twice as fast reaction time (RT) in normal prose as in syntactic prose, and slowest in random word order, as predicted. RT was faster than word pronunciation time, indicating that word recognition occurred before the whole word was available and selected, and that listeners must have known the word from a very early stage. I.e., both acoustic-phonetic and context input must have influenced the selection. The results of experiment 2 showed a significant slope steepness increase for normal prose when the lead-in sentence was missing, with the greatest effect at the first one or two word-positions, indicating that both semantic and syntactic information influenced the process from the start of the sentence. Syntactic prose was only affected by syntactic constraint, hence, the slope was similar to experiment 1. The main conclusion was strong evidence against an autonomous serial model and in favour of the Cohort model, which assumes bottom-up activation of an initial cohort of potential word candidates and interaction of context from the moment after the initial cohort has been activated and throughout the rest of the process. This disfavours purely interactive models like TRACE which assumes that top-down information may also influence the activation of the initial cohort (Marslen-Wilson & Tyler, 1980).

The issue of whether top-down information may influence word recognition processes is re-encountered in the discussion of **frequency effects**. A word's frequency, i.e., how often a particular word has been encountered through listening, reading, or in speaking, has shown to influence how fast a target word is recognized (Baayen, Wurm, & Aycock, 2007). Different theories have different explanations for how frequency may affect word recognition. Two examples are **search models**, which assume that the mental lexicon is ordered by frequency and that lexicon searches consider high-frequency words before low-frequency words (Forster, 1976, as referenced in Connine, Titone,

& Wang, 1993), and **activation models**, which assume that information about activation level is stored in the lexicon, such that high-frequency words have a higher base activation level than low-frequency words (e.g., McClelland & Rumelhart, 1981). Both the Cohort and TRACE models assume that frequency affects the process at an early stage before lexical access is completed. They both assume that high-frequency words are faster to process than low-frequency words due to a higher baseline activation level for high-frequency words and stronger connections between units on the sub-lexical and lexical level for high-frequency words than for low-frequency words (e.g., Connine et al., 1993).

In two experiments, Dahan, Magnuson, and Tanenhaus (2001) aimed to test the influence on frequency on spoken word recognition. In experiment 1, participants listened to spoken referent words while looking at pictures of four objects, i.e., one picture of the referent word (e.g., *bench*), two pictures with the same initial phonemes as the referent where one picture was high-frequency (e.g., *bed*) and the other picture was low-frequency (e.g., *bell*), and a distractor picture (e.g., *lobster*). Eye fixations were measured while participants listened to the referent word. Assumptions were that when hearing the referent, the similar phonology would lead to more fixation on the competitors than on the distractor. By comparing fixations to one low- and one high-frequency competitor the aim was to investigate whether participants treated the two options as equal alternatives or whether there would be a frequency bias. Experiment 2 tested whether a frequency effect would occur if referents only varied in frequency (e.g., high-frequent *horse* vs. low-frequent *horn*) and each referent picture was presented together with three unrelated distractors. If frequency affected lexical activation, faster fixations to high-frequency referents would be expected since high- frequency words are assumed to be activated faster than low-frequency words. The results of the two experiments showed that participants fixated more to high-frequency competitors from a very early stage. No evidence of late processing was found, which supports models which account for frequency in the word recognition process (Dahan et al., 2001). Evidence that high-frequency words are processed faster is an indication that frequency influences the process early, as soon as bottom-up input has contributed to generating an initial cohort of potential candidates (Connine et al., 1993).

Bilingual Speech Comprehension

The models discussed this far describe a monolingual speech recognition process where only one language is involved. However, while monolinguals only ever process one language, bilinguals use two or more languages and regularly switch between using each of their languages. Evidence indicates that even when only one of the bilingual's languages is used, both languages are active and

accessed in parallel (Marian & Spivey, 2003). This process is illustrated in Figure 5 below (Grosjean & Li, 2013), where the intended language (La) on the left is marked in black and the unintended language (Lb) on the right is marked in a slightly lighter colour to illustrate the different levels of activation of the two languages.

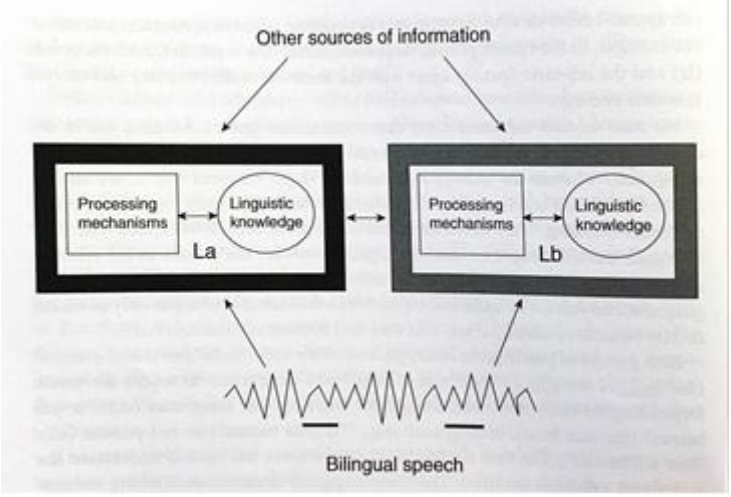

Figure 5. *Bottom-up vs. Top-down input in bilingual speech (Grosjean & Li, 2013, p. 40)*

Such a model may give the impression that two languages equally compete for activation. However, listening in your native language may be quite different from listening in your second language (Cutler, 2012). Although speech in our native language is understood naturally and effortlessly, listening in a non-native language can be more difficult. A question is whether the native language influences listening in the second language, and whether the listening process involves both a universal and a language specific aspect. Studies of the perception of non-native phonemes indicate that listening processes are strongly connected with previous speech listening experiences. Children seem to be born with universal learning abilities which enable them to distinguish between phonemes of all languages of the world. During their first year, and especially during a critical period for language learning between 6 and 12 months of age, this ability gradually diminishes as the infant fine-tunes and specializes their perception skills to their native language. After the first year, the ability is limited to distinguishing between the sounds of the language(s) children are surrounded with. Evidence indicates that continued exposure during the period between 6 and 12 months of age preserves the ability to discriminate between non-native speech sounds (e.g., Eimas, Siqueland, Jusczyk, & Vigorito, 1971; Hakuno, Omori, Yamamoto, & Minagawa, 2017; Kuhl, Tsao, & Liu, 2003).

Choi, Cutler, and Broersma (2017) recently studied a group of Korean-born Dutch-speaking adults who had been adopted from Korea between the age of 3 months and 70 months, i.e., many were older than around 1 year and must have been able to speak at least some Korean before being

adopted. After adoption, however, none of them had been exposed to Korean language, and none of them reported to be able to speak Korean any longer. Nevertheless, after a short period of training, the adoptees more easily learned Korean and could more accurately produce target words than a native Dutch control group. This indicates that the language exposure they went through as infants had permanently affected their ability to learn Korean language. The results also indicated no significant differences between adoptees adopted at an earlier age when they had not yet learned to speak and adoptees adopted at a later age when it was assumed that they must have spoken Korean, i.e., experience with speaking seemed to have no advantage over experience with listening (Choi et al., 2017).

This indicates that the basis for language learning is established as early as the first months after birth and that language-specific knowledge is generated this early and preserved for life. This may also explain well-known issues like the problems Japanese listeners have distinguishing between [r] and [l]. In English, these sounds are phonemes, i.e., swapping them would make a new word, as in the minimum pair [fraɪ] and [flaɪ], where only this one sound distinguishes the two words. In Japanese, however, the two sounds are allophones, i.e., they are non-contrastive and swapping them would not alter the meaning of the word. That children always learn the language(s) they are surrounded with, suggests that they are born with a universal capacity for language learning which as they grow, is fine-tuned and specialized to the language of their surroundings (Cutler, 2012). This is an interesting aspect to have in mind when testing and comparing comprehension in a listener's native language and their second language. If listeners are too proficient in more languages, or have early experience with other languages, this may cause effects which are not ideal for the experiment.

Modelling Bilingual Word Recognition

One of the most prominent models of word recognition in bilinguals is the BIA+ model, i.e., the Bilingual Interactive Activation + model (Dijkstra & van Heuven, 1998). The BIA+ model is based on the monolingual Interactive Activation model (McClelland & Rumelhart, 1981) and describes an interactive process with parallel activation from both languages and several levels of processing: a feature level, a letter level, and a word level, in addition to higher processing levels which may provide top-down input to the word level (see Figure 6 below). The first BIA model (Dijkstra & van Heuven, 1998) was later extended to the BIA+ model by including phonological and sub-lexical processing levels (Dijkstra & van Heuven, 2002). The BIA+ model is mainly a bilingual written word comprehension model which allows for simultaneous processing of four-letter words. Word activation is assumed to occur through a series of word identification steps. When reading the word

WORK, on the sub-lexical level (i.e., the feature/letter level) letters such as W, O, and K are activated and start forming word candidates, e.g., phonological neighbours like CORK, FORK, WORN, AND WORK, which are similar in form and differ from the target by only one letter (Lam & Dijkstra, 2010). A feedback process of competition and inhibition gradually reduces activation of candidates until only one word remains. This word goes on to the lexical level (i.e., the word level). Language nodes and semantics contribute in boosting the activation of the final target, and the task schema verifies that the final target suits the relevant task (Sunderman & Kroll, 2006). BIA+ and similar models claim that word recognition is data driven (bottom-up) in early stages, and that grammatical class and other higher-order cues (top-down information) enter relatively late in the word recognition process (Kroll, Gullifer, Mudry, Rossi, & Martín, 2015).

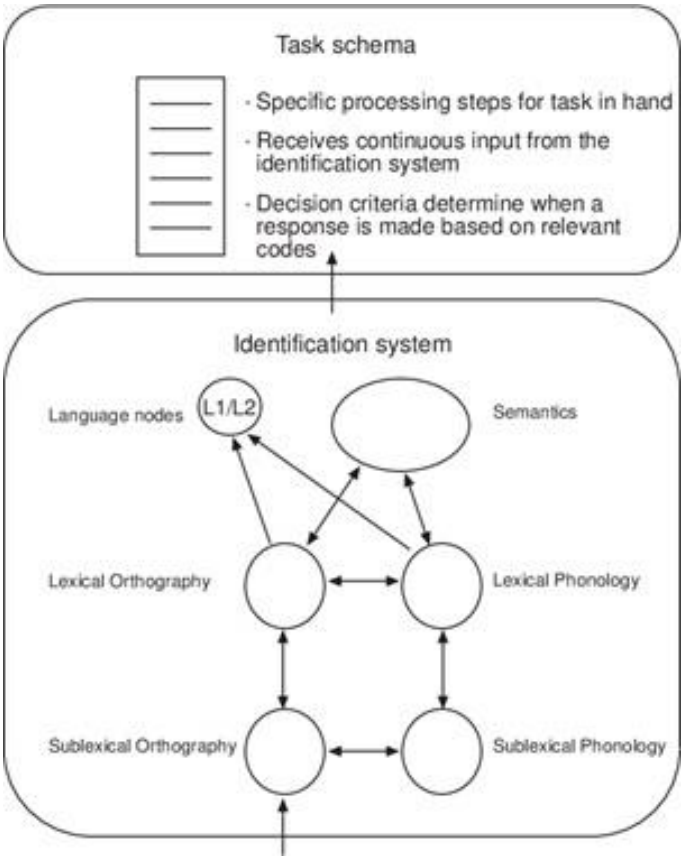

Figure 6. *The BIA+ model (Sunderman & Kroll, 2006, p. 415)*

Libben and Titone (2009) tested the predictions of the BIA+ model by investigating the influence of L1 on L2 during lexical processing at different levels of L2 proficiency. Highly proficient French-English bilinguals performed sentence and paragraph reading tasks. The sentence task consisted of French-English interlingual homographs (e.g., *coin*) and French-English cognates (e.g., *piano*), and a list of English control words matched with the homographs and cognates for word length, frequency, and neighbourhood density. Sentences were constructed to have either high

semantic constraint with obvious targets (e.g., “Since they liked to gossip, they had an extended **chat** that lasted all night”), or low semantic constraint with less obvious targets (e.g., “Since they really liked each other, they had an extended **chat** that lasted all night”). The paragraph task consisted of two paragraphs from the government of Canada web site – one in English and another in French, followed by three comprehension questions. Results showed that for both low- and high-constraint sentences, homographs were generally read more slowly than control words. Cognates also behaved differently from control words but showed a facilitation effect. For all words, reading was facilitated in highly constrained sentence contexts, which supports the BIA+ model. However, findings suggest that bilingual language processing is language non-selective at early stages of comprehension regardless of contextual constraint, and that cross-language ambiguity may be rapidly resolved at later comprehension stages in highly constraint sentence contexts. Libben and Titone (2009) thus support post-access processing, as in the Cohort model (Batel, 2019).

Dijkstra et al. (2019) recently presented the new and updated Multilink model (see Figure 7 below), which combines assumptions from the BIA+ and RHM models with the aim of simulating both production and recognition of both cognates and non-cognates. Multilink extends the length restrictions of the BIA+ from 4–5 letter words to 3–8 letter words and can process cognates of different lengths and frequencies. Being a computational model, it requires explicit assumptions to compute simulations. These assumptions include a series of computations and a huge number of connections between representations to model the full word retrieval process from input to output, hence the name Multilink. Like BIA+, Multilink assumes that access is non-selective and that word form neighbours create parallel activation. Parallel activation of orthographic neighbours are recoded phonologically, hence the model allows for possible competition between words where only meaning overlaps (i.e., translation equivalents), e.g., for the English word ‘ant’, the Dutch word /tante/ (‘aunt’) may compete with the correct Dutch word /mier/ (Dijkstra et al., 2019).

Currently, Multilink only supports Dutch and English, but the aim is to expand it to more languages. The lack of support for more languages than just a few combinations is a weakness of many bilingual models, but the Multilink model’s aim to account for both monolingual and bilingual word retrieval in both comprehension and production makes it an interesting model to follow in the future.

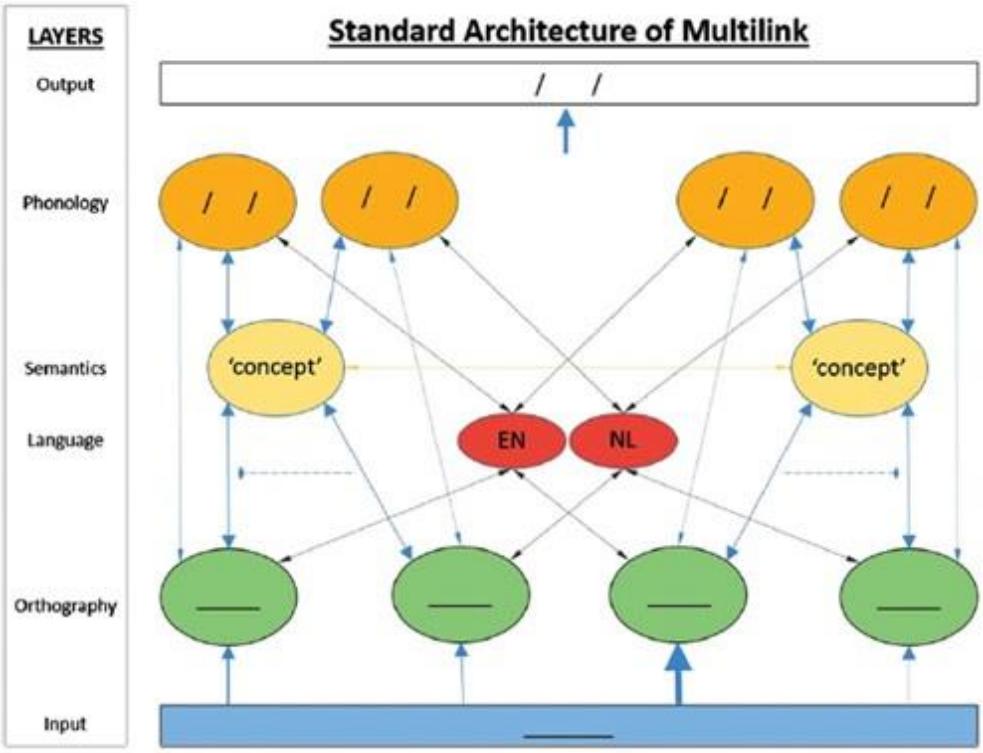

Figure 7. *Multilink, with input (blue), orthographic level (green), language level, semantics (yellow), and phonology (orange), and bi-directional activation flows between levels (Dijkstra et al., 2019, p. 662).*

Bilingual Speech Comprehension in a Sentence Context

Recognizing single words is very different from recognizing words in a sentence context, however. A continuous speech flow demands that the listener segments the words by knowing where one word ends and the next starts, and that the listener can process numerous variations of word pronunciations to understand which word exactly is said. Input also needs to be processed as quickly as possible for communication to work fluently and efficiently. These challenges are even bigger when listening in a second language (L2). Nevertheless, a sentence context contains much more information than the single word and may give cues to how to understand the target word. Variation and ambiguities are easier resolved because context limits the possible alternatives and aids in the prediction of the upcoming words (Cutler, 2012). In a gating task, Grosjean (1980) demonstrated the influence of context by gradually presenting a word, sound by sound, either in isolation or in a constraining context, e.g., "At the zoo, the kids rode on the …", where the target word is *camel*. Words presented in isolation took an average of 333 ms to identify, while words in an appropriate context took only 199 ms, which means that the word is identified before the whole word is heard in full.

Different types of sentence constraints are seen to influence the level of prediction and thereby the ease of comprehension. The Marslen-Wilson and Tyler (1980) study discussed earlier in

this paper showed that high-constrained sentences led to faster target word recognition than low-constraint sentences, which seems natural considering the extra contextual information which a sentence with a high sentence constraint provides. In their high-constraint sentences (e.g., "The church was broken into last night. Some thieves stole most of the **lead** off the roof."), both semantic and syntactical knowledge facilitated the word recognition process. In their sentences lacking a semantic context (e.g., "The power was located into great water. No buns puzzle some in the lead off the text"), word recognition was harder. Their random word-order sentences with neither semantic nor syntactic context, (e.g., "Into was power water the great located. Some the no puzzle buns in lead text the off") were even harder to process, but despite taking longer, the target word was always recognized.

In a recent study, Choi, Marslen-Wilson, Lyu, Randall, and Tyler (2020) investigated the temporal aspects of sentence processing and the incremental processing of subsequent words in an utterance, i.e., how contextual constraints develops as new words unfolds. Their aim was to investigate how predictive operations generate, refine, and evaluate semantic constraint for each new word which is heard. EMEG (electro/magnetoencephalography) was used to measure neural activity while participants listened to sentences of different levels of constraint. Their results indicated that the processing of information transitioned rapidly as new words unfolded and more contextual information became available, indicating that speech recognition in a sentence context is an incremental and dynamic cognitive process which changes as more words are heard.

Evidence is strong that monolinguals use contextual information to predict upcoming information and ease comprehension (Altmann & Kamide, 1999), but are bilinguals listening in their second language are able to use context to the same extent as monolinguals and as bilinguals listening in their native language? The question is whether bilinguals could use contextual information, i.e., top-down processing, or if their processing of speech in their second language rely more on the audible or visual input, i.e., bottom-up processing. Several bilingual studies have tried to replicate the findings of Marslen-Wilson and Tyler (1980) to investigate how bilinguals process speech in their non-native non-native language with varying results. One example is Martin et al. (2013), who tested how English monolinguals (L1 readers) and high proficiency Spanish-English bilinguals (L2 readers) who had learnt English after the age of 8 could predict upcoming words based on incrementally built-up information. E.g., for the sentence "Since it is raining, it is better to go out with an …" the choice of target word is *umbrella*, not *raincoat*, since the indefinite article raises expectations of a word starting with a vowel. Sentences varied between expected and unexpected nouns, and event-related potentials (ERP) were recorded during reading. Assumptions were that the more negative the N400, the less prediction of the final word. Results revealed an N400 increase for

unexpected articles in L1 readers, but no N400 increase for unexpected articles in L2 readers. Their conclusion was that the L2 readers could not predict upcoming words in a sentence context in the same way as L1 readers could.

Ito, Martin, and Nieuwland (2017) attempted a conceptual replication of the Martin et al. (2013) study, using the same material but letting participants read sentences word-by-word. Their results replicated previous findings for L1 readers, showing greater N400 effects for unexpected than expected final nouns, and an early start of the effect at 195 ms after noun onset, which supported active lexical prediction in L1 readers. For L2 readers, however, N400 effects were smaller and started later (300 ms after noun onset). These results indicated that L2 readers can use active lexical prediction in the same way as L1 readers can. However, it was still uncertain whether they just needed more time or in fact failed to predict and needed to rely on the sound input to recognize the word (Ito et al., 2017).

Dijkgraaf, Hartsuiker, and Duyck (2017), on the other hand, studied bilingual L2 listeners' ability to use contextual information, as we do in the present study. Their assumption was that bilinguals listening in L2 would not be able to use context as well as L1 listeners would, and that bilinguals listening in their L1 would have less experience overall in listening in their L2, compared to listening in their L1. Hence, assumptions were that L2 listeners would not be able to predict upcoming information as efficiently as monolingual L1 listeners could, in line with the weaker links hypothesis (Gollan et al., 2008). Two groups of participants were tested. The first group consisted of Dutch-English bilinguals listening in both Dutch (L1) and English (L2). The second group consisted of monolinguals listening in English, to enable a comparison between native language listening in bilinguals and monolinguals. In an eye tracking study, eye movements were tracked while participants listened to constraining (high-constraint) and neutral (low-constraint) sentences while looking at a four-picture display containing one target word picture and three distractor objects. Only one of the four pictures was appropriate in the constraining condition, while all pictures were appropriate in the neutral condition. As in the present study, cognate words were omitted from target word lists to eliminate effects caused by similarities between the languages. Results showed clear indications that unbalanced, proficient bilingual listeners were able to use semantic information to predict upcoming words both in their L1 and in their L2, but even when listening in their L1 they respond slightly slower than L1 listeners, which supports the weaker links hypothesis (Gollan et al., 2008).

Batel (2019) recently tested the impact of context on both reading and listening in L1 and L2. Many studies investigate closely related languages, so to avoid unnecessary influences caused by language similarities, the language combination of this study was Arabic and English, securing

different orthography and few cognates between the two languages. In addition, the study compared both the visual and the auditory modality, arguing that L2 learning is often highly visual and focusing on reading, such that results from visual studies are not necessarily transferrable to the auditory modality. The study included two experiments, one in the visual and one in the auditory modality. Two groups of participants, one of native speakers of English and one of highly proficient Arabic-English bilinguals, read and listened to high- and low-constraint sentences in English and were instructed to press the keyboard space bar when seeing/hearing the target word. Reaction times were measured from the moment the target word appeared until the space bar was pressed. Assumptions were that whereas the L1 participants would be able to use context both when reading and when listening, the L2 participants would be able to use context when reading, but not when listening. Results showed that although reaction times for the L1 participants were faster than for the L2 participants, the L2 participants were faster in a high-constraint than in a low-constraint context, supporting the results of Ito et al. (2017) and indicating that participants use contextual information in both their L1 and L2, but that processing in L2 takes longer.

Modelling Bilingual Speech Comprehension in a Sentence Context

Bilinguals are clearly a very heterogenous group with many variables. Different backgrounds, language experiences, and language use in their daily lives may lead to huge differences in how they process language. Consequently, modelling speech comprehension is difficult. Speech comprehension in a sentence context is even more difficult, which is probably why most models describe recognition of visual words, e.g., BIA+ (Dijkstra & van Heuven, 2002) and Multilink (Dijkstra et al., 2019). There are, however, models that aim to account for the recognition of spoken words. One is BIMOLA (Lewy & Grosjean, 2008), which like BIA+ is based on interactive word recognition models like TRACE. BIMOLA assumes separate lexicons, but instead of using language cues to mark language membership BIMOLA assumes that “global” language information, i.e., semantic and syntactic cues, is used to group words together to distinguish languages (Shook & Marian, 2013). Another model is SOMBIP (Li & Farkas, 2002), which also assumes one shared lexicon, but no language nodes. Instead, it describes a shared lexicon, and that phono-tactic principles of the audible input are used to activate the correct language items (Li & Farkas, 2002).

In an effort to model spoken word comprehension in a sentence context, Shook and Marian (2013) presented BLINCS, the Bilingual Language Interaction Network for Comprehension of Speech. This interactive model aims to overcome limitations of models like BIA+ and BIMOLA, which account for bilingual processing of steady-state instances of language, such as texts, and cannot account for the substantial variability of bilingual spoken language. Since spoken comprehension is a sequential

and incremental process, studies of the relative activation of words across time will give better and more nuanced measures of parallel language activation. Like other speech comprehension models, BLINCS describes phonological, phono-lexical, ortho-lexical, and semantic levels of representation, but in addition, BLINCS can also account for influence from visual information on processing. Visual impact on speech is for instance demonstrated in the McGurk effect, which describes how hearing one sound, e.g., [ba-ba], while seeing lip movements which correspond to another sound, [ga-ga], confuses the listener to hear a third sound, e.g., [da-da] (McGurk & Macdonald, 1976). A huge discussion is whether and how proficiency may influence listening, and the BLINCS model claims to have the potential of capturing subtle changes in activation patterns caused by different bilingual experience in listeners (Shook & Marian, 2013).

In the BLINCS model (see Figure 8), auditory input enters the phonological level and is integrated with visual information (e.g., the McGurk effect). Excitatory and inhibitory connections flow in both directions within and across different levels. In many models, inhibitory control is essential to ensure selection of the intended language. In the BLINCS model, however, languages on both the phono-lexical and ortho-lexical level are separate, but integrated. Language tags are allowed for, but the model can also identify language by associating items with similar characteristics both within and across languages with each other so that lexical items form separate clusters for each language, but cluster together for both cognates and false friends. Consequently, more similar languages with many cognates and false friends will be harder to separate than less similar languages (Persici, Vihman, Burro, & Majorano, 2019).

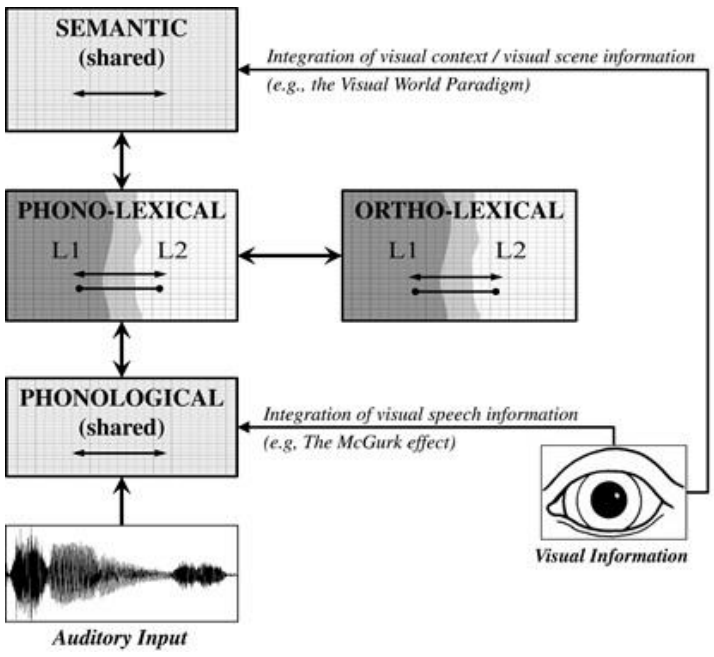

Figure 8. *The BLINCS model (Shook & Marian, 2013, p. 22), with processing starting with auditory input integrated with visual information, and excitatory connections in both directions within and between each level.*

In a recent study, Shook and Marian (2019) tested the predictions of the BLINCS model. Marian and Spivey (2003) had shown cross-language phonological overlap (e.g., EN: *marker* and RU: *marka* 'stamp'). Now, Shook and Marian (2019) wanted to investigate the degree of interactivity, in whether activation from co-activated translation equivalents could spread to phonologically overlapping items in the non-target language. Stimuli were target-competitor pairs, e.g., the English pair *duck/shovel*, where *shovel* is a competitor because the Spanish translation of the English word shovel, *pala*, overlaps phonetically with the Spanish translation of the English word duck, *pato*. Results revealed cascading activation to phonetically overlapping items, with spoken words co-activating translation equivalents, which then spread activation to their phonological cohorts in the non-target language, which then spread activation to their translation equivalents in the target language. This is in line with the BLINCS model, which assumes that highly overlapping translations may be activated by feedback from the semantic level. It also supports evidence that the unintended language can be accessed and activated, even if the bottom-up signal is not phonologically matching the items activated in the unintended language (Shook & Marian, 2019).

Norwegian-English Bilinguals

The previous section has shown that evidence is inconclusive as to whether bilingual listeners are able to use context in the same way when listening in their second language as they can in their native language. Hence, the present study aims to expand our knowledge by investigating how Norwegian-English bilingual adults process spoken sentences when listening both in their native Norwegian language and in their English second language. To be able to understand what is specific of Norwegian-English bilinguals, I will start by describing how the two languages have influenced each other, and in particular, how English has gradually grown to have a central place in the Norwegian society. I will also discuss some structural differences between the two languages which are relevant when comparing sentences and words in the two languages.

When studying spoken Norwegian, it is important to be aware of the different variations of the Norwegian language. Norway has a wealth of different dialects with huge variations in pronunciation and vocabularies. Since 1885, Norway has had two written standards of Norwegian. One is Nynorsk, which directly translated means "new" Norwegian, but which is not new, but based on a variety of rural Norwegian dialects. The other is Bokmål, which directly translated means "book language", and which originates from written Danish and has been gradually Norwegianized during the 19th and particularly 20th century through a series of language reforms (Lohndal, 2013). The language version chosen for the present speech comprehension experiment is Standard East Norwegian Bokmål.

Norwegian and English have very much in common. They both origin from Proto-Indo-European (PIE), but was split into West-Germanic languages (English, German, Dutch, and Frisian) and North-Germanic / Scandinavian (Swedish, Danish, Norwegian, and Icelandic) during the period of the Germanic migrations around A.D. 100–450. Nevertheless, being the languages of neighbouring countries with close contact between populations, they continued to influence each other (Haugen, 1976). Earlier influence is mainly seen from Old Norse to English, especially during the Viking ages between A.D. 800–1000 and is evident in the Old Norse (ON) loan words *knife (*ON: *knífr), take (*ON: *taka), thrive (*ON: *thrífa), dream (*ON: *draumr), window (*ON: *vindauga)*. But even in modern times, there is still influence from Scandinavian languages to English, e.g., *fiord, saga, troll, smorgasbord, orienteering* (Bergs & Brinton, 2017).

Influence from English to Norwegian has increased strongly during the last decades, especially through American popular culture, music, and media. Examples of this influence are the introduction of loan-words such as *weekend* and *streame* to the Norwegian language. Today, Norwegians are exposed to English from a very young age and rarely find themselves in a purely monolingual language mode (Grosjean, 2008). An important source of English exposure has been TV. One example of such early exposure is the children's TV show "Dora the Explorer" (https://en.wikipedia.org/wiki/Dora_the_Explorer) where the English original aims to teach children Spanish words, which has been translated to Norwegian with the Spanish words translated into English. The use of subtitling instead of dubbing as a standard for foreign language TV shows and films intended for older children and adults ensures that Norwegians hear spoken English regularly. Another important factor is the Internet, where English is the dominant language. Most Norwegians have access to and use the Internet frequently today. This has for instance led to YouTube gradually taking over as the preferred screen entertainment for children and teenagers instead of traditional broadcast TV shows, and to online gaming becoming another popular activity where exposure to English is high. Since Norwegian is a small language known to very few people outside of Norway, having sufficient proficiency in English is important to be able to communicate in a globalized world, and English is now seen to be dominating both higher education and trade and business in Norway (Rindal & Piercy, 2013).

Consequently, English has become the dominant foreign language in Norway today. Norway is currently on the 5th place on the EF English Proficiency Index (https://bit.ly/3aODDt4), and this high position can be attributed both to the huge exposure to English in the Norwegian society, as discussed above, and to the educational system, where Norwegian children start learning English as soon as they start school at 6 years old, and some even as early as in kindergarten. Other foreign languages are not taught until the 8th year of school, when children are 13 years old. English has

been a compulsory subject in Norwegian schools since 1969 (Rindal, 2014), and from being treated like any other foreign language when first introduced to the curriculum, English has reached a privileged position in the Norwegian educational system today (Rindal & Piercy, 2013). In the English curriculum for lower primary school, the Norwegian Directorate for Education and Training describes the relevance and central values of English as a subject for education, social life and working life. From the very first line, the message is that English is an important subject:

> "English is an important subject when it comes to cultural understanding, communication, all-round education and identity development. The subject shall give the pupils the foundation for communicating with others, both locally and globally, regardless of cultural or linguistic background. English shall help the pupils to develop an intercultural understanding of different ways of living, ways of thinking and communication patterns. It shall prepare the pupils for an education and societal and working life that requires English-language competence in reading, writing and oral communication."

Figure 9. *The Norwegian Directorate for Education and Training, Curriculum for English (https://www.udir.no/lk20/eng01-04/om-faget/fagets-relevans-og-verdier?lang=eng)*

This clearly shows that English has a strong position in Norwegian society with compulsory English classes from early on and strong exposure both from leisure activities such as TV, music, movies, gaming, etc., and in higher education and business life.

Another important aspect when studying and particularly comparing languages are structural differences. Being aware of structural differences which may affect processing and reaction times is important. As seen, the common origin and language history of Norwegian and English has obviously made them into very similar languages. One example of these similarities is the huge number of *cognates* between Norwegian and English, e.g., *ring, sang, hand*. In historical linguistics, cognates are usually defined as words which share a common etymological origin (Crystal, 2008). When studying language processing, however, we are interested in how representations of words in our mental lexicons, including information about orthography, phonology, and semantics, influence the processing of language. Hence, for this study we use the psycholinguistic definition of cognates, i.e., words that share both orthographic or phonological forms and have the same meaning in a language pair (Costa et al., 2000). Consequently, loanwords with same spelling, sound, and meaning across two languages such as *TV*, *radio*, *smoothie*, *booking*, *jazz*, and *artist* are also considered to be cognates (Sunderman & Schwartz, 2008).

Norwegian and English also share a large number of interlingual **homographs** and **homophones**, i.e., words with similar orthographic or phonological form, but different meaning (Libben & Titone, 2009). See examples in Table 1 below. So-called "false friends" are another issue

which is important to be aware of when comparing two languages in a study. False friends may create interference effects due to orthographically and phonologically similar forms which may influence results. In the present study, we wanted to avoid effects from both cognates and false friends, hence all such words were avoided in our target word lists.

Table 1

Examples of Norwegian-English homophones, with phonetic transcription.

English word	Norwegian word	Phonetic transcription	Translation of Norwegian word
Bark	Bak	/bɑːk/	Behind
Meal	Mil	/miːl/	Mile
Veal	Hvil	/viːl/	Rest
See	Si	/siː/	Say

Grammatical structural differences between the two languages are another aspect which may potentially affect experimental results. One example of structural differences between Norwegian and English are compound nouns, which are treated differently in the two languages. Whereas Norwegian compound nouns are usually written as one word, e.g., *sommerferie*, English compound nouns are usually written in two words, e.g., *summer holiday*. Definite nouns are another issue which may give different word counts for similar word forms in the two languages. Whereas Norwegian definite nouns have morphemes added to the end of the word, English definite nouns have a definite article added before the word (e.g., NO: *boke**n*** – EN: ***the*** *book*). Another example is the use of double definiteness for nouns in Norwegian, e.g., *den gamle hesten* 'the old horse.DEF', which adds both a word (i.e., a definite article) before the noun and a morpheme at the end of the noun (Lohndal, 2013). Structural issues like these often result in a slightly larger mean word count for English sentences (in the present study, between 9 and 23 words) than for Norwegian sentences (in the present study, between 6 and 22 words).

Word order is another difference between the two languages. Even if both English and Norwegian are SVO languages, i.e., they both follow the basic word order Subject-Verb-Object, Norwegian is a V2 language where finite verbs are consistently moved to the second position of clauses (Anderssen & Bentzen, 2018). The following examples from Jensen, Slabakova, Westergaard, and Lundquist (2020) illustrate the difference:

1. I går drakk studentene vin. (XVSO)
   Yesterday drank students.DEF wine
   'Yesterday the students drank wine. '

2. Studentene drakk ofte vin. (SVXO)
   students.DEF drank often wine
   'The students often drank wine.'

However, despite of some structural differences it is obvious that Norwegian and English are related languages with much in common, e.g., many cognates and homophones. The strong exposure to spoken English experienced by Norwegian bilinguals today through music, TV, movies, streaming, etc. in combination with the strong position of English in the Norwegian educational system contribute to the high proficiency level found in most Norwegians in English as a second language.

The Present Study

The aim of the present study was to expand our understanding of bilingual speech processing by comparing listening in Norwegian and in English as a second language. Our study is based on the classic study of Marslen-Wilson and Tyler (1980), who investigated the temporal aspects of speech processing in monolinguals listening to sentences of different constraint levels. Their study, along with other research, has confirmed listeners ability to make use of contextual information when listening in their first language (e.g., Altmann & Kamide, 1999; Marslen-Wilson & Tyler, 1980; McClelland & Rumelhart, 1981). For bilinguals processing in their second language, however, research on the use of contextual information show more diverse results. Two examples are Martin et al. (2013), who investigated the use of contextual information while reading and found evidence of influence from contextual information, and Ito et al. (2017), who aimed to replicate the Martin et al. (2013) study, but failed to find evidence of contextual influence.

Research on listening in a second language is sparse. In addition, many studies use different participant groups for each language, e.g., Batel (2019); (Dijkgraaf et al., 2017), which may create effects which are difficult to compare. Hence, in the present study we have chosen to test the same group of bilinguals in both their native Norwegian language and their English second language.

Two study questions were established:

1) Can bilinguals make use of sentence contextual information in word recognition when listening in their L2.
2) What aspects of the participants' bilingual profile modulates their use of sentence contextual information in word recognition.

For the first question, we wanted to explore to which extent Norwegian-English bilingual listeners can use the top-down information provided by sentence contextual information to ease word recognition when listening in their second language. To do so, we used stimuli consisting of sentences with different levels of sentence constraint. For this purpose, three different types of sentence conditions were constructed for each target word and in both languages. E.g., for the English target word *wood*, the high-constraint sentence was "At the sawmill they slice logs into long planks of **wood** with smooth edges", the low-constraint sentence was "At the old burial site they found weapons made of **wood** with smooth edges", and the mixed word order sentence was "Site made at burial they the weapons found old of **wood** smooth with edges". Participants were shown the target words in advance and were asked to listen to sets of sentences containing a variation of the three constraint levels. They were asked to press the spacebar if and when they knew that they heard the target word. Response times were measured and analysed to see whether the different contextual information levels in the sentences would affect response times.

For the second question, we wanted to explore whether there were aspects of participants' bilingual profiles which would influence their ability to use such contextual information in a word recognition process. To set up a bilingual profile for each of our participants, all participants were asked to self-report their language background and proficiency by filling in a LEAP-Q questionnaire. Questionnaire data were then analysed and submitted to a factor analysis to identify variables which share variance patterns and cluster them together in factor groups. The resulting factor groups were then analysed to investigate whether underlying constructs could indicate why bilinguals in the present study behaved in the way they did when listening in their L2 (Marian et al., 2007).

Method

General Method

The complete study consisted of two parts, one for the production and comprehension experiments, and one for the word-finding experiment. A total of 51 participants participated in one or both parts, and of these, 27 (20 female and 7 male) participated in the production and comprehension part. All participants were native Norwegian-English bilinguals between 18 and 34 years of age, with Norwegian as their dominant first language (L1) and English as their second most dominant language (L2). None were very proficient in a third language, with the limit defined at being able to hold a conversation in any third language. Participants reported normal or normal to corrected hearing and vision and no diagnosed language impairments (e.g., dyslexia, stuttering, etc.). Of the 27 participants in the production and comprehension experiment, 3 reported being left-handed and 24 reported being right-handed. Participants were recruited from the university and the local community and were compensated with a voucher at the university bookstore for NOK 300 if completing both sessions (i.e., both comprehension/production and word-finding) and NOK 150 if completing one session only (i.e., either comprehension/production or word-finding). The study was approved by the Norwegian Centre for Research Data (NSD – Norsk senter for forskningsdata), NSD Reference Code: 668647. In advance, all participants received written information (see Appendix B) and signed a written consent (see Appendix A).

Materials

LEAP-Q – Language Questionnaire

For bilingual profiling, we used an amended version of the LEAP-Q – Language Experience and Proficiency Questionnaire (Marian et al., 2007), see Appendix C. The questionnaire consisted of four sections, where the first three contained questions to be filled in by the participant and the fourth was dedicated to summary data.

Section 1 collected general information about the participant and any health issues which might affect results. First, participants were asked about age, gender, nationality, and whether they were native Norwegians with reasonable English skills. Then, they were asked about health, e.g., whether they were right- or left-handed and had normal or corrected to normal vision and hearing. Finally, they were asked about years and level of education. All years of education counted, from first year of elementary school and onwards, and answer options were adapted to the Norwegian educational system.

Section 2 contained detailed questions about language background and was kept very similar to the original version. First, participants were asked to list their languages in order of both age of acquisition and current dominance. Then, they were asked about language use, e.g., exposure, speaking, and reading, and to state which language they preferred to use if being able to choose. Next, participants were asked which cultures they identify with. Whereas the original version mentioned ethnical groups as examples of culture, our version suggested Norwegian, British, and American, which are wider cultural concepts than ethnicity and more related to a language variety and the regions where this variety is spoken. A question about changes in fluency was also added to our version, asking whether the participant feels that they were once better in one language and has become less fluent. If answering Yes, the participant was asked to state which language and at what age this happened. In the last question of this section, the participant was asked which language they preferred to use when doing maths, dreaming, expressing anger or affection, or talking to themselves, which may give an indication of language dominance.

Section 3 of our LEAP-Q version included questions about proficiency in Norwegian and English only, since these are the only two languages of interest for this particular study. The original LEAP-Q, however, allows responses for more than two languages. In addition, the our version extende and amended the original LEAP-Q questions to account for modern language use, e.g., streaming of film, TV series, and music. Questions about language use in school/workplace were amended to account for more flexible language use, e.g., our participants were asked whether they use each of their languages either ALL the time or just SOME of the time, while the original version does not separate this way. The final questions dealt with proficiency, e.g., fluency when speaking, listening, reading, and writing. Participants were asked which age they started hearing, speaking, and reading each of the two languages, and whether they had experienced mixing of one language into another while speaking, either accidentally or intentionally.

Section 4 was dedicated to summary data. Microsoft Excel formulas extracted values entered in the three questionnaire parts and collected them in a summarized manner to allow for further processing and analysis.

Participants were sent the LEAP-Q questionnaire by email in advance and were asked to complete and return it before coming to the laboratory. During the first test session, the experimenter went through the LEAP-Q answers together with the participant to check that all questions were understood and answered as properly and correctly as possible.

Word Monitoring Task

Although the production and comprehension group cooperated on production and comprehension experiments with one experimenter running both experiments in one session, each group created their experimental material separately. Below is a description of the material for the comprehension experiment.

The comprehension experiment consisted of a word monitoring task where participants listened for a given target word in sentences with different context levels. First, a list of target words was set up, see Appendix F for the full set of Norwegian target words and Appendix G for the full set of English target words. Then, test sentences were set up in triplets with one high-constraint (HC), one low-constraint (LC) and one mixed word order (M) sentence for each target word, see an example of the different sentences in Table 2 below. See Appendix H for the full set of Norwegian test sentences and Appendix I for the full set of English test sentences.

Table 2

Examples of sentence triplets with different constraints

Target Word	*Constraint*	*Sentence*
wood	high-constraint	At the sawmill they slice logs into long planks of **wood** with smooth edges.
wood	low-constraint	At the old burial site they found weapons made of **wood** with smooth edges.
wood	mixed word order	Site made at burial they the weapons found old of **wood** smooth with edges.

Target Words. Our target words were 120 Norwegian Bokmål and 120 British English monomorphemic non-cognate indefinite singular 1-3 syllable nouns with matched frequencies from the mid-range (see Appendix F and G). Norwegian target words were inspired by different online resources, e.g. Bokmålsordboka (https://ordbok.uib.no/) and a Wiktionary page of Norwegian nouns (https://en.wiktionary.org/wiki/Category:Norwegian_Bokm%C3%A5l_nouns). For the English target word list, we picked target words from sentence comprehension studies by Brothers and Kuperberg (2021) and Altarriba, Kroll, Sholl, and Rayner (1996) which fit our criteria. The rest of the English target words were found using the Cambridge English Dictionary (https://dictionary.cambridge.org/dictionary/english/).

To ensure that participants heard completely different words in the two languages and only encountered one word meaning once, we avoided direct translations between the two target word lists, e.g., if using the word “flower” in the English list, the direct translation “blomst” was avoided in the Norwegian list. Hence, the Norwegian and English target word lists contained lexically and semantically separate words. To ensure that target words were non-cognates, we used Norwegian-English dictionaries at Ordnett.no to check possible translations and avoid cognates. Homophones

(e.g., /bɑːk/, which means “behind” in Norwegian) and homographs (e.g., “art”, which means “species” in Norwegian) were also omitted to avoid unwanted interference from all types of similar forms between the two languages.

Monomorphemic nouns were chosen to avoid issues of different word counts for same word forms in the two languages, since different word counts for the same word form will affect frequency counts, as described in the introduction. Firstly, compound nouns are treated differently in the two languages. In English, compound nouns are written as two words (e.g., “summer holiday”), while in Norwegian, they are written in one (e.g., “sommerferie”). Secondly, definite nouns are created differently in the two languages. In Norwegian, definite nouns have morphemes added at the end of the indefinite form (e.g., “ferien”), while in English definite nouns have a definite article added before the indefinite form (e.g., “the holiday”).

If potential target words could be both nouns and verbs, the word class for Norwegian nouns was looked up in Bokmålsordboka (https://ordbok.uib.no/) to ensure that target words were predominantly nouns. For English, however, this proved to be more difficult because many more words can be used both as nouns and verbs.

To match target words for frequency, we used the Norwegian NoWaC corpus (Guevara, 2010) and the English SUBTLEX-UK corpus (van Heuven et al., 2018) to find usage counts for each target word. Our first set of Norwegian target words resulted in a mean frequency per million words (fpmw) of only 13, which was far lower than the English of 38.8. While searching for Norwegian target words with higher frequencies, we found two lists from the University of Bergen (https://www.korrekturavdelingen.no/ord-uttrykk-frekvensordliste-500-vanligste-norsk.htm and http://korpus.uib.no/humfak/nta/ord10k.txt) listing the most frequent Norwegian words. By exchanging low-frequency words with higher-frequency words, the mean fpmw of our final Norwegian target word list was 35.4, with a range of 0.4–199.8, which matched and was comparable to the mean fpmw for the English target word list of 38.8, which had a range of 0.8–202.6 (see Table 3 below).

Since listening tasks are affected by sound duration, and not orthographic length, we used phoneme and syllable length instead of orthographic length for target word length matching purposes. Syllable length and phoneme length was calculated after verifying phonetic transcription for British English using tophonetics.com. Table 3 below lists mean frequencies and word lengths for our Norwegian and English target words. For detailed lists of frequencies for all Norwegian and English target words, see Appendix F and G.

Table 3

Mean target word frequencies and lengths

	Mean freq.	*Range*	*Mean orth. length*	*Range*	*Mean syll. length*	*Range*	*Mean phon. length*	*Range*
NOR target words	35.4	0.4–199.8	5.3	2-9	1.8	1-3	4.9	2–9
ENG target words	38.8	0.8–202.6	5.5	3-10	1.6	1-3	4.3	2–9

Test Sentences. For each of the 120 target words, three sentences were constructed, resulting in a total of 360 test sentences for each language. See example of a sentence triplet in Table 2 above and full sets of test sentences in Appendix H and I. All sentences were pragmatic, i.e., based on real-world content. Collocations and set phrases were avoided, and since all our participants were Norwegian natives, we avoided cultural references which might be unfamiliar to Norwegian bilinguals.

First, a high-constraint sentence was constructed with sufficient pre-target word context to aid target word recognition, e.g., "At the sawmill they slice logs into long planks of **wood** with smooth edges", where context strongly indicates the target word **wood**. Then, a low-constraint sentence was constructed with the aim of providing no context information to indicate the target word, e.g., "At the old burial site they found weapons made of **wood** with smooth edges". Research indicates that preceding phoneme(s) influence word pronunciation (Ernestus & Baayen, 2011). Hence, in each sentence set we aimed to keep the word preceding the target word, and as a minimum the last phoneme, similar or at least from similar phoneme groups (e.g., vowel, stop, fricative, etc.). Another issue which can create unwanted influence is differing syntax, hence, we aimed to keep syntax preceding the target word as similar as possible across conditions.

All the Norwegian sentences were constructed from scratch. For the English sentences, however, we found test sentences in sentence comprehension studies by Brothers and Kuperberg (2021) and Altarriba et al. (1996) and adapted them to our criteria. Some English sentences were also adapted from example sentences found in the Cambridge English Dictionary (https://dictionary.cambridge.org/dictionary/english/), and the rest were made from scratch.

Across sentence triplets, target words were kept at the same position. However, to ensure that participants listened properly before clicking without just learning to predict where the target word would appear, sentences were adapted to ensure a variation of target word positions. Four ranges of target word positions were used, see Table 4 below.

Table 4

Examples of sentence triplets with different constraints

Lang.	*TW Syll. Position*	*TW*	*Sentence Example*
Nor	5th–10th	haug	Hun rakte lauvet til en stor **haug** på plenen.
Eng	5th–10th	spatula	I flipped the pancake with the **spatula** without breaking it.
Nor	11th–15th	gren	Hun så noen fine kongler som hang på en **gren** ute i skogen.
Eng	11th–15th	couch	Lauren turned on the TV and laid down on the **couch** in the den.
Nor	16th–20th	nøkkel	Døra var låst da de kom frem til hytta, men de fant en **nøkkel** som passet i boden.
Eng	16th–20th	nappy	The parent sensed a strange smell from the crib and checked the baby's **nappy** for accidents.
Nor	21th–26th	frisyre	Før bryllupet brukte hun flere timer på å få satt opp håret i en fin **frisyre** med pynt og blomster.
Eng	21th–26th	utensil	I searched among all the ladles and whisks in the drawer to find a suitable **utensil** for my purpose.

All Norwegian target words were positioned between the 5th and the 26th syllable and all English target words between the 7th and the 26th syllable of the sentences. No target words were placed at the very beginning of the sentence, to ensure listeners always had some context. Similarly, no target words were placed at the very end to prevent sentence prosody from revealing the end of the sentence. Across triplets, target word positions were matched and preceded by the same number of syllables. See Appendix H and I for a complete overview of sentences and target word positions in both languages.

After completing both high- and low-constraint sentences, mixed word order sentences were constructed by scrambling the word order of the low-constraint sentence using the online tool The Scramblinator (https://www.altastic.com/scramblinator/) to produce a random word order sentence, e.g., "Site made at burial they the weapons found old of wood smooth with edges" (see Table 2). Again, pre-target and target words were kept as in the low-constraint sentence to preserve phonemes before target words in triplets. Then, the parts before and after the pre-target and target words were scrambled separately, e.g., first "At the old burial site they found weapons made" and then "with smooth edges".

Practice and Filler Items. To avoid that participants learned the pattern and predicted when to click instead of listening properly, 36 filler sentences were created for each language. The fillers consisted of 24 no-response items where participants saw a target word which did not occur in the spoken sentence, and 12 early-response items where target words were positioned as early as in the the second- or third-word position of the sentence. The filler items included sentences of all three

conditions, high, low, and mixed, and were inserted in-between the test sentences in the run lists. For a brief training session before the actual experiment started, 10 practice items were constructed, including 2 high-constraint, 2 low-constraint, 2 mixed word order, 2 early-response and 2 no-response items. See Table 5 for examples of practice and filler items, and see Appendix J for the full set of Norwegian practice and filler items and Appendix K for the full set of English practice and filler items).

Table 5

Examples of practice and filler items

Item Type	*TW*	*Sentence Example*
Nor No Response	forsøk	Prøven var vanskelig, men hun gjorde en **innsats** uansett.
Eng No Response	pig	In the story, the wolf chased the three little **frogs** behind the house.
Nor Early Response	hage	Vakker **hage** er det eneste jeg ønsker meg når jeg flytter.
Eng Early Response	visitor	The **visitor** said hello but refused to shake my hand at the office.

Sound File Recording. In total, 360 test sentences, 36 fillers, and 10 practice items were created for each language, which gives a total of 406 sentences for each language, and 812 sentences in total for both languages. All sentences were recorded in a sound attenuated booth using Praat software (Boersma & Weenink, 2021) and a Røde VideoMic NTG microphone. One female Norwegian speaker with a Standard East Norwegian dialect read the Norwegian sentences, and one female British English speaker with a slight Scottish accent read the English sentences. Both Norwegian and English sentences went through a thorough quality assurance process before recording to ensure that they were idiomatic.

The speakers aimed to keep sentence triplets similar in length across conditions, and target words similar in length, and in a reading speed that felt normal for their language. To ensure as similar conditions as possible, several sentences were recorded in one sitting, resulting in a limited number of files containing many sentences. Each file was then opened in Praat and split into separate .wav files for each individual test sentence. For each .wav sound file, a .textgrid file was added in Praat. In the .textgrid files, we used the comment option to add three measures to the .wav file: from start of file to start of target word, from start of speech to start of target word, and from start of target word to end of target word. These measures were used later to measure participants' reaction time when identifying the target word and pressing the spacebar. See Figure 10 for a screen shot of Praat. A complete list of .wav file measurements for all target words and sentences are found in Appendix H and I.

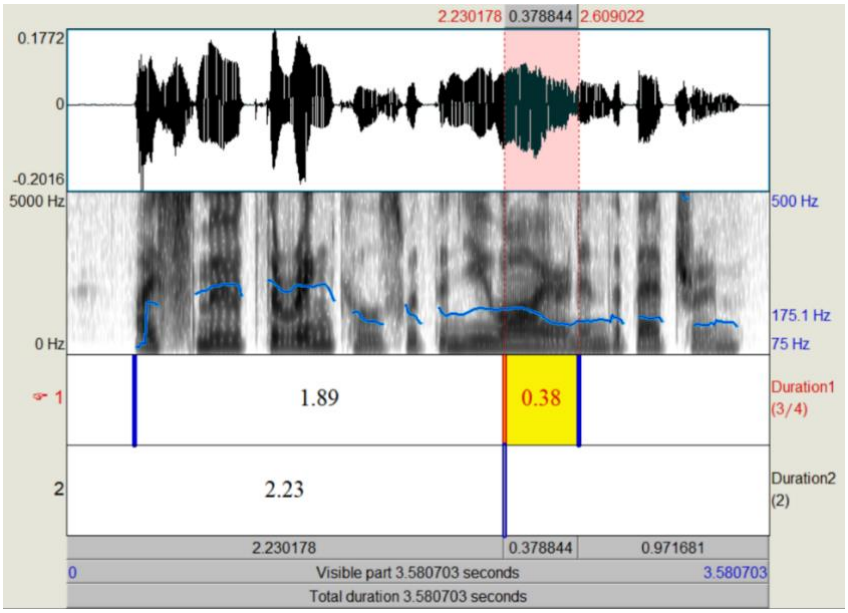

Figure 10. *Screen shot from Praat showing the .wav file for the English high-constraint sentence "I smoothed the wrinkles with the new iron in the bedroom" (target word = "iron").*

Experimental Design

For each language, the 120 target words were assigned to two matched sets of 60. Care was taken to assign sentences in a way that ensured that mean target word frequencies were matched between sets. Consequently, the two Norwegian sets had mean target word frequencies of 35.0 and 36.3, and the two English sets had mean target word frequencies of 38.4 and 39.3. The 36 fillers and 10 practice items were also added to each list, resulting in a total of 106 items per list.

To ensure that each participant saw each target word only once and in one condition only, target words of each set were assigned to different conditions and split into in three lists using a Latin Square design, so that each list contained the same number of items from each condition, and so that each target word occurred only once per list. Care was also taken to ensure that each list was matched for target word position, by assigning the same number of sentences from each of the four syllable position ranges (see Table 4) to each list. Next, test items and fillers in each list were assigned to 4 blocks of 18 trials, of which 15 were test sentences and 3 were fillers. The order of trials within a block was pseudo-randomised so that no more than three trials of the same condition occurred after each other. The same 10 practice items were placed first in all lists.

Finally, the lists were counter-balanced for block order by switching the first two and the last two blocks so that across lists, items would occur equally in the first and second halves of the experiment. Our final set thus consisted of 12 lists of 82 trials per language. Lists were assigned to participants using a system which ensured that all lists were run at least two times, and no list was run more than three times.

Procedure

This comprehension study was part of a bigger master project consisting of three parts – speech comprehension, speech production, and word finding – and investigated bilingual word recognition in a sentence context. The comprehension study consisted of two parts. The first was a profiling part where participants were asked to fill in an adapted LEAP-Q language questionnaire which they were sent by email in advance, to self-rate their language proficiency, language background and everyday use of language. The second part was the listening experiments, where participants listened for target words in Norwegian and English sentences in the laboratory. The listening experiments took place at the laboratory at UiA on two different days – one day for Norwegian and one day for English testing. The production and the comprehension group cooperated on running the experiments, such that the first part of each test session contained the production experiment, and the second part contained the comprehension experiment, with the same experimenter running the whole session.

All participants completed the Norwegian session on the first day and the English session on the second day. To minimize interference between languages, instruction language always corresponded to test language; when testing in Norwegian, instructions were given in Norwegian, and when testing in English, instructions were given in English. Both written instructions on screen and verbal instructions were given.

During experiments, participants sat in a sound-attenuated booth in comfortable distance from a computer screen and listened to sound via Creative SBS270 loudspeakers (and not headphones due to Covid 19 restrictions). The experimenter sat outside the booth keeping visual contact with the participant through a window and communicating through Sennheiser GSP 350 headphones with a built-in microphone.

For the comprehension experiment, each trial started with a fixation cross displayed on screen for 500 msec, followed by a 1000 msec blank screen. Then, the written target word appeared on screen for 1000 msec, followed by another 1000 msec blank screen, before the sound file started playing. (From start of sound file to voice onset, the time should have been the same. This detail slipped when cutting the sound files so lengths before voice onset varied in our files and should have been corrected had time permitted it. Nevertheless, response times were measured from target word onset and not from start of file so it should not have influenced results.) Participants were instructed to press the spacebar when hearing the target word in the sentence, and to not press if not hearing the target word, i.e., during no-response trials.

In total, each session lasted between 45 and 55 minutes, with the production experiment lasting between 30-40 minutes and the comprehension experiment lasting approximately 15

minutes. Time varied slightly between participants, depending on the need for instructions before and during practice blocks, and the participant's speed of answering during the production experiments. In the comprehension experiment, however, the need for instructions were limited and responses were given while the trials were playing, hence response times did not affect running time much for the comprehension experiment, only the length of the breaks which participants needed between experimental blocks.

Results

Participants. 51 participants (36 female and 15 male) between the age of 18-34 (M = 25.18) completed the LEAP-Q questionnaire. 3 participants reported being left-handed and 48 being right-handed. 50 participants reported being born in Norway and 1 in the US. All participants reported presently living in Norway.

Language Background. 48 participants listed Norwegian as their dominant language (L1) and English as their second most dominant language (L2), and 3 listed English as their dominant L1 and Norwegian as their L2. No participants listed other languages than English and Norwegian as L1 and L2. Although 3 reported having English as their L1, 50 participants reported learning Norwegian before learning English, and only 1 reported learning English before learning Norwegian. In total, 33 participants reported knowing only Norwegian and English, 18 participants listed a third language (i.e., Danish, French, German, Japanese, Spanish, and Swedish), and one person listed a fourth language (Norwegian Sign Language – NSL).

Education Level. High education levels were reported with participants having between 13–23 (M =16.73) years of education. 2 participants were still in upper secondary school, one participant was taking a one-year university course, 18 were current bachelor students, 24 had completed a bachelor's degree or were current master's students, and 6 participants had completed a master´s degree. I.e., a total of 30 of the 51 participants had completed either a bachelor's or a master's degree.

Language Dominance. When asked which language they used when doing simple maths, dreaming, expressing anger/affection, or talking to themselves, most participants answered Norwegian, see Figure 11 below. Apart from a few who answered English, especially for anger/affection and talking to themselves, the only other language listed was by one participant who reported using German to express anger/affection.

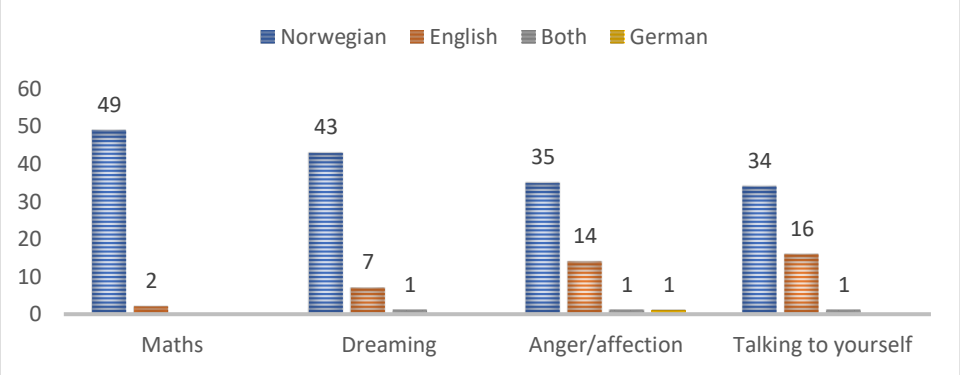

Figure 11*. Language used when doing simple maths, dreaming, expressing anger/affection, or talking to themselves*

Language Fluency. When asked whether they at some point in time felt that they had become less fluent in a language, 19 answered No and 32 answered Yes. When these 32 participants were asked which language they had become less fluent in, 15 reported English, 6 Norwegian, 4 German, 3 French, 2 Spanish, 1 Danish, and 1 Japanese.

Language Switching and Accidental and Intentional Language Mixing. Participants rated their ability to switch between their languages if needed as very good (M= 8.1, range 0–8). When asked whether they sometimes experienced accidental mixing of words/sentences between Norwegian and English, 44 answered Yes and 7 answered No. On a scale ranging from 0–10 where 0 is never and 10 is all the time, participants reported that accidental mixing of English words into Norwegian was higher (M=3.7) than of Norwegian words into English (M=1.7). The same applied to intentional mixing of English words into Norwegian (M=4.4), which was higher than intentional mixing of Norwegian words into English (M=2.1).

Cultural Identity. Participants' cultural identity was reported to be strongly dominated by Norwegian culture. 49 participants listed Norwegian, 1 listed American, and 1 listed British as their dominant culture. Of participants reporting a second and third most dominant culture, most listed American (11 and 8 participants) and British (9 and 2 participants). Other cultures were also listed, i.e., Australian, Canadian, Sámi, Danish, German, French, Korean, and Swiss, but only by one or two participants and not as the dominant culture.

Language Immersion (Years). This and the following sections refer to table 6, which shows participants' self-reported language background and proficiency with mean measures and ranges for Norwegian and English only, which are the two languages of interest to our study. The Language

Immersion section shows that most participants reported having spent most of their life in Norway, and most participants reported learning Norwegian first at a very early age and learning English later. In addition, most participants reported going to school or work in a Norwegian dominated environment.

Contribution to Language Learning. The main factor reported to contribute to learning Norwegian was interacting with family. Other reported high contributing factors were friends, school/education, and reading. For learning English, however, family was reported as having little influence, and important contributing factors were school/education, watching TV, reading, music, and friends.

Language Exposure. Norwegian language exposure was reported to be highest from interacting with family and friends, while English language exposure was reported to be highest from watching TV / streaming, music/media, and reading.

Self-rated Proficiency Level. Participants rated themselves as very proficient both in Norwegian and English. They reported to be best at Norwegian, with high proficiency reported for all items. Still, they also reported high proficiency in English, with the highest results for listening, reading, writing, and speaking, and slightly lower but still high ratings for vocabulary, pronunciation, spelling, and grammar.

Age Milestones. Participants reported learning Norwegian first and English later. They reported being exposed to Norwegian before English and learning to speak and read Norwegian before English.

Table 6

Self-Reported Language Background, Use and Proficiency

Measure Description	*Norwegian*		*English*	
	Measure	*Range*	*Measure*	*Range*
Language Immersion (years)[a]				
Country	24.52	17.75–32.58	1.51	0–17.25
Family	25.24	18.67–34.92	1.72	0–34.92
School where lang. is spoken ALL the time	14.33	0–27	0.73	0–2.5
School where lang. is spoken SOME of the time	5.25	0–27	6.75	0–18.08
Workplace where lang. is spoken ALL the time	5.67	0–21	0.12	0–3
Workplace where lang. is spoken SOME of the time	2.66	0–21	1.44	0–10
Contribution to Language Learning[b]				
Interacting with friends	7.75	0–10	6.1	0–10
Interacting with family	9.3	5–10	2.5	0–10
Reading (e.g., books, magazines, online)	6.8	0–10	7.2	2–10
School and education	7.5	2–10	7.6	0–10
Self-instruction (e.g., learning videos or apps)	1.3	0–10	2.7	0–10
Watching TV	3.9	0–10	7.5	2–10
Listening to music	3.3	0–10	6.4	0–10
Language Exposure[b]				
Interacting with friends	9.1	4–10	3.8	0–10
Interacting with family	9.4	0–10	1.1	0–9
Reading (e.g., books, magazines, online)	5.3	0–10	6.9	1–10
Self-instruction (e.g., learning videos or apps)	1.1	0–10	1.7	0–10
Watching TV / streaming	3.4	0–10	8.1	4–10
Listening to music / media	3.3	0–10	8.0	4–10
Self-Rated Proficiency Level[c]				
Speaking (general fluency)	9.5	5–10	7.8	4–10
Pronunciation (accent)	9.5	6–10	7.0	2–10
Listening (understanding spoken language)	9.8	6–10	8.5	6–10
Reading	9.5	3–10	8.3	3–10
Writing	9.1	5–10	7.8	4–10
Grammar	8.4	4–10	6.9	3–10
Vocabulary	8.7	6–10	7.2	4–10
Spelling	8.7	4–10	7.0	3–10
Age Milestones[a]				
Started hearing this language on a regular basis	0.1	0–3	7.1	0–14
Became fluent in speaking this language	4.31	0-16	13.9	6–23
Started learning to read this language	5.2	3-8	7.8	5–13
Became fluent in reading this language	8.1	5-19	13.2	7–22

[a] Years and months are expressed in decimal values.

[b] Expressed in values from 1-10, where 1 is the weakest and 10 is the strongest contribution/exposure.

[c] Expressed in values from 1-10, where 1 is the lowest and 10 is the highest proficiency level.

Factor analysis

Data Exclusions. From the LEAP-Q dataset, we removed data from written answer variables. We also removed data from questions with little-to-no variation in answers, e.g., many Norwegian answers. See Appendix E for a full list of removed variables. A correlation matrix was run on the 46 remaining variables to find variables with sufficient, but not too much, covariation. One variable, i.e., intentional mixing of Norwegian into English, was removed for having a correlation of less than 0.3 with another variable, and 7 variables were removed for having a correlation of greater than 0.8 with another variable. If variables correlated between L1 and L2 versions of data, the L1 (Norwegian) variable was removed, since the English data were the most interesting for the present study. For

instance, variables for exposure to L1 and exposure to L2 correlated with 0.99, hence the variable for exposure to L1 was removed.

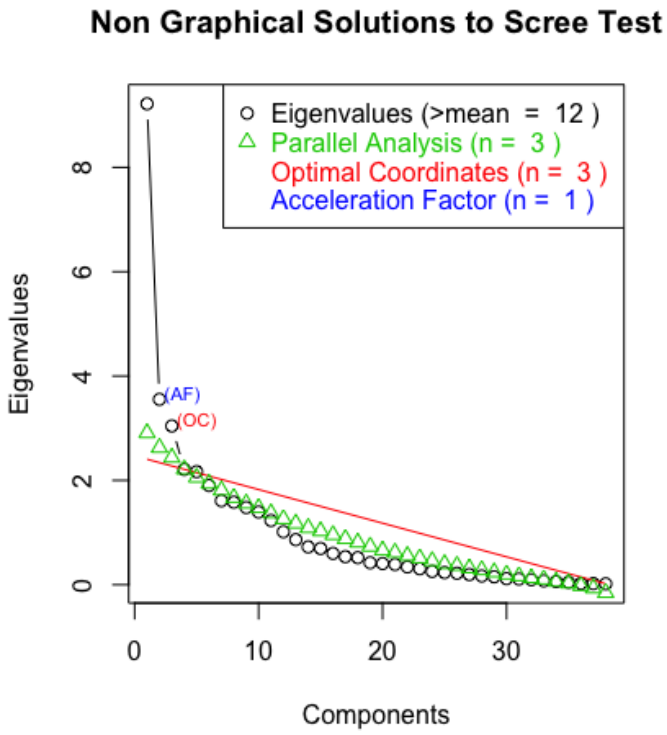

Figure 12. *Calculation of optimal number of factors using a Scree Test (Ledesma, Valero-Mora, & Macbeth, 2015)*

Factor analysis was conducted on the remaining 38 variables. 12 eigenvalue factors were extracted. A parallel analysis suggested that the optimal number of factors would be 3, see Figure 12. Inspection of the output, however, suggested that 4 factors would give the most interpretable groupings. The four resulting factor groups were then given names which indicated the general theme of the group, see Table 7.

Table 7 – Factor Table

Factor RC1: **English Proficiency**	*Load. Values*	**Factor RC4:** **Spoken English Proficiency**	*Load. Values*	**Factor RC3:** **Informal Learning of English**	*Load. Values*	**Factor RC2:** **Age of Acquisition**	*Load. Values*
ENG Grammar Proficiency	0.84	Time Spent Speaking in L2	0.68	ENG Learning from TV	0.74	ENG Fluent Reading Age	0.69
ENG Writing Proficiency	0.82	NOR Fluent Speaking Age	0.60	ENG Learning from Music	0.65	ENG Age Started Hearing	0.65
ENG Reading Proficiency	0.82	NOR Fluent Reading Age	0.59	ENG Exposure through TV	0.61	ENG Fluent Speaking Age	0.62
ENG Vocabulary Proficiency	0.78	% of Time Choosing to Use L2	0.59	ENG Exposure through Music	0.56	ENG Age Started Reading	0.61
ENG Listening Proficiency	0.74	Time Spent Exposed to L2	0.57	ENG Learning from Reading	0.49	ENG Learning from Friends	0.51
ENG Speaking Proficiency	0.71	ENG Learning from Family	0.44	Time Spent Exposed to L2	0.46	NOR Learning from Reading	0.48
ENG Pronunciation Proficiency	0.69	ENG Exposure through Friends	0.41	Language Switching Proficiency	0.44	NOR Learning from TV	0.47
ENG Exposure through Reading	0.65	Accidental Mix ENG into NOR	0.37	ENG Exposure through Friends	0.35	Accidental Mix NOR into ENG	-0.37
Language Switching Proficiency	0.60	ENG Vocabulary Proficiency	0.33	ENG Self-Instructed Learning	0.35	Intentional Mix ENG into NOR	-0.58
ENG Learning from Reading	0.59	ENG Pronunciation Proficiency	0.33	Time Spent Reading in L2	0.31		
NOR Learning from School	0.43	Time Spent Reading in L2	0.33	NOR Fluent Speaking Age	-0.30		
Accidental Mix ENG into NOR	0.41	NOR Learning from Reading	-0.37	ENG Fluent Reading Age	-0.40		
NOR Learning from Reading	0.41	NOR Learning from School	-0.40				
Time Spent Reading in L2	0.38	NOR Exposure through Reading	-0.44				
NOR Fluent Speaking Age	0.36	NOR Exposure through TV	-0.71				
NOR Fluent Reading Age	0.35						
ENG Exposure through Friends	0.35						
ENG Exposure through Music	0.35						
ENG Learning from School	0.33						
% of Time Choosing to Use L2	0.31						
ENG Learning from Family	0.31						
ENG Exposure through TV	0.31						
Proportion Variance	0.19	**Proportion Variance**	0.11	**Proportion Variance**	0.09	**Proportion Variance**	0.09
Cumulative Variance	0.19	**Cumulative Variance**	0.30	**Cumulative Variance**	0.39	**Cumulative Variance**	0.47

* Table with original variable names is included in Appendix XX.

** Variables removed from the factor analysis due to insufficient co-variation are listed in Appendix XX.

The first factor contained only positively loading variables accounting for proficiency in reading, writing, listening, and speaking and variables accounting in general for how they had learnt English, e.g., through school, friends and family, or from activities such as reading, listening to music and watching TV. I.e., more exposure and learning of English lead to reports of higher proficiency in grammar, reading, writing, and vocabulary. Hence, this factor was named *English Proficiency*.

In the second factor, the highest positively loading variable accounted for time spent speaking in English. The lowest negatively loading variables accounted for reading and watching TV in Norwegian. I.e., the less participants reported reading and watching TV in Norwegian, the more they reported speaking English. Many of the variables in this group accounted for speaking, pronunciation, and vocabulary of English, hence, this factor was named *Spoken English Proficiency*.

In the third factor, the highest positively loading variables accounted for learning of English from music and TV. The lowest negatively loading variable accounted for age of becoming fluent in English. I.e., the earlier participants reported becoming fluent in English, the more learning they reported to have had from informal sources such as music and TV. Other variables accounted for exposure and other informal sources of learning such as reading, friends, and self-instruction, hence, this factor was named *Informal Learning of English*.

In the fourth factor, the highest positively loading variable accounted for age of becoming fluent in English. The lowest negatively loading variable accounted for intentional mixing of English into Norwegian. I.e., the earlier participants reported becoming fluent in English, the more they reported mixing English into their spoken Norwegian. Many of the variables account for learning and for age of starting to speak or read English. Hence, this factor was named *Age of English Acquisition*.

Experimental Results

Data Exclusion. 27 participants completed the comprehension experiment. 3240 observations were collected in total. As few data as possible were discarded and all 27 participants and 240 trials were included. However, 40 observations (1.23%) had a smaller measure than -200ms, indicating that the participant pressed the spacebar before word onset and may have guessed instead of listening, and 8 observations (0.25%) had a bigger measure than 1000ms, which is very long after word onset and might indicate an error or that they have not listened properly. Hence, these 48 observations were discarded. RTs for the remaining 3192 observations appeared almost normally distributed and were subject to an outlier trim which discarded observations which deviated more than 2.5SD from the mean value, resulting in the loss of a further 2.63% of the data.

Linear regression tests for statistical interference. The experimental design crossed sentence condition, i.e., mixed-order vs. low-constraint vs. high-constraint (within-language variable), with language, i.e., Norwegian vs. English (between-participants variable). Response time (RT) was measured from target word onset until the participant pressed the response button.

Analysis. A linear mixed model (LMM; Baayen, Davidson, & Bates, 2008) was run with RT as a dependent variable and language and sentence condition (mixed-order vs. low-constraint vs. high-constraint) as independent variables. Since there were two variable levels for language (Norwegian vs. English), a centering contrast was used where English was given a value of -0.5 and Norwegian a value of 0.5. For sentence condition (high-constraint, low-constraint, and mixed-order), backward difference coding was used to compare two pairs of adjacent levels: low-constraint minus mixed-order, and high-constraint minus low-constraint.

Since frequency may influence response times, we added frequency as a variable. The frequency values extracted from NoWac and SubtLex were log transformed to achieve a more interpretable measure of frequency, as suggested by van Heuven et al. (2014) (the full model syntax is given in Appendix L). The model output is given in Table 8 and the pattern of RTs is shown in Figure 13.

Table 8

Output of the LMM Model Fitted to RT

Mean Response time				
	Estimate	Std. Error	z value	p value
(Intercept)	378.89	10.42	36.37	**<.01**
language [en, -0.5; no, 0.5]	**-41.13**	**8.73**	**-4.71**	**<.01**
mixedOrder.lowConstr	**70.10**	**3.86**	**18.17**	**<.01**
lowConstr.highConstr	**31.87**	**3.87**	**8.25**	**<.01**
Frequency	**-14.32**	**4.93**	**-2.90**	**<.01**
mixedOrder.lowConstr:frequency	-9.59	5.98	-1.60	0.11
lowConstr.highConstr:frequency	**13.98**	**5.92**	**2.36**	**0.02**
language:mixedOrder.lowConstr	-0.40	7.86	-0.05	0.96
language:lowConstr.highConstr	3.79	7.88	0.48	0.63

Note: Since no differences were found between lists, the output of the model was collapsed across lists.

The model yielded a significant effect of language with slower RTs in English than in Norwegian. There is also a significant effect in the contrast between the mixed-order and low-constraint condition with participants responding significantly slower for the mixed-order condition compared to the low-constraint condition across languages. Another significant effect is found in the contrast between the low-constraint and high-constraint condition. See Figure 13 below.

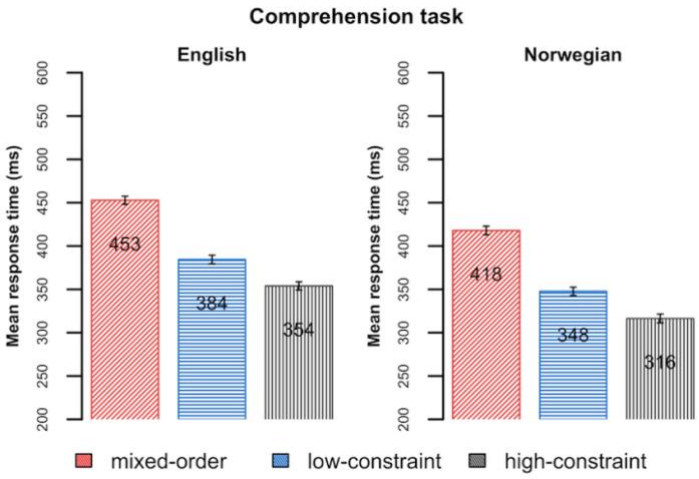

Figure 13. *Mean reaction times by sentence type for English (left panel) and Norwegian (right panel)*

For both Norwegian and English, a main effect of frequency was found in the contrast between low-constraint and high-constraint condition, indicating faster RTs for higher frequency target words, i.e., increasing advantage of contextual information with increasing word frequency, see Figure 14.

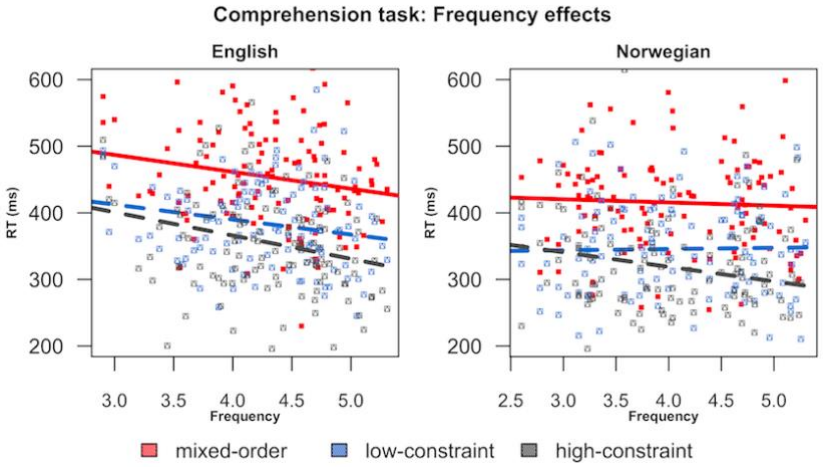

Figure 14. *Frequency and mean RT for each item and condition. Lines represent predicted linear regressions on RT as a function of frequency.*

Individual Differences. To investigate whether individual differences in bilingual profiles affected processing in the word monitoring task, we ran the same model on the response times including the participants' individual values on the 4 factors from the factor analysis as predictors: English Proficiency, English Spoken Proficiency, Informal English Learning, and Age of Acquisition. Table 9 and Figure 15 show output for English RT values. The only factor that showed a significant effect for English was Informal English Learning, where a significant effect was found in the contrast between

the low-constraint and high-constraint condition, with the advantage of the high-constraint condition decreasing as informal English learning increased, i.e., in high-constraint sentences, response times were slower with more informal English learning, see Figure 15.

Table 9

Output of the LMM model for English RTs

Mean Response time – English				
	Estimate	Std. Error	z value	p value
(Intercept)	398.30	11.68	34.10	<1e-04
mixOrder.lowConstr	**69.78**	**5.45**	**12.81**	**<1e-04**
lowConstr.highConstr	**31.64**	**5.44**	**5.82**	**<1e-04**
EngProficiency	-1.61	11.59	-0.14	0.89
SpokenEngProficiency	-15.17	9.76	-1.55	0.12
InfEngLearning	-3.76	9.30	-0.40	0.69
AoAEng	-2.60	9.85	-0.26	0.79
mixOrder.lowConstr:EngProficiency	2.64	6.27	0.42	0.67
lowConstr.highConstr:EngProficiency	1.24	6.27	0.20	0.84
mixOrder.lowConstr:SpokenEngProficiency	-0.12	5.01	-0.02	0.98
lowConstr.highConstr:SpokenEngProficiency	1.83	4.99	0.37	0.71
mixOrder.lowConstr:InfEngLearning	**13.16**	**4.99**	**2.64**	**0.01**
lowConstr.highConstr:InfEngLearning	**-10.46**	**4.98**	**-2.10**	**0.04**
mixOrder.lowConstr:AoAEng	5.08	5.09	1.00	0.32
lowConstr.highConstr:AoAEng	-0.19	5.10	-0.04	0.97

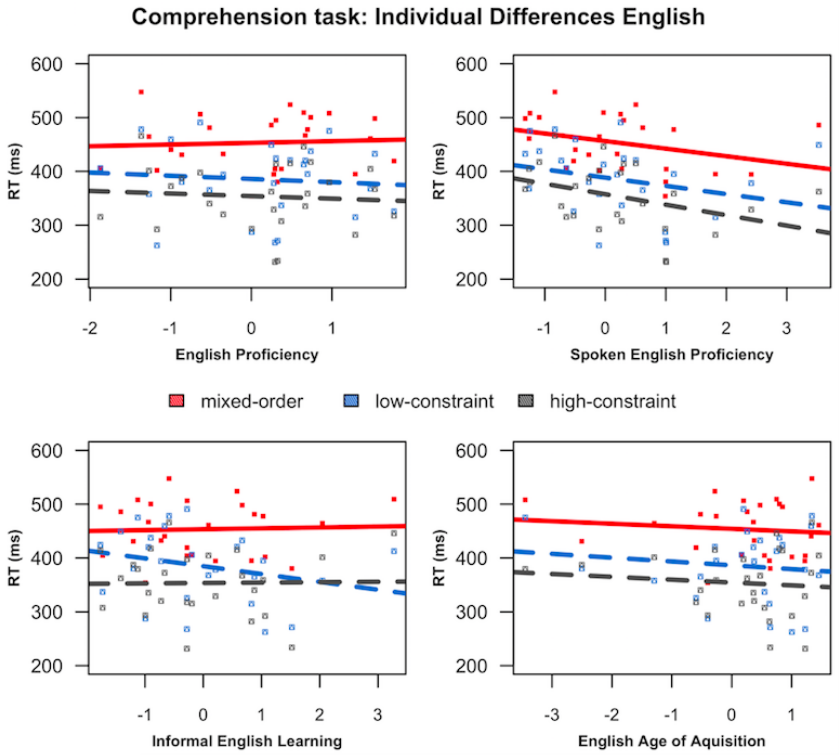

Figure 15. *Effects on English RTs of factors from factor analysis, indicating an effect of Informal English Learning and no effect on the other three factors.*

The same analysis was run on the Norwegian response times, see Table 10 and Figure 16. Again, the only factor showing an effect was Informal English Learning, but this time, interaction occurred only in the contrast between the mixed-order and the low-constraint, with increasing advantage of and faster responses in the low-constraint condition than in the mixed word order condition as informal English increased, see Figure 16.

Table 10

Output of the LMM model for Norwegian RTs

Mean Response time – Norwegian				
	Estimate	Std. Error	z value	p-value
(Intercept)	361.90	12.22	29.60	<1e-04
mixOrder.lowConstr	**70.10**	**5.52**	**12.70**	**<1e-04**
lowConstr.highConstr	**29.92**	**5.54**	**5.40**	**<1e-04**
EngProf	0.63	12.10	0.05	0.96
SpokenEngProficiency	-9.67	10.18	-0.95	0.34
InfEngLearning	-8.63	9.70	-0.89	0.37
AoAEng	-5.71	10.29	-0.56	0.58
mixOrder.lowConstr:EngProficiency	-3.17	6.33	-0.50	0.62
lowConstr.highConstr:EngProficiency	10.72	6.39	1.68	0.09
mixOrder.lowConstr:SpokenEngProficiency	-7.34	5.05	-1.45	0.15
lowConstr.highConstr:SpokenEngProficiency	7.80	5.09	1.53	0.13
mixOrder.lowConstr:InfEngLearning	**14.61**	**5.10**	**2.87**	**0.00**
lowConstr.highConstr:InfEngLearning	1.86	5.08	0.37	0.71
mixOrder.lowConstr:AoAEng	4.61	5.23	0.88	0.38
lowConstr.highConstr:AoAEng	-6.18	5.26	-1.18	0.24

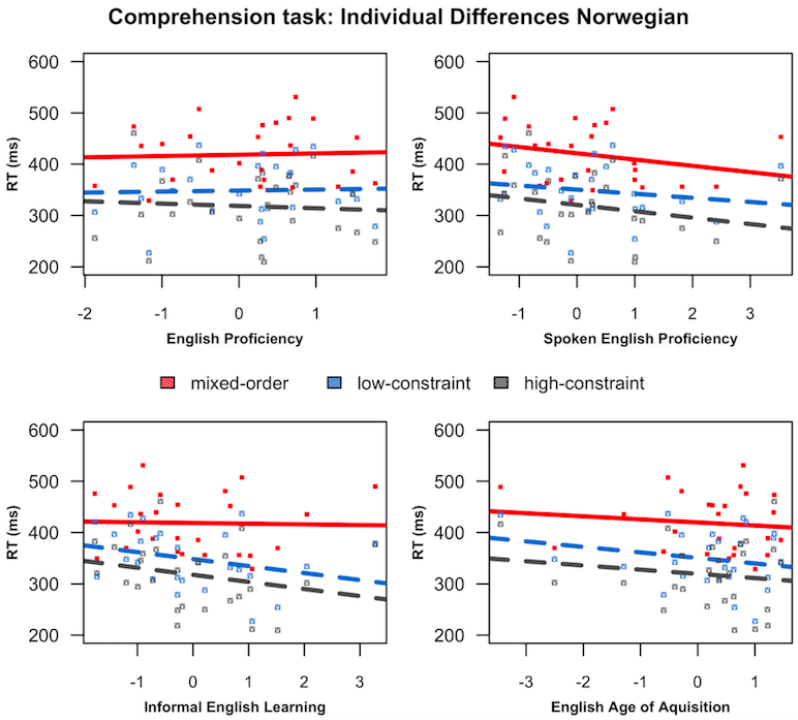

Figure 16. *Effects on Norwegian RTs of factors from factor analysis, indicating an effect of Informal English Learning and no effect on the other three factors.*

Discussion

The aim of this study was to expand our knowledge of Norwegian-English bilinguals' ability to use sentence contextual information to predict upcoming words when listening to sentences in Norwegian and in English as a second language. In addition, we were interested in investigating whether specific aspects of participants' bilingual profiles would influence the degree to which they could use sentence context to predict upcoming words when listening to sentences. We started by establishing bilingual profiles for our participants by asking them to fill in an amended LEAP-Q questionnaire (Marian et al., 2007) specifically developed for self-reporting of language background, use, and proficiency. All answers were analysed and submitted to a factor analysis to identify factors which may affect results. Next, participants were tested in the laboratory in a word monitoring task where they listened to Norwegian and English sentences of different conditions. Instructions were to press the keyboard spacebar when they knew that they heard the target word. In this section, I will start by discussing findings from the LEAP-Q questionnaire and move on to discuss findings from our experiment, before discussing findings from the factor analysis and whether they may reveal any explanations to our results based on our participants' bilingual profiles.

Pre-study predictions for the LEAP-Q questionnaire were that our participants would be highly proficient Norwegian-English bilinguals. The findings from the LEAP-Q questionnaire confirmed that all participants were dominant in Norwegian and had all learnt this language early in life, which naturally led to high self-rated proficiency levels for Norwegian. All participants reported having English as their second most dominant language. Most participants reported having learnt English around the age of 5–8, which reflected the Norwegian education system where learning of English starts at around 6 years old. Self-reported proficiency levels were high for English as well. None of our participants reported being multilingual, i.e., being able to communicate in other languages than Norwegian and English. This confirmed that our bilinguals were highly proficient second language users with Norwegian as their dominant language and English as their second most dominant language, and no other dominant languages, in line with the aims of the present study.

Pre-study predictions for the word monitoring task was that our bilinguals would be able to use contextual information both when listening in their L1 and in their L2, but with slower response times in L2, in line with the results of e.g., Batel (2019) and Dijkgraaf et al. (2017). The results revealed three significant effects. The first significant effect was a **main effect of language**, which revealed overall faster response times for Norwegian than for English. This supported our prediction that English would be slower than Norwegian, and it also supported other bilingual listening studies (e.g., Batel, 2019; Dijkgraaf et al., 2017; Ito et al., 2017; Martin et al., 2013). Note that our participants were consistently slower on the English trials, even if they were all tested in English

after being tested in Norwegian, i.e., no learning was observed on the English trials from the previous Norwegian trials. For each language, two contrasts of sentence conditions were compared, i.e., mixed word order vs. low-constraint, and low-constraint vs. high-constraint. Similar listening patterns were revealed for both languages, with faster response times for the high-frequency condition than for the low-frequency condition, and faster responses for the low-frequency condition than for the mixed order condition. This contradicted the results of Martin et al. (2013) who found that bilinguals did not use context information in the same way in their L2 as in their L1, but supported the results of Batel (2019) and Dijkgraaf et al. (2017), who indicated that both L1 and L2 participants recognized words more quickly in semantically high-constraint sentences.

Consequently, despite of being slower in English, our bilinguals showed the same listening pattern in both languages and thereby the same ability to use contextual information in L2 as they can in L1. As expected, the slowest response times were found in the mixed word order condition, which confirmed that regardless of language, words are more easily recognized in normal sentences than in random series of words where neither syntactical nor semantic contextual information are present to aid in the word recognition. Slower reaction times for low-constraint sentences than high-constraint sentences confirmed that the more available contextual information, the easier the recognition of words in a sentence becomes, supporting both recent studies such as Batel (2019) and Dijkgraaf et al. (2017), and the classic monolingual study of Marslen-Wilson and Tyler (1980).

Another significant effect was a **main effect of frequency**. Our pre-study prediction for frequency was that higher-frequency words would be faster to recognize than lower-frequency words, regardless of sentence condition. The results showed no significant frequency effect in the contrast between the mixed-order vs. low-constraint condition, but a significant frequency effect in the contrast between low- and high-constraint sentences both when listening in Norwegian and English. In both languages, response times in the high-constraint condition became faster as target word frequency increased. When participants were listening in Norwegian in the low-constraint condition, however, an interesting observation was that response times did not become faster with increasing target word frequency but stayed more or less similar as frequency increased. Generally, higher word frequency would be assumed to facilitate word recognition, regardless of condition, but in our case, when listening in Norwegian neither the mixed-order or the low-constraint condition showed no advantage of higher frequency target words.

Why higher frequency did not help our participants to recognize Norwegian target words faster in the low-constraint condition, was puzzling. One explanation may be that knowing the target word in advance influences the recognition process, and that frequency consequently is not as important as when the target word is not known when hearing the sentence. Another question is

whether the frequencies we found for our Norwegian words were suitable for our purpose. When calculating frequencies for our Norwegian target words, we used the NoWac corpus (Guevara, 2010), which is based on texts collected from Norwegian websites. For our English target word frequencies, we used SUBTLEX-UK (van Heuven et al., 2014), which is based on texts generated from subtitles. van Heuven et al. (2014) argued that corpuses with more informal language texts such as subtitles may give more accurate measures of frequency of use than texts from books and other types of written sources. Baayen et al. (2016) discussed how different communicative goals of the texts sampled in the corpora may give different frequency counts. In some type of texts, particular words are more frequent than they are in other types of texts. Since NoWac is based on written texts collected from the Internet, this may have resulted in a weighting of a certain type of words and may not have reflected a spoken language style as well as the SUBTLEX-UK corpus of subtitle texts which clearly reflects spoken language. This issue was raised during the process of finding Norwegian target words, when some of the words were found to have unnatural frequencies which might be explained by the type of use which the original texts were intended for. One example is that the term *tilgang* (Eng: access) which is frequently used on websites had 49993 matches in NoWac, while the presumably far more commonly used noun *flaske* (Eng: bottle) only had 8644 matches. This may indicate that the NoWac corpus frequencies do not reflect spoken language and may not be the most suitable corpus for finding word frequencies for a listening study.

Usually, higher frequencies should facilitate the recognition process, in that the more you have heard or seen a word, the faster you should recognize it. According to the Cohort model (Marslen-Wilson & Tyler, 1980; Marslen-Wilson, 1987), higher frequency words have both higher activation level and stronger links between the sublexical and the lexical levels and should be recognized faster (Connine, Titone, & Wang, 1993). Gollan et al. (2008) suggested that different modalities yield different frequencies. They argued that higher used modalities will yield smaller frequency effects, e.g., listening tasks will be less affected by frequency because comprehension is a more frequently used modality than production. Hence, the lack of an advantage of frequency in the low-constraint condition may be caused by comprehension being more used than production. This may have resulted in our highly proficient participants reaching a ceiling level where word frequency did not affect processing to the same degree as it would have for less proficient listeners, hence the advantage of the high-constraint condition was reduced or even eliminated. Our unexpected result stemmed from the Norwegian native language listening task. The weaker links hypothesis may explain why such effects appeared here, and not when listening in English, because our bilinguals were of course more proficient in their native language than in their second language. Consequently,

a reduced or even eliminated advantage of higher frequency target words may well be explained by a ceiling level, as suggested by Gollan et al. (2008).

Another study of whether different modalities yield different results is Batel (2019) who investigated whether there would be a difference in bilinguals' ability to use contextual information in a visual versus a listening task. Batel argued that second language learners are often more exposed to texts through reading and writing than to spoken language, which may produce an advantage when processing written second language over spoken. His assumptions were that his Arabic-English bilinguals would not be able to use context as well in the listening task as in the visual task, due to less exposure to spoken language. Results, however, indicated an advantage of the high-constraint condition when listening in L2, but with slower response times in the spoken than in the visual modality. In the present study, participants were only tested in the auditory modality, but we found strong evidence of a similar listening pattern in both languages, although slower in L2.

Yet another explanation to the reduced advantage of frequency when listening to the Norwegian high-constraint sentences may be the task type. The present study was a behavioural study, where participants were given the target word in advance and needed to perform an action to give their response. It seems probable that giving participants the target words in advance may influence response times. Since they all reported being highly proficient both in Norwegian and English and all reported much informal English learning, it might be that knowing which word to listen for may have reduced the importance of sentence constraint, as long as the sentence was sensible. It also seems sensible that this would have reduced the importance of frequency, since participants already knew which word to listen to, which should facilitate the lexical activation process. It would have been interesting to see whether results had been different if this had been an EEG task, where participants would not need to be given the target word in advance and could just have sat quietly and listened to sentences while brain responses were monitored. However, the strong results and significant effects seen in our results indicated that the results would not necessarily have been stronger with an EEG task in this particular study.

One aim of the present study was to investigate whether factors of bilingual profiles might influence response times. Hence, LEAP-Q results were submitted to a factor analysis where variables were compared and grouped together according to covariance, i.e., if one variable in the group changes, the other variables change either in the same or in the opposite direction. Four groups were identified, i.e., *English Proficiency*, *English Spoken Proficiency*, *Informal Learning of English* and *Age of Acquisition*, which were all found to account heavily for spoken English learning and proficiency (see Table 7 in the Results section).

Since the present study investigated spoken language comprehension, a pre-study prediction was that more exposure to spoken language and longer periods of immersion in an English-speaking environment would affect proficiency. To investigate the effect of individual differences in bilingual profiles, response times were run against the four factor groups identified by the factor analysis. The results of the individual differences analysis showed a significant effect of one of the factor groups, i.e., **Informal Learning of English**. No significant effects were found for the other three factor groups. In the Informal Learning of English factor group, the highest positively loading variables accounted for learning of English from TV and music, with exposure to English through TV and music coming next on the list. In addition, exposure to English was reported from spending time with English speaking friends and through reading in English. The lowest negatively loading variable accounted for the age which participants became fluent in English. In other words, the earlier participants reported having learnt English, the more they reported to have been exposed to English music and TV. An assumption would be that more exposure would lead to higher proficiency (e.g., Gollan et al., 2008). This was confirmed by our results, in that the more exposure to English in the form of informal English learning, i.e., the more time our participants reported that they have spent listening to, speaking, and reading English, the higher their self-reported English proficiency was. And the higher their English Proficiency, the better they should be able to make use of context when listening in second language English.

For the informal English learning factor group, an assumption would be that the more informal English learning, the higher proficiency, and the faster response times. When listening in Norwegian (L1), however, results showed that in the mixed-order condition, response times were not affected by informal English learning and stayed the same regardless of reported level of informal English learning. Both in the low-constraint and in the high-constraint condition, however, response times were faster the more informal English learning the participants reported. When listening in English (L2), however, results rather unexpectedly revealed some interesting effects. In the first contrast between the mixed-order and the low-constraint condition, there was no significant effect, although both showed a slight reduction in response times as informal English learning increased, i.e., in both conditions of this contrast, response times were slower the more informal English learning participants reported. In the second contrast between the low-constraint and high-constraint condition, however, a significant effect was found. Here, response times in the low-constraint condition supported the assumption of faster responses as informal English learning increased, while the high-constraint condition showed the opposite pattern, with slower response times as informal English learning increased. I.e., the more informal learning participants reported, the less advantage they had of the high-constraint compared to the low-constraint condition. In

other words, having more sentence context did not contribute to faster word recognition in the high-constraint condition. Previous research, e.g., Batel (2019) and Dijkgraaf et al. (2017), has suggested that more context should always result in faster word recognition. So, why was context not an advantage when Norwegian bilinguals who had had more informal learning were listening in English?

One reason for a reduced advantage of the high-constraint condition could be that the difference between the constraint levels of the high- and low-constraint sentences was too small. Preferably, if time had permitted it, we would have run a sentence completion test (i.e., a cloze test) on our sentences before using them in the experiment to verify that all test sentences had the intended constraint level. However, the strong significant effect of condition both when listening in Norwegian and in English, with a clear pattern of steps in response times between conditions, indicates that the level of constraint was sufficiently low for the low-constraint sentences and sufficiently high for the high-constraint sentences.

Another explanation could be the type of task. Our comprehension task was a behavioural task where participants needed to act by pressing the spacebar to respond, and not an EEG task where brain activity is measured while participants listen to sentences without needing to act. Even if an EEG task might have given more accurate results, our general results were very strong with slower mean responses for low- than high-constraint sentences, which indicated that type of task is an unlikely explanation.

The Weaker Links hypothesis (Gollan et al., 2008) may provide another possible explanation to why our participants responded slower when listening to English high-constraint sentences the more informal English learning they reported to have had. A natural assumption would be that the more English you have learnt, either formally or informally, the faster you should be able to respond. For English low-constraint sentences, however, the more informal English learning, the less advantage the participants had of the extra contextual information in the high-constraint sentences. Again, it might be that the ceiling effect levelled out the difference in advantage between the conditions, such that with low levels of learning, the advantage is higher than with high levels of learning. This, however, does not explain why the effect when listening in Norwegian was different.

However, when submitting variables to factor analysis, many variables were found to have either too little or too much covariation with another variable and were removed. Many of these variable pairs consisted of one Norwegian and one English variable. Since English was the most interesting for the present study, many Norwegian variables were removed in this process. This could perhaps be yet an explanation of why the individual differences analysis yielded different results for informal English learning when listening in Norwegian and in English.

When studying speech perception in bilinguals, it is important to be aware that groups of bilingual participants vary hugely from study to study, both in terms of proficiency levels in their languages and in terms of the position or dominance of their second language. As described in the introduction, English as a second language in Norway has a rather different position than second languages in many other countries, e.g., French as a second language in England or English as a second language in France. English has a very strong position in Norway, as discussed in the introduction. Children are exposed to English through music, TV, and other sources from a very young age, and they start learning English in school at 6 years old. Hence, Norwegians are highly exposed to both written and spoken English throughout their life. This may lead to difficulties in finding a participant group with more variation in proficiency. The LEAP-Q questionnaire revealed that our group of bilinguals were highly proficient in English, and also that they were very similar in many ways. All but one were university students or had graduated, most of them with at least a bachelor's degree. At the level of proficiency which they reported, many Norwegians use English regularly. It would have been interesting to explore whether a more diverse group of bilinguals with a more varied proficiency and background would yield different results.

Another question worth asking is whether the restrictions and limitations caused by Covid-19 may have affected the LEAP-Q answers. Normally, the experimenter would have sat down together with the participants to help and guide them when filling in the LEAP-Q questionnaire to ensure that no questions were misunderstood or left out. This time, however, to limit the time each participant had to spend in the laboratory, all participants filled in the forms on their own in advance. When going through results, some issues were discovered despite our strong attempts to establish good routines to check that forms were correctly filled in, e.g., while three participants had reported learning English first, the rest of their answers, including age of learning each language, indicated that only one of the three participants had learned English first, suggesting that the other two must have given wrong answers. Another issue was the high age which some of the participants reported for starting to learn English, at between 12–14 years, even if other of their answers confirmed that they were native Norwegians who had attended Norwegian schools where English is taught from approximately 6 years of age. If time and situation had permitted, we would have preferred to fill in the forms together with the participants. Nevertheless, despite of these few issues there was no doubt that our group of participants were very proficient bilinguals with Norwegian as their dominant language and with English was their second most dominant language.

Conclusion

The aim of our study was to expand our knowledge of whether Norwegian-English bilinguals were able to use contextual information to facilitate word recognition when listening to sentences both in Norwegian and in English as a second language. In a word monitoring task, highly proficient Norwegian-English bilinguals listened to sentences of three conditions: mixed word order, low-constraint, and high-constraint. Reaction times were measured from target word onset until the participant pressed the spacebar to confirm that they had recognized the target word.

Results revealed a main effect of language, with faster response times overall for Norwegian than for English even if English was tested second, indicating that no learning was generated from the Norwegian session to facilitate responses during the English task. As expected, there was also a significant effect of constraint, with the slowest response times in the mixed word order condition where listeners were in fact asked to pick out the target word from a random list of words; faster response times in the low-constraint sentence where normal syntax facilitated word recognition; and fastest response times in the high-constraint sentence where both syntax and semantic information facilitated word recognition. The same pattern was found both when our participants listened in Norwegian and in English as a second language, but with slightly slower response times in English. This clearly confirmed that our participants were able to use the extra contextual information provided by the high-constraint sentences to facilitate word recognition, which supported theories based on the Cohort model (Marslen-Wilson & Tyler, 1980; Marslen-Wilson, 1987) which assume that contextual top-down information may influence the speech recognition process as soon as the audible input has created an initial cohort of potential target words. This contradicted the results of the Martin et al. (2013) study, where no advantage of the high-constraint condition was found when comparing late Spanish-English bilinguals listening in their L2 with English monolinguals listening in their L1. It did, however, support the Ito et al. (2017) study, which tried to replicate the study of Martin et al. (2013) and this time found an advantage of the high-constraint condition when listening in L2. Our results also supported the findings of Dijkgraaf et al. (2017), where bilingual listeners were found to use contextual information when listening in their L2, even if response times were faster for bilinguals listening in their L1, and still faster for monolinguals listening in their native language, as predicted by the Weaker Links hypothesis (Gollan et al., 2008).

In sum, our results clearly supported the pre-study assumption that our bilingual participants would be able to use contextual information both when listening in Norwegian and in English as a second language.

References

Aitchison, J. (2012). *Words in the mind : an introduction to the mental lexicon* (4th ed. ed.). Oxford: Wiley-Blackwell.

Altarriba, J., Kroll, J. F., Sholl, A., & Rayner, K. (1996). The influence of lexical and conceptual constraints on reading mixed-language sentences: Evidence from eye fixations and naming times. *Memory & cognition, 24*(4), 477-492.

Altmann, G. T. M., & Kamide, Y. (1999). Incremental interpretation at verbs: restricting the domain of subsequent reference. *Cognition, 73*(3), 247-264. doi:10.1016/S0010-0277(99)00059-1

Anderssen, M., & Bentzen, K. (2018). Different Outcomes in the Acquisition of Residual V2 and Do-Support in Three Norwegian-English Bilinguals: Cross-Linguistic Influence, Dominance and Structural Ambiguity. *Frontiers in psychology, 9*, 2130-2130. doi:10.3389/fpsyg.2018.02130

Batel, E. (2019). Context Effect on L2 Word Recognition: Visual Versus Auditory Modalities. *J Psycholinguist Res, 49*(2), 223-245. doi:10.1007/s10936-019-09683-6

Bergs, A., & Brinton, L. (2017). *The History of English. : Volume 2, : Old English*(Vol. Volume 2).

Bialystok, E., Anderson, J. A. E., & Grundy, J. G. (2018). Interpreting cognitive decline in the face of cognitive reserve: Does bilingualism affect cognitive aging? *Linguistic Approaches to Bilingualism*. doi:https://doi.org/10.1075/lab.18040.bia

Bialystok, E., & Hakuta, K. (1994). In other words: the psychology and science of second language acquisition. In: New York: Basic Books.

Bialystok, E., Peets, K. F., Yang, S., & Luk, G. (2010). Receptive vocabulary differences in monolingual and bilingual children. *13*(4). doi:10.1017/S1366728909990423

Biber, D. (1988). *Variation across speech and writing*. Cambridge: Cambridge University Press.

Bloomfield, L. (1933). *Language*. New York: Holt.

Boersma, P., & Weenink, D. (2021). Praat: doing phonetics by computer (Version 6.1.38). Retrieved from https://www.fon.hum.uva.nl/praat/download_win.html

Bokmålsordboka. (n.d.). Retrieved from https://ordbok.uib.no/

Brothers, T., Dave, S., Hoversten, L. J., Traxler, M. J., & Swaab, T. Y. (2019). Flexible predictions during listening comprehension: Speaker reliability affects anticipatory processes. *Neuropsychologia, 135*, 107225-107225. doi:10.1016/j.neuropsychologia.2019.107225

Brothers, T., & Kuperberg, G. R. (2021). Word predictability effects are linear, not logarithmic: Implications for probabilistic models of sentence comprehension. *Journal of Memory and Language, 116*. doi:10.1016/j.jml.2020.104174

Brown, R., & McNeill, D. (1966). The "tip of the tongue" phenomenon. *Journal of Verbal Learning and Verbal Behavior, 5*(4), 325-337. doi:10.1016/S0022-5371(66)80040-3

Brysbaert, M., & Duyck, W. (2010). Is it time to leave behind the Revised Hierarchical Model of bilingual language processing after fifteen years of service? *Bilingualism (Cambridge, England), 13*(3), 359-371. doi:10.1017/S1366728909990344

Baayen, R., Wurm, L., & Aycock, J. (2007). Lexical dynamics for low-frequency complex words: A regression study across tasks and modalities. *The Mental Lexicon, 2*, 419-463.

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language, 59*(4), 390-412. doi:10.1016/j.jml.2007.12.005

Baayen, R. H., Milin, P., & Ramscar, M. (2016). Frequency in lexical processing. *Aphasiology, 30*(11), 1174-1220. doi:10.1080/02687038.2016.1147767

Cambridge Dictionary of English. Retrieved from https://dictionary.cambridge.org/dictionary/english/

Carlson, S. M., & Meltzoff, A. N. (2008). Bilingual experience and executive functioning in young children. *Developmental Science, 11*(2), 282-298. doi:10.1111/j.1467-7687.2008.00675.x

Choi, H. S., Marslen-Wilson, W., Lyu, B., Randall, B., & Tyler, L. (2020). Decoding the Real-Time Neurobiological Properties of Incremental Semantic Interpretation. doi:10.17863/CAM.55920

Choi, J. Y., Cutler, A., & Broersma, M. (2017). Early development of abstract language knowledge: Evidence from perception-production transfer of birth-language memory. *R Soc Open Sci, 4*(1), 160660-160660. doi:10.1098/rsos.160660

Connine, C. M., Titone, D., & Wang, J. (1993). Auditory Word Recognition: Extrinsic and Intrinsic Effects of Word Frequency. *J Exp Psychol Learn Mem Cogn, 19*(1), 81-94. doi:10.1037/0278-7393.19.1.81

Costa, & Santesteban. (2004). Lexical access in bilingual speech production: Evidence from language switching in highly proficient bilinguals and L2 learners. *J. Mem. Lang., 50*(4), 491-511. doi:10.1016/j.jml.2004.02.002

Costa, A., Caramazza, A., & Sebastian-Galles, N. (2000). The Cognate Facilitation Effect: Implications for Models of Lexical Access. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26*(5), 1283-1296. doi:10.1037/0278-7393.26.5.1283

Costa, A., Pannunzi, M., Deco, G., & Pickering, M. J. (2017). Do Bilinguals Automatically Activate Their Native Language When They Are Not Using It? *Cogn Sci, 41*(6), 1629-1644. doi:10.1111/cogs.12434

Costumero, V., Marin-Marin, L., Calabria, M., Belloch, V., Escudero, J., Baquero, M., . . . Ávila, C. (2020). A cross-sectional and longitudinal study on the protective effect of bilingualism against dementia using brain atrophy and cognitive measures. *Alzheimer's research & therapy, 12*(1), 11. doi:10.1186/s13195-020-0581-1

Council Resolution of 21 November 2008 on a European strategy for multilingualism (2008/C 320/01). *Official Journal C 320 of 16.12.2008, p. 1-3*.

Crystal, D. (2008). *A dictionary of linguistics and phonetics* (6th ed. ed.). Malden, Mass: Blackwell.

Cutler, A. (2012). *Native Listening: Language Experience and the Recognition of Spoken Words*. Cambridge, Massachusetts: Cambridge, Massachusetts: The MIT Press.

Cutler, A., Weber, A., Smits, R., & Cooper, N. (2004). Patterns of English phoneme confusions by native and non-native listeners.

Dahan, D., Magnuson, J. S., & Tanenhaus, M. K. (2001). Time Course of Frequency Effects in Spoken-Word Recognition: Evidence from Eye Movements. *Cogn Psychol, 42*(4), 317-367. doi:10.1006/cogp.2001.0750

de Bruin, A. (2019). Not All Bilinguals Are the Same: A Call for More Detailed Assessments and Descriptions of Bilingual Experiences. *Behav Sci (Basel), 9*(3), 33. doi:10.3390/bs9030033

Del Maschio, N., Sulpizio, S., Toti, M., Caprioglio, C., Del Mauro, G., Fedeli, D., & Abutalebi, J. (2019). Second language use rather than second language knowledge relates to changes in white matter microstructure. *Journal of Cultural Cognitive Science*. doi:10.1007/s41809-019-00039-z

Dijkgraaf, A., Hartsuiker, R. J., & Duyck, W. (2017). Predicting upcoming information in native-language and non-native-language auditory word recognition. *Bilingualism, 20*(5), 917-930. doi:10.1017/S1366728916000547

Dijkstra, A. F. J., Wahl, A. R., Buytenhuijs, F., Halem, N. v., Al-jibouri, Z. S. H., Korte, M. d., & Rekke, S. T. (2019). Multilink: A computational model for bilingual word recognition and word translation. *Bilingualism (Cambridge, England), 22*(4), 657-679. doi:10.1017/S1366728918000287

Dijkstra, T. (2005). Bilingual Visual Word Recognition and Lexical Access. In J. F. Kroll & A. M. B. D. Groot (Eds.), *Handbook of Bilingualism: Psycholinguistic Approaches* (pp. 179-201): Oxford University Press.

Dijkstra, T., & van Heuven, W. J. B. (1998). The BIA model and bilingual word recognition. In *Localist connectionist approaches to human cognition.* (pp. 189-225). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Dijkstra, T., & van Heuven, W. J. B. (2002). The architecture of the bilingual word recognition system: From identification to decision. *Bilingualism, 5*(3), 175-197. doi:10.1017/S1366728902003012

EF Education First. (n.d.). EF English Proficiency Index. Retrieved from https://www.ef.co.uk/assetscdn/WIBIwq6RdJvcD9bc8RMd/legacy/__/~/media/centralefcom/epi/downloads/full-reports/v10/ef-epi-2020-english.pdf

Eimas, P. D., Siqueland, E. R., Jusczyk, P., & Vigorito, J. (1971). Speech Perception in Infants. *Science, 171*(3968), 303-306. doi:10.1126/science.171.3968.303

Ernestus, M., & Baayen, R. H. (2011). 12 Corpora and Exemplars in Phonology. In J. Goldsmith, J. Riggle, & A. C. L. Yu (Eds.), *The Handbook of Phonological Theory* (Second Edition ed.): Blackwell Publishing Ltd.

Forster, K. I. (1981). Priming and the effects of sentence and lexical contexts on naming time: Evidence for autonomous lexical processing. *The Quarterly Journal of Experimental Psychology Section A, 33*(4), 465-495. doi:10.1080/14640748108400804

Frauenfelder, U. H., & Tyler, L. K. (1987). The process of spoken word recognition: An introduction. In (pp. 1-20). Amsterdam :.

Gollan, T. H., Montoya, R. I., Cera, C., & Sandoval, T. C. (2008). More use almost always means a smaller frequency effect: Aging, bilingualism, and the weaker links hypothesis. *Journal of Memory and Language, 58*(3), 787-814. doi:10.1016/j.jml.2007.07.001

Gonzales, K., Byers-Heinlein, K., & Lotto, A. J. (2019). How bilinguals perceive speech depends on which language they think they're hearing. *Cognition, 182*, 318-330. doi:10.1016/j.cognition.2018.08.021

Green, D. W., & Abutalebi, J. (2013). Language control in bilinguals: The adaptive control hypothesis. *Journal of Cognitive Psychology: What bilinguals tell us about cognitive control, 25*(5), 515-530. doi:10.1080/20445911.2013.796377

Grosjean, F. (1980). Spoken word recognition processes and the gating paradigm. *Percept Psychophys, 28*(4), 267-283. doi:10.3758/BF03204386

Grosjean, F. (1989). Neurolinguists, beware! The bilingual is not two monolinguals in one person. *Brain Lang, 36*(1), 3-15. doi:10.1016/0093-934x(89)90048-5

Grosjean, F. (1997). The bilingual individual. *Interpreting, 2*(1-2), 163-187. doi:https://doi.org/10.1075/intp.2.1-2.07gro

Grosjean, F. (2010). *Bilingual: Life and reality*. Cambridge, MA, US: Harvard University Press.

Grosjean, F., & Byers-Heinlein, K. (2018). *The listening bilingual: Speech perception, comprehension, and bilingualism*: John Wiley & Sons.

Grosjean, F., & Li, P. (2013). *The psycholinguistics of bilingualism*. Malden, Mass: Wiley-Blackwell.

Grosjean, F. o. (2008). *Studying bilinguals*.

Grundy, J. G., Anderson, J. A. E., & Bialystok, E. (2017). Neural correlates of cognitive processing in monolinguals and bilinguals. In (Vol. 1396, pp. 183-201).

Guevara, E. R. (2010). *NoWaC: a large web-based corpus for Norwegian.* Paper presented at the Proceedings of the NAACL HLT 2010 Sixth Web as Corpus Workshop.

Hakuno, Y., Omori, T., Yamamoto, J.-I., & Minagawa, Y. (2017). Social interaction facilitates word learning in preverbal infants: Word–object mapping and word segmentation. *Infant Behavior and Development, 48*(Pt B), 65-77. doi:10.1016/j.infbeh.2017.05.012

Harley, T. A. (2014). *The psychology of language : from data to theory* (4th ed.). London: Psychology Press.

Haugen, E. (1969). *The Norwegian language in America: A study in bilingual behavior* (Vol. 1).

Haugen, E. (1976). *The Scandinavian languages : an introduction to their history*. London: Faber and Faber.

Hulstijn, J. H. (2019). An Individual-Differences Framework for Comparing Nonnative With Native Speakers: Perspectives From BLC Theory: (Near)nativeness. *Language Learning, 69*, 157-183. doi:10.1111/lang.12317

Ito, A., Martin, A. E., & Nieuwland, M. S. (2017). How robust are prediction effects in language comprehension? Failure to replicate article-elicited N400 effects. *Language, Cognition and Neuroscience, 32*(8), 954-965. doi:10.1080/23273798.2016.1242761

Jensen, I. N., Slabakova, R., Westergaard, M., & Lundquist, B. (2020). The Bottleneck Hypothesis in L2 acquisition: L1 Norwegian learners' knowledge of syntax and morphology in L2 English. *Second language research, 36*(1), 3-29. doi:10.1177/0267658318825067

Klein, R. M., Christie, J., & Parkvall, M. (2016). Does multilingualism affect the incidence of Alzheimer's disease?: A worldwide analysis by country. *Ssm - Population Health, 2*, 463-467. doi:10.1016/j.ssmph.2016.06.002

Klimovich-Gray, A., Tyler, L., Randall, B., Kocagoncu, E., Devereux, B., & Marslen-Wilson, W. (2019). Balancing Prediction and Sensory Input in Speech Comprehension: The Spatiotemporal Dynamics of Word Recognition in Context. doi:10.17863/CAM.34013

Kroll, J. (2008). Juggling Two Languages in One Mind. Retrieved from https://www.researchgate.net/profile/Judith_Kroll/publication/265566523_Juggling_Two_Languages_in_One_Mind/links/55a27a8908ae1c0e04651c2c/Juggling-Two-Languages-in-One-Mind.pdf

Kroll, J., Gullifer, J., McClain, R., Rossi, E., & Martín, M. C. (2015). Selection and control in bilingual comprehension and production. In J. W. Schwieter (Ed.), *The Cambridge Handbook of bilingual processing*: Cambridge University Press.

Kroll, J., Gullifer, J., Mudry, R., Rossi, E., & Martín, M. (2015). Selection and control in bilingual comprehension and production. In J. W. Schwieter (Ed.), *The Cambridge Handbook of bilingual processing (Cambridge Handbooks in Language and Linguistics)*. Cambridge: Cambridge University Press.

Kroll, J. F., & Stewart, E. (1994). Category Interference in Translation and Picture Naming: Evidence for Asymmetric Connections Between Bilingual Memory Representations. *Journal of Memory and Language, 33*(2), 149-174. doi:10.1006/jmla.1994.1008

Kuhl, P. K., Tsao, F.-M., & Liu, H.-M. (2003). Foreign-language experience in infancy: effects of short-term exposure and social interaction on phonetic learning.(Author Abstract). *Proceedings of the National Academy of Sciences of the United States, 100*(15), 9096. doi:10.1073/pnas.1532872100

Lagrou, E., Hartsuiker, R., & Duyck, W. (2013). The influence of sentence context and accented speech on lexical access in second-language auditory word recognition. *BILINGUALISM-LANGUAGE AND COGNITION, 16*(3). doi:10.1017/S1366728912000508

Lahiri, A., & Reetz, H. (2010). Distinctive features: Phonological underspecification in representation and processing. *Journal of Phonetics, 38*(1), 44-59. doi:10.1016/j.wocn.2010.01.002

Lam, K. J. Y., & Dijkstra, T. (2010). Word repetition, masked orthographic priming, and language switching: bilingual studies and BIA+ simulations. *International Journal of Bilingual Education and Bilingualism, 13*(5), 487-503. doi:10.1080/13670050.2010.488283

Ledesma, R., Valero-Mora, P., & Macbeth, G. (2015). The Scree Test and the Number of Factors: a Dynamic Graphics Approach. *The Spanish Journal of Psychology, 18*. doi:10.1017/sjp.2015.13

Levelt, W. J. (1974). Formal grammars in linguistics and psycholinguistics: Vol. III, Psycholinguistic applications.

Levelt, W. J. M. (1989). *Speaking: from intention to articulation*. Cambridge, Mass.: Cambridge, Mass.: MIT Press.

Lewy, N., & Grosjean, F. o. (2008). The Léwy and Grosjean BIMOLA model. In F. o. Grosjean (Ed.), *Studying Bilinguals*. Oxford/New York: Oxford University Press.

Li, P., & Farkas, I. (2002). A self-organizing connectionist model of bilingual processing. In *Advances in psychology* (Vol. 134, pp. 59-85): Elsevier.

Libben, M. R., & Titone, D. A. (2009). Bilingual Lexical Access in Context: Evidence From Eye Movements During Reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 35*(2), 381-390. doi:10.1037/a0014875

Lohndal, T. (2013). *In search of universal grammar : from old Norse to Zoque*(Vol. 202).

Marian, V., Blumenfeld, H. K., & Kaushanskaya, M. (2007). The Language Experience and Proficiency Questionnaire (LEAP-Q): Assessing Language Profiles in Bilinguals and Multilinguals. *J Speech Lang Hear Res, 50*(4), 940-967. doi:10.1044/1092-4388(2007/067)

Marian, V., & Hayakawa, S. (2020). Measuring bilingualism: The quest for a "bilingualism quotient". *Applied Psycholinguistics*, 1-22. doi:10.1017/S0142716420000533

Marian, V., & Spivey, M. (2003). Competing activation in bilingual language processing: Within- and between-language competition. *Bilingualism, 6*(2), 97-115. doi:10.1017/S1366728903001068

Marslen-Wilson, W. (1973). Linguistic structure and speech shadowing at very short latencies. *Nature, 244*(5417), 522-523.

Marslen-Wilson, W., & Tyler, L. K. (1980). The temporal structure of spoken language understanding. *Cognition, 8*(1), 1-71. doi:10.1016/0010-0277(80)90015-3

Marslen-Wilson, W., Tyler, L. K., & Seidenberg, M. (1978). Sentence processing and the clause boundary.

Marslen-Wilson, W. D. (1984). Function and process in spoken word recognition: A tutorial review. *Attention and performance: Control of language processes*, 125-150.

Marslen-Wilson, W. D. (1987). Functional parallelism in spoken word-recognition. *Cognition, 25*(1-2), 71-102. doi:10.1016/0010-0277(87)90005-9

Marslen-Wilson, W. D., & Welsh, A. (1978). Processing interactions and lexical access during word recognition in continuous speech. *Cognitive psychology, 10*(1), 29-63. doi:10.1016/0010-0285(78)90018-X

Martin, C. D., Thierry, G., Kuipers, J.-R., Boutonnet, B., Foucart, A., & Costa, A. (2013). Bilinguals reading in their second language do not predict upcoming words as native readers do. *Journal of Memory and Language, 69*(4), 574-588. doi:10.1016/j.jml.2013.08.001

McClelland, J. L. (1991). Stochastic interactive processes and the effect of context on perception. *Cogn Psychol, 23*(1), 1-44. doi:10.1016/0010-0285(91)90002-6

McClelland, J. L., & Elman, J. L. (1986). The TRACE model of speech perception. *Cogn Psychol, 18*(1), 1-86. doi:10.1016/0010-0285(86)90015-0

McClelland, J. L., & Rumelhart, D. E. (1981). An interactive activation model of context effects in letter perception: I. An account of basic findings. *Psychological Review, 88*(5), 375-407. doi:10.1037/0033-295X.88.5.375

McGurk, H., & Macdonald, J. (1976). Hearing lips and seeing voices. *Nature, 264*(5588), 746-748. doi:10.1038/264746a0

Miller, G. A., & Chomsky, N. (1963). Finitary models of language users.

Morton, J. (1969). Interaction of information in word recognition. *Psychological Review, 76*(2), 165-178. doi:10.1037/h0027366

Oller, D. K., Pearson, B. Z., & Cobo-Lewis, A. B. (2007). Profile effects in early bilingual language and literacy. *Applied Psycholinguistics, 28*(2), 191-230. doi:10.1017/S0142716407070117

Ordnett.no. (n.d.). Kunnskapsforlaget. Retrieved from Ordnett.no

Paradis, M. (1997). The cognitive neuropsychology of bilingualism. In A. M. B. de Groot & J. F. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 331–354). Mahwah, NJ: Lawrence Erlbaum Publishers.

Persici, V., Vihman, M., Burro, R., & Majorano, M. (2019). Lexical access and competition in bilingual children: The role of proficiency and the lexical similarity of the two languages. *J Exp Child Psychol, 179*, 103-125. doi:10.1016/j.jecp.2018.10.002

Pierrehumbert, J. B. (2001). Exemplar dynamics: Word frequencies, lenition and contrast. In J. Bybee & P. J. Hopper (Eds.), *Frequency and the Emergence of Linguistic Structure* (pp. 137-157). Philadelphia: Philadelphia: John Benjamins Publishing Company.

Potter, M. C., So, K.-F., Eckardt, B. V., & Feldman, L. B. (1984). Lexical and conceptual representation in beginning and proficient bilinguals. *Journal of Verbal Learning and Verbal Behavior, 23*(1), 23-38. doi:10.1016/S0022-5371(84)90489-4

Rindal, U. (2014). What is English? *Acta didactica Norge, 8*(2), 14. doi:10.5617/adno.1137

Rindal, U., & Piercy, C. (2013). Being 'neutral'? English pronunciation among Norwegian learners. 211-229. doi:info:doi/
Shook, A., & Marian, V. (2013). The Bilingual Language Interaction Network for Comprehension of Speech. *Bilingualism, 16*(2), 304-324. doi:10.1017/S1366728912000466
Shook, A., & Marian, V. (2019). Covert Co-Activation of Bilinguals' Non-Target Language: Phonological Competition from Translations. *Linguistic Approaches to Bilingualism, 9*(2), 228-252. doi:10.1075/lab.17022.sho
Sunderman, G., & Kroll, J. F. (2006). First Language Activation During Second Language Lexical Processing: An Investigation of Lexical Form, Meaning, and Grammatical Class. *Stud Sec Lang Acq, 28*(3), 387-422. doi:10.1017/S0272263106060177
Sunderman, G., & Schwartz, A. I. (2008). Using Cognates to Investigate Cross-Language Competition in Second Language Processing. *TESOL quarterly, 42*(3), 527-536. doi:10.1002/j.1545-7249.2008.tb00145.x
The Norwegian Directorate for Education and Training. ((n.d.)). Curriculum in English: Relevance and central values. Retrieved from https://www.udir.no/lk20/eng01-04/om-faget/fagets-relevans-og-verdier?lang=eng
Thierry, G., & Wu, Y. J. (2007). Brain Potentials Reveal Unconscious Translation during Foreign-Language Comprehension. *Proc Natl Acad Sci U S A, 104*(30), 12530-12535. doi:10.1073/pnas.0609927104
toPhonetics.com. (n.d.). Retrieved from tophonetics.com
Tyson, L. (2015). *Critical theory today : a user-friendly guide* (3rd ed. ed.). London: Routledge.
UiB. (n.d.-a). De 10000 hyppigste ordformer i norsk. Retrieved from http://korpus.uib.no/humfak/nta/ord10k.txt
UiB. (n.d.-b). Frekvensordliste: de vanligste norske ord. Retrieved from https://www.korrekturavdelingen.no/ord-uttrykk-frekvensordliste-500-vanligste-norsk.htm
van Heuven, W. J. B., Mandera, P., Keuleers, E., & Brysbaert, M. (2014). Subtlex-UK: A new and improved word frequency database for British English. *Quarterly Journal of Experimental Psychology, 67*(Dec 2020), 1176-1190.
van Heuven, W. J. B., Mandera, P., Keuleers, E., & Brysbaert, M. (2018). Subtlex-UK: A New and Improved Word Frequency Database for British English. *Q J Exp Psychol (Hove)*(Dec 2020), 1176-1190. doi:10.1080/17470218.2013.850521
Weber, A., & Scharenborg, O. (2012). Models of spoken-word recognition. *Wiley Interdiscip Rev Cogn Sci, 3*(3), 387-401. doi:10.1002/wcs.1178 This article is categorized under: Linguistics > Computational Models of Language
10.1002/wcs.1178
Weinreich, U. (1968). *Languages in Contact : Findings and Problems*. The Hague: De Gruyter Mouton.
Wikipedia. (n.d.). Dora the Explorer. Retrieved from https://en.wikipedia.org/wiki/Dora_the_Explorer
Wiktionary. (n.d.). Wiktionary. Retrieved from https://en.wiktionary.org/wiki/Category:Norwegian_Bokm%C3%A5l_nouns

Appendices

Appendix A – Consent Form

Participant·consent·form → → → → → ... ¶

¶

·English·as·a·second·language:·language·processing·and·bilingual·profile¶

¶

→ ¶

ID#¶

PARTICIPANT·IDENTIFICATION·NUMBER·FOR·THIS·STUDY¶

¶

1)→I·confirm·that·I·have·read·and·understand·the·information·sheet·for·the·above·study.·I·have·had·the·opportunity·to·consider·the·information,·ask·questions·and·have·had·these·answered·satisfactorily.¶

¶

2)→I·understand·that·my·participation·is·voluntary·and·that·I·am·free·to·withdraw·at·any·time·without·giving·any·reason.·I·understand·that·I·can·withdraw·my·data·at·any·time·during·the·experiment·and·for·the·duration·of·one·month·after·my·completion·of·the·study.¶

¶

3)→I·understand·that·data·collected·during·the·study·will·be·looked·at·by·researchers·from·the·University·of·Agder.·I·give·permission·for·these·individuals·to·have·access·to·my·data.·Upon·completion·of·the·study,·the·data·may·be·placed·on·an·appropriate·repository·for·data-sharing·and·be·accessed·by·researchers·not·affiliated·with·the·University·of·Agder.·I·understand·that·all·my·data·will·be·stored·anonymously.·¶

.....¶

¶

4)→I·agree·to·take·part·in·the·study.¶

¶

¶

Name·of·Participant·(BLOCK·LETTERS)¤		Date¤	¤	Signature¤	¤
¶ ¤	¶ ¤	¤	¤	¤	¤
Name·of·Researcher·(BLOCK·LETTERS)¤		Date¤	¤	Signature¤	¤

¶

¶

date¤	Participant's·Signature¤	¤

¶

Appendix B – Information Sheet

INVITATION TO PARTICIPATE IN A RESEARCH PROJECT

English as a second language: language processing and bilingual profile

We are looking for Native speakers of Norwegian to take part in a study investigating the relationship between bilingualism and language processing.

In order to participate in this study you need to be between **18 and 35 years of age** and a **Native speaker of Norwegian** with no other home languages (excluding perhaps English). You should have a reasonable proficiency in **English as your second language**. You should have normal or corrected-to-normal vision and hearing and have no diagnosed cognitive impairments or language impairments such as dyslexia or stuttering.

This research is conducted in the Experimental Linguistics Research groups at the University of Agder, headed by Professor Linda Wheeldon (linda.r.wheeldon@uia.no), Professor Allison Wetterlin (Allison.wetterlin@uia.no).

The study is run by our Masters students Ellinor Skjerli (ellinor.skjerli@gmail.com), Karethe Nilsen (karethe.nilsen@gmail.com), Renate Gjetnes (renatg16@student.uia.no), Helene Øya (heleno15@student.uia.no), Heidi Baardsen (heidi.baardsen@gmail.com), and Yvonne Møtteberg Karlsen (yvonmk15@student.uia.no). Please contact them if you have any queries about the study.

WHAT IS THE STUDY ABOUT?

This study is designed to investigate the use of English as a second language. We are interested in how aspects of bilingual learning and language-use relate to language processing. The study has two components:

1. A questionnaire asking questions about your language background and about how you rate your own level of proficiency in different aspects of the languages that you speak.

2. Some simple tests assessing language processing in Norwegian and English. These tests are designed to investigate word finding, sentence production and sentence comprehension.

If, after having read the information below, you agree that you are eligible, and you decide to take part in the study, you will be sent a consent form to be filled out and signed.

VOLUNTARY PARTICIPATION AND THE POSSIBILITY TO WITHDRAW CONSENT (OPT-OUT)

Participation in the study is voluntary. If you wish to take part, you will need to sign the declaration of consent. This will allow us to process your data. You can, at any given time and without reason withdraw your consent. If you decide to withdraw participation in the project,

you can ask that your test results and personal data be deleted, unless the data and tests have already been analysed or used in scientific publications.

So long as you can be identified in the collected data you have the right to:

- access the personal data that is being processed about you
- request that your personal data is deleted
- request that incorrect personal data about you is corrected/rectified
- receive a copy of your personal data (data portability), and
- send a complaint to the Data Protection Officer or The Norwegian Data Protection Authority regarding the processing of your personal data.

If you at a later point, wish to withdraw consent or have questions regarding the project, you can contact the principal investigator (Linda Wheeldon). Questions about the study or withdrawing consent can also be directed to the University of Agder's Data protection officer Ina Danielsen ina.danielsen@uia.no or NSD (Norsk senter for forskningsdata AS) by email personvernombudet@nsd.no or telephone: 55 58 21 17.

WHAT WILL HAPPEN TO YOUR INFORMATION?

The study will collect and record personal information about you. However, you will never at any time be mentioned as an individual in relation to this study. The information that is recorded about you will only be used as described in the purpose of the study. Your personal data will be assigned a number code related to your name and stored on a non-networked, password protected PC. Only the laboratory directors and experimenters will have access to your data and to the key relating your data number to your name. In addition, we will record the responses you produce during the experiment, this includes key strokes and speech. These data will be also be anonymised and treated as described above.

The results derived from the pooled data will be published. In the interest of being open to the scientific community and others interested in this research we would also like, with your permission, to publish the anonymised data to an open access database. If you agree to this, please sign the consent form. The decision you make does not affect your eligibility for this study.

All information will be processed and used without your name or personal identification number, or any other information that is directly identifiable to you.

The principal investigators have the responsibility for the daily operations/running of this research project and that any information about you will be handled in a secure manner. Information about you will be anonymised or deleted a maximum of 5 years after the project end date (20.12.2021).

FINANCE

In appreciation for your time and effort, you will receive a voucher for 300 NOK on completion of this study.

Appendix C – LEAP-Q questionnaire

REMEMBER TO 'SAVE AS' Y + SUBJECT NUMBER (E.G., Pp_01) FIRST!!

General note: cells are locked to prevent formula being changed (you can unlock if necessary by removing the worksheet protection).

Participant number: | **Date of testing:**

SCREENING QUESTIONNAIRE

Experimenter: Ask participant the following questions and fill in the yellow boxes with their responses.

1	What is your age? (in years)		
2	What is your gender?		
3	Are you a native speaker of Norwegian?		
4	Is Norwegian the only language you speak at home (aside from English)?	*If no, please specify other home language*	
5	Are you a reasonably good speaker of English?		
6	Do you have normal vision or vision that is corrected to normal with elasses or contact		
7	Can you confirm that you have no language impairments such as dyslexia, stuttering etc.?		
8	Do you have normal hearing or hearing that is corrected to normal?		
9	Are you left or right handed?		
10	What is your country of birth?		
11	What is your current country of residence?		
12	How many years of education do you have?		
13	What is the highest education level you have? (Select from the drop-down options)	*If other, please specify*	
14	Have you participated in any experiments here before?		

2. LANGUAGE BACKGROUND

Participant: please answer these questions below about the different languages you speak.
Please fill in your responses in the appropriate yellow boxes, and ask the experimenter if you have any questions.

Q1 Please list all the languages you speak in order of DOMINANCE (up to 5).

1	
2	
3	
4	
5	

Q2 Please list all the languages you speak in order of ACQUISITION (up to 5).

1	
2	
3	
4	
5	

Q3 Please list what percentage of the time you are on average exposed to each language (e.g. exposure in terms of talking, listening, and reading, including TV, films and music).
(All your answers should add up to 100%)

	Language	%
1		
2		
3		
4		
5		
	Total:	0

Please make sure your answer adds up to 100%

Q4 Please list what percentage of the time you spend speaking each language.
(All your answers should add up to 100%)

	Language	%
1		
2		
3		
4		
5		
	Total:	0

Please make sure your answer adds up to 100%

Q5 Please list what percentage of the time you typically spend reading in each language.
(All your answers should add up to 100%)

	Language	%
1		
2		
3		
4		
5		
	Total:	0

Please make sure your answer adds up to 100%

Q6 When choosing a language to speak, with a person who is equally fluent in all your languages, what percentage of time would you choose to speak each language? Please report percentage of total
(All your answers should add up to 100%)

	Language	%
1		
2		
3		
4		
5		
	Total:	0

Please make sure your answer adds up to 100%

Q7 What cultures do you identify with (e.g., Norwegian, British, American, etc)? Please list each culture below (up to 5) and use the scale from 0-10 to rate the degree of identification, whereby 0 = no identification, 5 = moderate identification, 10 = complete identification.

	Culture	Identification
1		
2		
3		
4		
5		

Q8 Do you feel that you were once better in one of your languages and that you have become less

If yes, which one? *And at what age did you become less fluent?*

Q9 In which language do you usually do the following tasks?

Task	Language
Simple maths (count, add)	
Dream	
Express anger or affection	
Talk to yourself	

3. NORWEGIAN AND ENGLISH PROFICIENCY

Participant: please answer these questions below about your experience with Norwegian and English.
Please fill in your responses in the appropriate yellow boxes, and ask the experimenter if you have any questions.

Q1 Please list the number of years and months you have spent in each language environment.

	Norwegian		English	
	Years	Months	Years	Months
A country where this language is spoken				
A family where this language is spoken				
A school where this language is spoken ALL of the time				
A school where this language is spoken SOME of the time				
A workplace where this language is spoken ALL of the time				
A workplace where this language is spoken SOME of the time				

Q2 Please rate how much the following factors contributed to your learning of each language on a scale of 0-10 whereby 0 = not a contributor, 5 = moderate contributor and 10 = most important contributor.

	Norwegian	English
Interacting with friends / colleagues		
Interacting with family		
Reading (e.g., books, magazines, online material)		
School and education		
Self-instruction (e.g., language learning videos or apps)		
Watching TV / streaming		
Listening to music/media		

Q3 Please rate to what extent you are currently (e.g. in the last month or so) exposed to each language on a scale of 0-10 whereby 0 = never, 5 = half of the time and 10 = almost always.

	Norwegian	English
Interacting with friends		
Interacting with family		
Reading (e.g., books, magazines, online material)		
Self-instruction (e.g., language learning videos or apps)		
Watching TV / streaming		
Listening to music/media		

Q4 Please rate your level of proficiency in the following aspects of each language on a scale of 0-10 whereby: 0 = none; 1 = very low; 2 = low; 3 = fair; 4 = slightly less than adequate; 5 = adequate; 6 = slightly more than adequate; 7 = good; 8 = very good; 9 = excellent; 10 = perfect.

	Norwegian	English
Speaking (general fluency)		
Pronunciation (accent)		
Listening (understanding spoken		
Reading		
Writing		
Grammar		
Vocabulary		
Spelling		

Q5 Please list the AGE (in years) you were when the following occurred for each language.

	Norwegian	English
Started hearing this language on a regular basis		
Became fluent in speaking this language		
Started learning to read in this language		
Became fluent in reading this language		

Q6 Please rate your level of proficiency in switching between your languages when you need to, on a scale of 0-10 whereby: 0 = none; 1 = very low; 2 = low; 3 = fair; 4 = slightly less than adequate; 5 = adequate; 6 = slightly more than adequate; 7 = good; 8 = very good; 9 = excellent; 10 = perfect.

Q7 When you are speaking do you ever find yourself accidentally mixing words or sentences from Norwegian and English?

(a) If yes, how often does English accidentally intrude in your Norwegian on a scale of 0-10 (whereby 0 = never, 5 = half of the time, 10 = all of the time)?

(b) And how often does Norwegian accidentally intrude into your English on a scale of 0-10 (whereby 0 = never, 5 = half of the time, 10 = all of the time)?

Q8 When you are speaking with a person who also knows both Norwegian and English do you ever find yourself intentionally mixing words or sentences from Norwegian and English?

(a) If yes, how often do you intentionally use English words when speaking Norwegian on a scale of 0-10 (whereby 0 = never, 5 = half of the time, 10 = all of the time)?

(b) And how often do you intentionally use Norwegian words when speaking English on a scale of 0-10 (whereby 0 = never, 5 = half of the time, 10 = all of the time)?

END OF QUESTIONNAIRE - THANK YOU FOR YOUR TIME!

SUMMARY PAGE FOR EXPERIMENTER USE

All of the participant's responses for each part of the questionnaire is stored here.
For each response, there is the corresponding variable name and the question number (if applicable).
If the participant did not provide a response, it will be listed as NA.
To copy the information elsewhere (i.e., to another excel file) you should:
1) Highlight the appropriate boxes
2) Press Control-C or right-click and select 'Copy'
3) Paste the cells in the desired location using the 'PASTE VALUES ONLY OPTION' (the second paste option when you right click)
It is important that you only paste the values/text and not the formula that the cells are based (otherwise you likely encounter problems!)

DESCRIPTIVE INFO

Variable	Response
Pp_No	0
Age	0
Gender	0
Handedn	0
Birth_Cou	0
Resident	0
Educatio	0
Educatio	0

LANG_BACKGROUND

Quest	Variable	Response
	Pp_No	0
	L1	NA
	L2	NA
	L3	NA
	L4	NA
	L5	NA
Q1a	Dom_1	NA
Q1b	Dom_2	NA
Q1c	Dom_3	NA
Q1d	Dom_4	NA
Q1e	Dom_5	NA
Q2a	Acq_1	NA
Q2b	Acq_2	NA
Q2c	Acq_3	NA
Q2d	Acq_4	NA
Q2e	Acq_5	NA
Q3a	Exposure	NA
Q3b	Exposure	NA
Q3c	Exposure	NA
Q3d	Exposure	NA
Q3e	Exposure	NA
Q4a	Speaking	NA
Q4b	Speaking	NA
Q4c	Speaking	NA
Q4d	Speaking	NA
Q4e	Speaking	NA
Q5a	Read_L1	NA
Q5b	Read_L2	NA
Q5c	Read_L3	NA
Q5d	Read_L4	NA
Q5e	Read_L5	NA
Q6a	Choice_L	NA
Q6b	Choice_L	NA
Q6c	Choice_L	NA
Q6d	Choice_L	NA
Q6e	Choice_L	NA
Q7a	Culture_	NA
Q7b	Culture_	NA
Q7c	Culture_	NA
Q7d	Culture_	NA
Q7e	Culture_	NA
Q7f	Ident_Cu	NA
Q7g	Ident_Cu	NA
Q7h	Ident_Cu	NA
Q7i	Ident_Cu	NA
Q7j	Ident_Cu	NA
Q8	Once_Be	NA
Q8a	Better_W	NA
Q8b	Better_A	NA
Q9a	Maths_L	NA
Q9b	Dream_L	NA
Q9c	Anger_La	NA
Q9d	Selftask_	NA

NORSK_ENG_PROF

Quest	Variable	Response
	Pp_No	0
Q1a	Country_N	:
Q1b	Family_No	:
Q1c	School_AL	:
Q1d	School_SO	:
Q1e	Work_ALL	:
Q1f	Work_SON	:
Q1g	Country_E	:
Q1h	Family_En	:
Q1i	School_AL	:
Q1j	School_SO	:
Q1k	Work_ALL	:
Q1l	Work_SON	:
Q2a	Contrib_In	NA
Q2b	Contrib_In	NA
Q2c	Contrib_R	NA
Q2d	Contrib_S	NA
Q2e	Contrib_S	NA
Q2f	Contrib_T	NA
Q2g	Contrib_M	NA
Q2h	Contrib_In	NA
Q2i	Contrib_In	NA
Q2j	Contrib_R	NA
Q2k	Contrib_S	NA
Q2l	Contrib_S	NA
Q2m	Contrib_T	NA
Q2n	Contrib_M	NA
Q3a	Expos_Int	NA
Q3b	Expos_Int	NA
Q3c	Expos_Rea	NA
Q3d	Expos_Sel	NA
Q3e	Expos_TV_	NA
Q3f	Expos_Mu	NA
Q3g	Expos_Int	NA
Q3h	Expos_Int	NA
Q3i	Expos_Rea	NA
Q3j	Expos_Sel	NA
Q3k	Expos_TV_	NA
Q3l	Expos_Mu	NA
Q4a	Speaking_	NA
Q4b	Pronoucin	NA
Q4c	Listening_	NA
Q4d	Reading_N	NA
Q4e	Writing_N	NA
Q4f	Grammar_	NA
Q4g	Vocab_No	NA
Q4h	Spelling_N	NA
Q4i	Speaking_	NA
Q4j	Pronoucin	NA
Q4k	Listening_	NA
Q4l	Reading_E	NA
Q4m	Writing_E	NA
Q4n	Grammar_	NA
Q4o	Vocab_Eng	NA
Q4p	Spelling_E	NA
Q5a	StartHear	NA
Q5b	FluentSpe	NA
Q5c	StartRead	NA
Q5d	FluentRea	NA
Q5e	StartHear	NA
Q5f	FluentSpe	NA
Q5g	StartRead	NA
Q5h	FluentRea	NA
Q6	Switch_Pr	NA
Q7	Accient_M	NA
Q7a	Accident_	NA
Q7b	Accident_	NA
Q8	Intentiona	NA
Q8a	Intentiona	NA
Q8b	Intentiona	NA

Appendix D – Factor Table with Original Variable Names

Factor RC1: **English Proficiency**	*Load. Values*	**Factor RC4:** **Spoken English Proficiency**	*Load. Values*	**Factor RC3:** **Informal Learning of English**	*Load. Values*	**Factor RC2:** **Age of Acquisition**	*Load. Values*
Q4n.Grammar_Eng	0.84	Q4b.Speaking_L2	0.68	Q2m.Contrib_TV_Eng	0.74	Q5h.FluentReading_Age_Eng	0.69
Q4m.Writing_Eng	0.82	Q5b.FluentSpeaking_Age_Norsk	0.60	Q2n.Contrib_Music_Eng	0.65	Q5e.StartHearing_Age_Eng	0.65
Q4l.Reading_Eng	0.82	Q5d.FluentReading_Age_Norsk	0.59	Q3k.Expos_TV_Eng	0.61	Q5f.FluentSpeaking_Age_Eng	0.62
Q4o.Vocab_Eng	0.78	Q6b.Choice_L2	0.59	Q3l.Expos_Music_Eng	0.56	Q5g.StartReading_Age_Eng	0.61
Q4k.Listening_Eng	0.74	Q3b.Exposure_L2	0.57	Q2j.Contrib_Reading_Eng	0.49	Q2h.Contrib_InteractFriend_Eng	0.51
Q4i.Speaking_Eng	0.71	Q2i.Contrib_InteractFamily_Eng	0.44	Q3b.Exposure_L2	0.46	Q2c.Contrib_Reading_Norsk	0.48
Q4j.Pronoucing_Eng	0.69	Q3g.Expos_InteractFriend_Eng	0.41	Q6.Switch_Proficiency	0.44	Q2f.Contrib_TV_Norsk	0.47
Q3i.Expos_Reading_Eng	0.65	Q7a.Accident_Mix_Words_Freq	0.37	Q3g.Expos_InteractFriend_Eng	0.35	Q7b.Accident_Norsk_Intrude_Eng	-0.37
Q6.Switch_Proficiency	0.60	Q4o.Vocab_Eng	0.33	Q2l.Contrib_SelfInstruct_Eng	0.35	Q8a.Intentional_SubIn_Eng	-0.58
Q2j.Contrib_Reading_Eng	0.59	Q4j.Pronoucing_Eng	0.33	Q5b.Read_L2	0.31		
Q2d.Contrib_School_Norsk	0.43	Q5b.Read_L2	0.33	Q5b.FluentSpeaking_Age_Norsk	-0.30		
Q7a.Accident_Mix_Words_Freq	0.41	Q2c.Contrib_Reading_Norsk	-0.37	Q5h.FluentReading_Age_Eng	-0.40		
Q2c.Contrib_Reading_Norsk	0.41	Q2d.Contrib_School_Norsk	-0.40				
Q5b.Read_L2	0.38	Q3c.Expos_Reading_Norsk	-0.44				
Q5b.FluentSpeaking_Age_Norsk	0.36	Q3e.Expos_TV_Norsk	-0.71				
Q5d.FluentReading_Age_Norsk	0.35						
Q3g.Expos_InteractFriend_Eng	0.35						
Q3l.Expos_Music_Eng	0.35						
Q2k.Contrib_School_Eng	0.33						
Q6b.Choice_L2	0.31						
Q2i.Contrib_InteractFamily_Eng	0.31						
Q3k.Expos_TV_Eng	0.31						
Proportion Var	0.19	**Proportion Var**	0.11	**Proportion Var**	0.09	**Proportion Var**	0.09
Cumulative Var	0.19	**Cumulative Var**	0.30	**Cumulative Var**	0.39	**Cumulative Var**	0.47

Appendix E – Variables Removed from Factor Analysis Due to Insufficient Co-Variation (< 0.3 or > 0.8)

Removed Variable		**Correlation of >0.8 with**	
Variable Name	*Short Description*	*Variable Name (correlation)*	*Short Description*
Q8b.Intentional_SubIn_Norsk	Intentional Mix NOR into ENG	No correlations of at least 0.3 with another variable	
Q3a.Exposure_L1	Time Spent Exposed to L1	Q3b.Exposure_L2 (-0.99)	Time Spent Exposed to L2
Q4a.Speaking_L1	Time Spent Speaking in L1	Q4b.Speaking_L2 (-0.98)	Time Spent Speaking in L2
Q5a.Read_L1	Time Spent Reading in L1	Q5b.Read_L2 (-0.90)	Time Spent Reading in L2
Q6a.Choice_L1	% of Time Choosing to Use L1	Q6b.Choice_L2 (-0.99)	% of Time Choosing to Use L2
Q4p.Spelling_Eng	ENG Spelling Proficiency	Q4n.Grammar_Eng (0.86)	ENG Grammar Proficiency
Q2g.Contrib_Music_Norsk	NOR Learning from Music	Q2f.Contrib_TV_Norsk (0.81)	NOR Learning from TV
Q3f.Expos_Music_Norsk	NOR Exposure through Music	Q3e.Expos_TV_Norsk (0.82)	NOR Exposure through TV

Appendix F – Full Set of Norwegian Target Words

Norwegian Noun	NoWac frequency count	Frequency per Million Words	Number of Letters	Number of Syllables	Number of Phonemes
advarsel	6898	9.9	8	3	8
alder	44591	63.7	5	2	5
ansatt	23840	34.1	6	2	5
ansvar	82031	117.2	6	2	6
appelsin	1640	2.3	8	3	7
arbeid	126357	180.5	6	2	6
bamse	2469	3.5	5	2	5
behov	101164	144.5	9	3	9
bekk	1380	2.0	4	1	3
beskjed	34875	49.8	7	2	7
bilde	100418	143.5	5	2	5
billett	5940	8.5	7	2	5
blyant	1096	1.6	6	2	6
bolig	27971	40.0	5	2	4
brann	78766	112.5	5	1	4
bunad	923	1.3	5	2	5
dam	1518	2.2	3	1	3
dommer	12318	17.6	6	2	5
drage	1410	2.0	5	2	5
dugnad	4846	6.9	6	2	6
elg	4394	6.3	3	1	3
etappe	4128	5.9	6	3	5
fengsel	28658	36.5	7	2	6
ferie	29393	42.0	5	3	5
fiende	5092	7.3	6	3	6
flis	1361	1.9	4	1	4
formue	7428	10.6	6	3	6
forslag	101089	144.4	7	2	7
Frakk	624	0.9	5	1	4
frisyre	718	1.0	7	3	7
gaffel	1011	1.4	6	2	5
genser	3216	4.6	6	2	6
gren	1361	1.9	4	1	4
greve	1193	1.7	5	2	5
gris	3705	5.3	4	1	4
gutt	36779	52.5	4	1	3
hale	2630	3.8	4	2	4
handel	17211	24.6	6	2	6
hatt	6952	9.9	4	1	3
haug	12125	17.3	4	1	2
herre	9774	14.0	5	2	4
himmel	10847	15.5	6	2	5
hjelm	3871	5.5	5	1	4
hjerne	3907	5.6	6	2	5
hummer	2102	3.0	6	2	5
høst	40542	57.9	4	1	4
jeger	5540	7.9	5	2	5
jente	51222	73.2	5	2	5
kalkun	962	1.4	6	2	6
kamp	104326	149.0	4	1	4
kanin	3782	5.4	5	2	5
kirurg	1007	1.4	6	2	6
kiste	509	0.7	5	2	5
kjole	5360	7.7	5	2	5
klem	17199	24.6	4	1	4
klynge	447	0.6	6	2	5
kommode	254	0.4	7	3	6
konvolutt	1031	1.5	9	3	8

kunde	16950	24.2	5	2	5
kurv	1190	1.7	4	1	4
kveld	64813	92.6	5	1	4
kvinne	50292	71.8	6	2	5
linjal	411	0.6	6	2	6
mage	7637	10.9	4	2	4
menneske	31480	45.0	8	3	7
mor	56642	80.9	3	1	3
møll	253	0.4	4	1	3
møte	53500	76.4	4	2	4
måned	37917	54.2	5	2	5
navn	121113	173.0	4	1	4
nisse	948	1.4	5	2	4
nøkkel	3110	4.4	6	2	5
omgang	45690	65.3	6	2	5
ord	117990	168.6	3	1	2
paraply	1272	1.8	7	3	7
pensel	778	1.1	6	2	6
perm	1335	1.9	4	1	4
pil	2303	3.3	3	1	3
plakat	1943	2.8	6	2	6
premie	7374	10.5	6	3	6
pølse	2365	3.4	5	2	5
regel	41042	58.6	5	2	5
regjering	31408	44.9	9	3	7
rekke	113324	161.9	5	2	4
retning	37294	53.3	7	2	6
rett	56866	81.2	4	1	3
røver	309	0.4	5	2	5
sak	85084	121.5	3	1	3
selskap	38829	55.5	7	2	7
sikring	4906	7.0	7	2	6
sitron	1949	2.8	6	2	6
skade	26877	38.4	5	2	5
skap	4698	6.7	4	1	4
skatt	31823	45.5	5	1	4
skinke	1601	2.3	6	2	5
skjørt	2521	3.6	6	1	4
skole	89753	128.2	5	2	5
skuff	1166	1.7	5	1	4
skyld	35102	50.1	5	1	4
sprøyte	1467	2.1	7	2	7
sted	139833	199.8	4	1	4
stein	30351	43.4	5	1	5
stol	6217	8.9	4	1	4
svulst	626	0.9	6	1	6
tallerken	1248	1.8	9	3	8
teppe	2715	3.8	5	2	4
tro	46163	65.9	3	1	3
trussel	11522	16.5	7	2	6
tvang	6021	8.6	5	1	4
uke	115424	164.9	3	2	3
ulv	7682	11.0	3	1	3
vask	4297	6.1	4	1	4
vegg	7651	10.9	4	1	3
vekt	63696	91.0	4	1	4
verdi	34896	49.9	5	2	5
veske	2655	3.8	5	2	5
vits	8884	12.7	4	1	4
øl	34797	49.7	2	1	2
ønske	29338	41.9	5	2	5
åker	663	0.9	4	2	4
Mean values	***24835.0***	***35.4***	***5.3***	***1.8***	***4.9***

Appendix G – Full Set of English Target Words

English Noun	SUBTLEX-UK frequency count	Frequency per Million Words	Number of Letters	Number of Syllables	Number of Phonemes
advantage	10324	51.3	9	3	8
air	30027	149.2	3	1	2
animal	37117	184.4	6	3	6
army	10377	51.5	4	2	3
art	22554	112.0	3	1	2
attempt	8540	42.4	7	2	6
attic	2036	10.1	5	2	4
beach	11140	55.3	5	1	3
bed	25860	128.5	3	1	3
bike	9567	47.5	4	1	3
bleach	323	1.6	6	1	4
border	7402	36.8	6	2	4
bottle	12071	60.0	6	2	4
broom	721	3.6	5	1	4
candy	1360	6.8	5	2	5
carrot	2325	11.5	6	2	5
cart	1071	5.3	4	1	3
cave	2488	12.4	4	1	3
chalk	1361	6.8	5	1	3
cheese	12097	60.1	6	1	3
chimney	1591	7.9	7	2	5
coin	2245	11.2	4	1	3
collection	12007	59.6	10	3	8
couch	803	4.0	5	1	3
court	18117	90.0	5	1	3
curtain	2919	14.5	7	2	4
desk	4336	21.5	4	1	4
dice	938	4.7	4	1	3
drought	1526	7.6	7	1	4
election	23321	115.9	8	3	7
equipment	6729	33.4	9	3	9
farm	11066	55.0	4	1	3
farmer	3829	19.0	6	2	4
favour	9971	49.5	6	2	4
floor	21880	108.7	5	1	3
flour	4604	22.9	5	2	4
flower	5689	28.3	6	2	4
forest	7689	38.2	6	2	6
frame	10923	54.3	5	1	4
garden	40787	202.6	6	2	4
glove	1206	6.0	5	1	4
goal	18878	93.8	4	1	3
hook	2686	13.3	4	1	3
hose	695	3.5	4	1	3
ink	1524	7.6	3	1	3
iron	4672	23.2	4	2	3
island	13225	65.7	6	2	5
kitchen	33307	165.5	7	2	5
lane	3128	15.5	4	1	3
lawn	1693	8.4	4	1	3
lawyer	3383	16.8	6	2	4
leaf	3479	17.3	4	1	3
letter	21528	106.9	6	2	4
liar	1795	8.9	4	2	3
library	3544	17.6	7	3	7
memory	7657	38.0	6	3	6
mountain	7299	36.3	8	2	6
napkin	409	2.0	6	2	6
nappy	420	2.1	5	2	4

nest	4918	24.4	4	1	4
nurse	5377	26.7	5	1	3
office	19160	95.2	6	2	4
paint	5920	29.4	5	1	4
paw	713	3.5	3	1	2
pillow	1060	5.3	6	2	4
plane	7722	38.4	5	1	4
poison	1652	8.2	6	2	4
pool	6550	32.5	4	1	3
possession	4637	23.0	10	3	7
puddle	478	2.4	6	2	4
pumpkin	818	4.1	7	2	7
recipe	8896	44.2	6	3	6
relief	5976	29.7	6	2	5
revenge	2022	10.0	7	2	6
rope	3962	19.7	4	1	3
rubbish	10119	50.3	7	2	5
sauce	12221	60.7	5	1	3
scripture	152	0.8	9	2	8
sentence	4365	21.7	8	2	7
shark	2898	14.4	5	1	3
shelf	2107	10.5	5	1	4
shelter	3027	15.0	7	2	5
shield	994	4.9	6	1	4
shovel	681	3.4	6	2	5
sign	12705	63.1	4	1	3
skin	11349	56.4	4	1	4
slice	2225	11.1	5	1	4
smoke	4759	23.6	5	1	4
snake	4091	20.3	5	1	4
south	23670	117.6	5	1	3
spatula	182	0.9	7	3	7
speech	9776	48.6	6	1	4
spell	2508	12.5	5	1	4
spider	2828	14.0	6	2	6
sponge	2558	12.7	6	1	5
spoon	3291	16.3	5	1	4
squid	755	3.8	5	1	5
stage	30295	150.5	5	1	4
star	17572	87.3	4	1	3
stove	849	4.2	5	1	4
street	31989	158.9	6	1	5
suit	6032	30.0	4	1	3
sugar	10645	52.9	5	2	4
teacher	15551	77.3	7	2	4
thimble	198	1.0	7	2	5
throat	2664	13.2	6	1	4
tooth	2280	11.3	5	1	3
towel	2098	10.4	5	2	4
truth	16137	80.2	5	1	4
turtle	1190	5.9	6	2	4
utensil	167	0.8	7	3	7
valley	3342	16.6	6	2	4
vegetable	8007	39.8	9	3	7
vehicle	10207	50.7	7	2	5
veil	554	2.8	4	1	3
vision	7631	37.9	6	2	5
voice	14388	71.5	5	1	3
wedding	17764	88.2	7	2	5
witch	2000	9.9	5	1	3
wood	9327	46.3	4	1	3
Mean Values	***7818.9***	***38.8***	***5.5***	***1.6***	***4.3***

Appendix H – Full Set of Norwegian Test Sentences

WAV	TARGET	FREQ		SENTENCE	TW word pos	TW syll pos	Tot. words	D1	D2	TW
røver_h.wav	røver	0.4	HC	De lekte politi og **røver** ute i gata med de andre hele dagen.	5	8	13	1.34	1.75	0.42
røver_l.wav	røver	0.4	LC	Han ville gjerne være **røver** mens vennen var politi når de lekte.	5	8	12	1.40	1.70	0.57
røver_m.wav	røver	0.4	M	Ville gjerne han være **røver** lekte når var mens de politi vennen.			12	1.34	1.78	0.53
linjal_h.wav	linjal	0.6	HC	Å tegne en rett strek uten **linjal** er ikke lett.	7	9	10	1.83	2.22	0.54
linjal_l.wav	linjal	0.6	LC	Å tegne et helt hus uten **linjal** er ikke lett.	7	9	10	1.92	2.04	0.54
linjal_m.wav	linjal	0.6	M	Helt tegne hus et å uten **linjal** er lett ikke.			10	1.77	2.11	0.52
blyant_h.wav	blyant	1.6	HC	Hun kladdet med **blyant** for å kunne viske ut igjen.	4	5	10	0.76	0.91	0.56
blyant_l.wav	blyant	1.6	LC	Jenta fant fram blyant fra pennalet og skrev i vei.	4	5	10	1.02	1.20	0.33
blyant_m.wav	blyant	1.6	M	Fant jenta fram blyant skrev og fra pennalet vei i.			10	0.93	1.13	0.40
skuff_h.wav	skuff	1.7	HC	Hun trakk ut en **skuff** og tok frem vottene.	5	5	9	0.76	0.89	0.47
skuff_l.wav	skuff	1.7	LC	Bortglemt i en **skuff** fant hun vottene.	4	5	7	0.86	1.02	0.55
skuff_m.wav	skuff	1.7	M	En i bortglemt **skuff** vottene fant hun.			7	0.90	1.05	0.48
tallerken_h.wav	tallerken	1.8	HC	Hun fant frem bestikk og **tallerken** og begynte å legge opp maten.	6	6	12	1.32	1.77	0.65
tallerken_l.wav	tallerken	1.8	LC	Gutten fant frem duk og **tallerken** og begynte å dekke på bordet.	6	6	12	1.37	1.65	0.71
tallerken_m.wav	tallerken	1.8	M	Duk frem fant gutten og **tallerken** å bordet begynte dekke og på.			12	1.39	1.80	0.68
dam_h.wav	dam	2.2	HC	Endene svømte i en **dam** og ble matet med brød av barna.	5	8	12	1.19	1.48	0.40
dam_l.wav	dam	2.2	LC	De tok turen ned til en **dam** for å mate endene.	8	8	11	1.25	1.45	0.33
dam_m.wav	dam	2.2	M	Tok ned til de turen en **dam** for mate å endene.			11	1.44	1.63	0.34
skinke_h.wav	skinke	2.3	HC	Vi kjøpte horn med ost og **skinke** til niste på turen.	7	8	11	1.35	1.67	0.57
skinke_l.wav	skinke	2.3	LC	Vi kjøpte poteter og **skinke** som skulle bli julemat.	5	8	9	1.30	1.63	0.45
skinke_m.wav	skinke	2.3	M	Kjøpte poteter vi og **skinke** bli som skulle julemat.			9	1.34	1.60	0.65
skjørt_h.wav	skjørt	3.6	HC	Kleskoden var kjole eller **skjørt** for damer og dress for menn.	5	9	11	1.30	1.49	0.35
skjørt_l.wav	skjørt	3.6	LC	Ofte foretrakk de heller **skjørt** enn kjole på søndager.	5	9	9	1.16	1.39	0.39
skjørt_m.wav	skjørt	3.6	M	Foretrakk ofte de heller **skjørt** søndager på kjole enn.			9	1.29	1.55	0.38
veske_h.wav	hale	3.8	HC	Å logre uten **hale** er vanskelig for hunder.	4	6	8	0.72	1.10	0.47
veske_l.wav	hale	3.8	LC	Å leve uten **hale** går fint for en hund.	4	6	9	0.81	1.04	0.44

veske_m.wav	hale	3.8	M	Leve å uten **hale** hund for går en fint.			9	1.24	1.50	0.35
veske_h.wav	veske	3.8	HC	Som håndbagasje kan du ha en **veske** med inn på flyet.	7	10	11	1.57	1.71	0.38
veske_l.wav	veske	3.8	LC	Hun reiste seg og tok med seg en **veske** med lommebok og mobil.	9	10	13	1.68	1.83	0.49
veske_m.wav	veske	3.8	M	Reiste med hun seg tok seg og en **veske** mobil med lommebok og.			13	1.97	2.16	0.47
etappe_h.wav	etappe	5.9	HC	På stafetten vant de siste **etappe** og sikret gullet.	6	9	9	1.53	1.92	0.52
etappe_l.wav	etappe	5.9	LC	Han skulle av sted på neste **etappe** og gjorde seg klar.	7	9	11	1.38	1.70	0.52
etappe_l.wav	etappe	5.9	M	Sted skulle på han av neste **etappe** seg gjorde og klar.			11	1.62	1.78	0.49
formue_h.wav	formue	10.6	HC	Min tante etterlot seg en stor **formue** som vi arvet.	7	10	10	1.60	1.82	0.54
formue_l.wav	formue	10.6	LC	Jeg fikk vite at det lå en stor **formue** og ventet på meg der.	9	10	14	1.67	1.82	0.55
formue_m.wav	formue	10.6	M	Lå en fikk det at jeg vite stor **formue** meg og på ventet der.			14	1.84	2.12	0.49
herre_h.wav	herre	14.0	HC	Mannen var en eldre **herre** med hatt som kjørte forsiktig.	5	7	10	1.08	1.61	0.38
herre_l.wav	herre	14.0	LC	Varene fantes for **herre** og dame i forskjellige størrelser.	4	7	9	1.00	1.24	0.34
herre_m.wav	herre	14.0	M	Fantes varene for **herre** forskjellige dame i og størrelser.			9	1.26	1.43	0.38
trussel_h.wav	trussel	16.5	HC	Terroristene var en stor **trussel** for rikets sikkerhet.	5	9	8	1.25	1.40	0.41
trussel_l.wav	trussel	16.5	LC	Hun oppfattet det som en rar **trussel** og ikke en reell fare.	7	9	12	1.47	1.62	0.41
trussel_m.wav	trussel	16.5	M	En som det hun oppfattet rar **trussel** ikke fare og reell en.			12	1.51	1.68	0.34
himmel_h.wav	himmel	15.5	HC	Utenfor var det sol, blå **himmel** og fantastisk natur.	6	8	9	1.40	1.64	0.43
himmel_l.wav	himmel	15.5	LC	Det finnes en nydelig **himmel** over jorda.	5	8	7	1.09	1.19	0.44
himmel_m.wav	himmel	15.5	M	Finnes en det nydelig **himmel** jorda over.			7	1.28	1.47	0.42
haug_h.wav	haug	17.3	HC	Hun rakte lauvet til en stor **haug** på plenen.	7	9	9	1.70	2.10	0.23
haug_l.wav	haug	17.3	LC	Jenta så plutselig en stor **haug** på plenen.	6	9	8	1.36	1.76	0.30
haug_m.wav	haug	17.3	M	en så jenta plutselig stor **haug** plenen på.			8	1.72	2.06	0.26
pølse_h.wav	pølse	31.7	HC	Vi tente bål og grillet ei **pølse** mens vi så på skiløperne som kom forbi.	7	9	15	1.36	1.60	0.44
pølse_l.wav	pølse	31.7	LC	Vi pratet litt og fant frem ei **pølse** mens vi så på skiløperne som kom forbi.	7	9	16	1.33	1.48	0.41
pølse_m.wav	pølse	31.7	M	Og litt vi fant frem pratet ei **pølse** kom så mens forbi på som skiløperne vi.			16	1.46	1.67	0.44
regjering_h.wav	regjering	44.9	HC	Høyre dannet **regjering** sammen med Fremskrittspartiet.	3	5	6	0.68	0.94	0.53
regjering_l.wav	regjering	44.9	LC	Men uansett **regjering** blir resultatet ganske likt for miljøet.	3	5	9	0.65	1.09	0.42
regjering_m.wav	regjering	44.9	M	Uansett men **regjering** likt miljøet ganske resultatet for blir.			9	0.78	1.12	0.52
skatt_h.wav	skatt	45.5	HC	Piraten lette etter en **skatt** som var skjult på øya.	5	9	10	1.03	1.16	0.36
skatt_l.wav	skatt	45.5	LC	Det viste seg å være en **skatt** som var skjult i hagen.	7	9	12	1.07	1.34	0.35

skatt_m.wav	skatt	45.5	M	Å være det seg viste en **skatt** var hagen som skjult i.			12	1.03	1.31	0.28
beskjed_h.wav	beskjed	48.9	HC	Legen hadde ringt og lagt igjen **beskjed** på telefonsvareren til pasienten.	7	10	11	1.45	1.97	0.29
beskjed_l.wav	beskjed	48.9	LC	Mannen hadde vært og gitt en **beskjed** til sekretæren på kontoret.	7	10	11	1.23	1.76	0.32
beskjed_m.wav	beskjed	48.9	M	Hadde og mannen gitt vært en **beskjed** på sekretæren kontoret til.			11	1.35	1.68	0.29
skyld_h.wav	skyld	50.1	HC	Kevin angret og følte **skyld** for det som hadde skjedd.	5	8	10	1.25	1.75	0.30
skyld_l.wav	skyld	50.1	LC	De endte med å dele **skyld** for det som hadde skjedd.	6	8	11	0.97	1.39	0.33
skyld_m.wav	skyld	50.1	M	Å de med endte dele **skyld** skjedd for det hadde som.			11	1.04	1.29	0.27
alder_h.wav	alder	63.7	HC	Ved femten års **alder** er det vanlig å konfirmeres.	4	5	9	0.75	1.01	0.32
alder_l.wav	alder	63.7	LC	Dette er en **alder** der det er vanlig å konfirmeres.	5	5	10	0.59	1.09	0.36
alder_m.wav	alder	63.7	M	Er dette en **alder** er konfirmeres vanlig det der å.			10	0.55	1.08	0.35
kvinne_h.wav	kvinne	71.8	HC	Brundtland var landets første **kvinne** til å bli statsminister.	5	8	9	1.30	1.70	0.42
kvinne_l.wav	kvinne	71.8	LC	Siri var aller første **kvinne** til å bestige det høye fjellet.	5	8	11	1.30	1.47	0.42
kvinne_m.wav	kvinne	71.8	M	Aller var Siri første **kvinne** høye å det bestige til fjellet.			11	1.15	1.36	0.42
møte_h.wav	møte	76.4	HC	Politikerne satt i **møte** og ble avbrutt av telefonen.	4	8	9	0.82	1.29	0.46
møte_l.wav	møte	76.4	LC	Kameratene var i **møte** på jobben da det skjedde.	4	8	9	0.93	1.31	0.49
møte_m.wav	møte	76.4	M	Var kameratene i **møte** da det jobben skjedde på.			9	0.83	1.16	0.37
rett_h.wav	rett	81.2	HC	Kokken tilberedte en helt ny **rett** til konkurransen.	6	10	8	1.53	1.99	0.22
rett_l.wav	rett	81.2	LC	Teamet hans utviklet en helt ny **rett** til konkurransen.	7	10	9	1.89	2.19	0.22
rett_m.wav	rett	81.2	M	En utviklet teamet helt hans ny **rett** konkurransen til.			9	1.82	2.06	0.21
kveld_h.wav	kveld	92.6	HC	Jenta la seg trist hver **kveld** i fjorten dager på rad.	6	7	11	1.24	1.52	0.23
kveld_l.wav	kveld	92.6	LC	Guttene fant en klar **kveld** i august til å sove under åpen himmel.	5	7	13	1.13	1.38	0.28
kveld_m.wav	kveld	92.6	M	En fant gutten klar **kveld** å til himmel i åpen under sove august.			13	1.15	1.41	0.30
brann_h.wav	brann	112.5	HC	De så flammer fra en stor **brann** i kjøpesenteret.	7	8	9	1.55	1.73	0.34
brann_l.wav	brann	112.5	LC	Pål fikk øye på en stor **brann** rett i nærheten.	7	8	10	1.31	1.38	0.31
brann_m.wav	brann	112.5	M	En øye fikk på Pål stor **brann** i rett nærheten.			10	1.55	1.73	0.28
skole_h.wav	skole	128.2	HC	Elevene gikk på en **skole** som lå like i nærheten.	5	8	10	0.71	0.90	0.45
skole_l.wav	skole	128.2	LC	De hadde oppdaget en **skole** ikke langt unna huset.	5	8	9	0.76	0.88	0.45
skole_m.wav	skole	128.2	M	Hadde oppdaget de en **skole** langt ikke huset unna.			9	0.93	1.03	0.39
bilde_h.wav	bilde	143.5	HC	Jeg fant frem kamera og tok et **bilde** av den fine utsikten.	8	10	12	1.50	1.73	0.26
bilde_l.wav	bilde	143.5	LC	Jeg lette videre og fant et **bilde** av den fine utsikten.	8	10	11	1.31	1.37	0.34

bilde_m.wav	bilde	143.5	M	Videre og lette jeg fant et **bilde** utsikten av fine den.			11	1.34	1.42	0.28
arbeid_h.wav	arbeid	180.5	HC	Elektrikerne gjorde et godt **arbeid** og firmaet gikk så det suste.	7	10	11	1.40	1.61	0.39
arbeid_l.wav	arbeid	180.5	LC	Det er bedre å gjøre et godt **arbeid** helt fra starten av prosjektet.	8	10	13	1.07	1.23	0.37
arbeid_m.wav	arbeid	180.5	M	Å er bedre det et gjøre godt **arbeid** starten helt prosjektet av fra.			13	1.61	1.77	0.35
klynge_h.wav	klynge	0.6	HC	Alle jentene stod samlet i en stor **klynge** midt i skolegården.	8	12	11	1.57	1.77	0.34
klynge_l.wav	klynge	0.6	LC	Simon kjørte langs veien og så en stor **klynge** med hus midt på jordet.	9	12	14	1.98	2.05	0.38
klynge_m.wav	klynge	0.6	M	Så kjørte og veien en langs Simon stor **klynge** på med jordet midt hus.			14	1.90	1.97	0.32
svulst_h.wav	svulst	0.9	HC	Kreftlegene undersøkte ham og fant en stor **svulst** i tarmen.	8	14	10	2.10	2.19	0.46
svulst_l.wav	svulst	0.9	LC	De undersøkte ham nærmere og fant en stor **svulst** i tarmen.	9	14	11	1.92	2.05	0.43
svulst_m.wav	svulst	0.9	M	Ham en fant nærmere og undersøkte de stor **svulst** tarmen i.			11	2.01	2.07	0.41
pensel_h.wav	pensel	1.1	HC	Han likte å male landskap med tynn **pensel** på lerret, og satte seg ved vinduet.	8	12	15	1.75	1.84	0.44
pensel_l.wav	pensel	1.1	LC	Det tok altfor mye tid å bruke tynn **pensel** til å male med, så han fant en tykkere.	9	12	18	1.70	1.87	0.40
pensel_m.wav	pensel	1.1	M	Mye tok bruke å altfor tid de tynn **pensel** så han tykkere med, til fant male å en.			18	1.79	1.97	0.45
nisse_h.wav	nisse	1.4	HC	I jula pleier de å sette ut grøt til en **nisse** som de tror bor på låven.	11	14	17	1.65	1.77	0.31
nisse_l.wav	nisse	1.4	LC	Barna ble vettskremte da det plutselig kom en **nisse** inn i stua.	9	14	12	1.90	2.00	0.30
nisse_m.wav	nisse	1.4	M	Plutselig ble vettskremte barna kom da det en **nisse** stua inn i.			12	1.90	2.02	0.30
gren_h.wav	gren	1.9	HC	Hun så noen fine kongler som hang på en **gren** ute i skogen.	10	13	13	2.10	3.10	0.34
gren_l.wav	gren	1.9	LC	På den daglige joggeturen så hun en **gren** med fine kongler ute i skogen.	8	13	14	1.57	2.24	0.40
gren_m.wav	gren	1.9	M	Daglige så hun den joggeturen på en **gren** skogen i ute fine med kongler.			14	1.89	2.32	0.25
konvolutt_h.wav	konvolutt	1.5	HC	Hun signerte brevet og fant frem frimerke og **konvolutt** for å skrive på adressen.	8	14	14	2.08	2.23	0.53
konvolutt_l.wav	konvolutt	1.5	LC	Hun lette nederst i skuffen og fant frem penn og **konvolutt** og begynte å skrive brevet.	10	14	16	2.12	2.31	0.44
konvolutt_m.wav	konvolutt	1.5	M	Og skuffen fant hun i penn nederst frem lette og **konvolutt** skrive begynte brevet og å.			16	2.50	2.52	0.40
paraply_h.wav	paraply	1.8	HC	Hun ville ikke bli våt og tok med seg en **paraply** da hun gikk ut.	11	13	15	1.60	2.21	0.48
paraply_l.wav	paraply	1.8	LC	Hun lette gjennom veska og fant til slutt en **paraply** helt på bunnen.	10	13	13	1.68	2.01	0.47
paraply_m.wav	paraply	1.8	M	Til gjennom lette slutt hun og veska fant en **paraply** bunnen helt på.			13	1.85	1.94	0.45
bekk_h.wav	bekk	2.0	HC	De hørte sildringen fra vannet som rant i en **bekk** ved siden av stien.	10	14	14	2.00	2.66	0.25
bekk_l.wav	bekk	2.0	LC	De gikk tur på søndag formiddag og hørte en **bekk** med vann som sildret.	10	14	14	2.04	2.65	0.25
bekk_m.wav	bekk	2.0	M	Tur gikk på de formiddag og hørte søndag en **bekk** med sildret som vann.			14	2.03	2.50	0.26
sitron_h.wav	sitron	2.8	HC	Kremen på kaken hadde en syrlig smak av **sitron** og smakte deilig.	9	13	12	1.94	2.22	0.48
sitron_l.wav	sitron	2.8	LC	Siri spurte desperat hva de hadde av **sitron** i butikken den dagen.	10	13	12	1.74	2.21	0.41

sitron_m.wav	sitron	2.8	M	Desperat hva Siri spurte hadde de av **sitron** i dagen butikken den.			12	1.75	2.30	0.41
pil_h.wav	pil	3.3	HC	Han strammet buen godt, siktet og skjøt en **pil** mot blinken.	9	12	11	1.96	2.65	0.20
pil_l.wav	pil	3.3	LC	Han rettet seg opp, pustet og sendte en **pil** mot blinken.	9	12	11	1.77	2.48	0.30
pil_m.wav	pil	3.3	M	Og rettet opp, sendte han pustet seg en **pil** blinken mot.			11	1.97	2.36	0.34
bamse_h.wav	bamse	3.5	HC	Far ligner på en bjørn og mor kaller han sin store **bamse** som alltid passer på.	12	15	16	2.33	2.77	0.46
bamse_l.wav	bamse	3.5	LC	Mor sier hun ser noe som ligner hennes store **bamse**, og det er far.	10	15	14	2.11	2.45	0.56
bamse_m.wav	bamse	3.5	M	Kun som noe ligner mor hennes sier ser store **bamse**, er det og far.			14	2.30	2.88	0.56
teppe_h.wav	teppe	3.8	HC	Gulvet var trist og kaldt, så de kjøpte et **teppe** som kunne friske opp stua.	9	12	15	1.61	2.17	0.42
teppe_l.wav	teppe	3.8	LC	På vei hjem fra bestemor kjøpte de et **teppe** som kunne gjøre det litt lunere i stua.	9	12	17	1.56	1.77	0.48
teppe_m.wav	teppe	3.8	M	Kjøpte bestemor fra på de hjem vei et **teppe** gjøre litt kunne stua det lunere som i.			17	2.19	2.54	0.43
vask_h.wav	vask	6.1	HC	Bilen var skitten og trengte en **vask**, så hun fant frem vannslangen.	7	10	12	1.32	1.65	0.32
vask_l.wav	vask	6.1	LC	Hun så at alt sammen trengte en **vask**, så hun fant frem vannslangen.	8	10	13	1.47	1.73	0.25
vask_m.wav	vask	6.1	M	Hun alt trengte så sammen at en **vask**, frem fant så vannslangen hun.			13	1.56	1.87	0.31
fiende_h.wav	fiende	7.3	HC	Jeg ble virkelig min egen verste **fiende**, sa gutten trist.	7	11	9	1.35	1.56	0.44
fiende_l.wav	fiende	7.3	LC	Gutten sa at Ola var hans beste **fiende** i hele klassen.	8	11	11	1.51	1.70	0.41
fiende_m.wav	fiende	7.3	M	Gutten Ola sa hans var at beste **fiende** klassen i hele.			11	1.83	2.08	0.37
billett_h.wav	billett	8.5	HC	Jeg dro til kinoen for å kjøpe **billett** til kveldens forestilling.	8	11	11	1.35	1.74	0.44
billett_l.wav	billett	8.5	LC	Jeg dro ned til byen for å kjøpe **billett** til kinoforestillingen.	9	11	11	1.31	1.73	0.44
billett_m.wav	billett	8.5	M	Til å byen jeg for ned dro kjøpe **billett** kinoforestillingen til.			11	1.92	2.12	0.39
vegg_h.wav	vegg	10.9	HC	De ville utvide kjøkkenet og slo ut en **vegg** mot stua for å få bedre plass.	9	14	16	1.90	2.19	0.24
vegg_l.wav	vegg	10.9	LC	De pusset opp kjøkkenet og oppdaget at en **vegg** var full av råte.	9	14	13	1.94	**gar**	0.20
vegg_m.wav	vegg	10.9	M	Opp at kjøkkenet de oppdaget og pusset en **vegg** av var full råte.			13	2.16	2.39	0.33
mage_h.wav	mage	10.9	HC	Gutten lurte på om babyen i mammas **mage** kunne le slik som han.	8	13	13	1.60	1.91	0.34
mage_l.wav	mage	10.9	LC	Gutten spurte om moren visste hvordan en **mage** ser ut innvendig.	8	13	11	1.68	1.87	0.36
mage_m.wav	mage	10.9	M	Om visste moren gutten hvordan spurte en **mage** innvendig ut ser.			11	1.87	2.04	0.35
vits_h.wav	vits	12.7	HC	Hun trengte å le litt, så han fortalte en god **vits** for å muntre henne opp.	11	14	16	1.87	2.05	0.32
vits_l.wav	vits	12.7	LC	Vennene satt på toget og ble servert en god **vits** som skulle få dem til å le.	10	14	17	1.87	2.03	0.28
vits_m.wav	vits	12.7	M	På og ble satt en vennene servert toget god **vits** til dem le skulle få å som.			17	2.28	2.49	0.30
ønske_h.wav	ønske	41.9	HC	Til jul skrev hun brev til nissen med ett eneste **ønske**, som var en ny sykkel.	11	14	16	2.00	2.20	0.41
ønske_l.wav	ønske	41.9	LC	Camilla gikk rundt og tenkte på sitt eneste **ønske**, som var å feire jul hjemme.	9	14	15	2.01	2.16	0.44

ønske_m.wav	ønske	41.9	M	Tenkte Camilla på rundt og sitt gikk eneste **ønske**, hjemme feire som jul å var.			15	2.19	2.35	0.42
stein_h.wav	stein	43.4	HC	Han knuste naboens vindu med en **stein**, og dermed ringte de politiet.	7	11	12	1.67	1.83	0.42
stein_l.wav	stein	43.4	LC	Han vandret rundt i byen og fant en **stein** som han kastet på vinduet til naboen.	9	11	16	1.61	1.79	0.34
stein_m.wav	stein	43.4	M	Vandret og i han fant byen rundt en **stein** han på som vinduet kastet naboen til.			16	1.66	1.85	0.30
øl_h.wav	øl	49.7	HC	Det beste Ola visste om sommeren var en kald **øl** i sola	10	15	12	2.09	2.21	0.19
øl_l.wav	øl	49.7	LC	Det beste Ola visste i hele verden var kald **øl** i sola om sommeren.	10	15	14	2.12	2.25	0.18
øl_m.wav	øl	49.7	M	I Ola var verden hele visste det beste kald **øl** sola sommeren om i.			14	2.56	2.67	0.23
selskap_h.wav	selskap	55.5	HC	Kristine fylte år og pyntet til et stort **selskap** hjemme på gården.	9	13	12	1.85	2.07	0.50
selskap_l.wav	selskap	55.5	LC	To rørleggere dro kjapt av sted til et stort **selskap** med vannlekkasje.	10	13	12	2.51	2.59	0.53
selskap_m.wav	selskap	55.5	M	Et rørleggere sted til kjapt av to dro stort **selskap** vannlekkasje med.			12	2.93	3.12	0.35
regel_h.wav	regel	58.6	HC	De spilte Monopol og laget hver sin nye **regel** fordi de ikke kunne de vanlige reglene.	9	14	16	1.86	1.99	0.42
regel_l.wav	regel	58.6	LC	Hele kvelden satt de og laget hver sin nye **regel** fordi de ikke kunne spillet.	10	14	15	1.91	2.01	0.41
regel_m.wav	regel	58.6	M	Hver satt laget kvelden de og sin hele nye **regel** kunne fordi spillet ikke de.			15	2.20	2.31	0.34
tro_h.wav	tro	65.9	HC	De ville tenke positivt, men hadde ingen **tro** på at dette skulle gå godt.	8	14	14	1.66	1.85	0.17
tro_l.wav	tro	65.9	LC	De tre ungdommene prøvde, men hadde ingen **tro** på at dette skulle gå godt.	8	14	14	1.93	2.04	0.20
tro_m.wav	tro	65.9	M	Ungdommene de prøvde, hadde tre men ingen **tro** på gå skulle at dette godt.			14	1.96	2.12	0.23
jente_h.wav	jente	73.2	HC	Guttene sa det var for tøft for henne som var **jente**, så derfor fikk hun ikke være med.	11	14	18	2.00	2.16	0.46
jente_l.wav	jente	73.2	LC	Tante ble veldig overrasket da en som var **jente** prøvde og likevel klarte det.	9	14	14	1.81	1.98	0.39
jente_m.wav	jente	73.2	M	Tante da veldig som overrasket ble en var **jente** likevel klarte det prøvde og.			14	2.02	2.14	0.39
mor_h.wav	mor	80.9	HC	Hun hadde endelig fått et barn og var blitt **mor** for første gang.	10	13	13	1.58	1.77	0.21
mor_l.wav	mor	80.9	LC	Tannlegen kjente naboen min som var blitt **mor** for første gang.	8	13	11	1.69	1.88	0.23
mor_m.wav	mor	80.9	M	Min som tannlegen var naboen kjente blitt **mor** gang første for.			11	2.07	2.14	0.32
ansvar_h.wav	ansvar	117.2	HC	Den jobben fører med seg et veldig stort **ansvar** for pasientene.	9	11	11	1.57	1.87	0.41
ansvar_l.wav	ansvar	117.2	LC	De to barna gikk og snakket om hvor stort **ansvar** man får som voksen.	10	11	14	1.64	1.90	0.39
ansvar_m.wav	ansvar	117.2	M	Barna de snakket gikk hvor to og om stort **ansvar** man voksen som får.			14	2.09	2.34	0.64
rekke_h.wav	rekke	161.9	HC	Hun stilte dem opp etter hverandre på **rekke** og rad bortover på plenen.	8	12	13	1.83	1.95	0.24
rekke_l.wav	rekke	161.9	LC	Hun kommenterte at alt sammen stod på **rekke** og rad bortover på plenen.	8	12	13	1.68	1.78	0.24
rekke_m.wav	rekke	161.9	M	Hun stod alt kommenterte at sammen på **rekke** rad på bortover og plenen.			13	2.08	2.19	0.33
uke_h.wav	uke	164.9	HC	På Sørlandet er vinterferien alltid i **uke** åtte hvert år.	7	14	10	1.69	1.87	0.20
uke_l.wav	uke	164.9	LC	Barna synes det er vanskelig å vente til **uke** åtte og vinterferien.	9	14	12	1.54	1.79	0.18

uke_m.wav	uke	164.9	M	Synes vanskelig er vente barna å det til **uke** vinterferien og åtte.			12	2.33	2.55	0.25
sted_h.wav	sted	199.8	HC	Om sommeren vet jeg om et hemmelig **sted** der det vokser jordbær.	8	12	12	1.57	1.78	0.31
sted_l.wav	sted	199.8	LC	Snekkeren oppdaget et merkelig **sted** som var spennende å pusse opp.	5	12	11	1.44	1.73	0.26
sted_m.wav	sted	199.8	M	Et oppdaget snekkeren merkelig **sted** spennende pusse å var opp som.			11	1.51	1.97	0.24
kiste_h.wav	kiste	0.7	HC	Etter begravelsen måtte den avdøde bæres i ei **kiste** ut til gravstedet.	9	17	12	2.18	2.31	0.44
kiste_l.wav	kiste	0.7	LC	Etter at det hadde gått enda en stund, tok de med seg ei **kiste** for å legge ham i.	14	17	19	2.12	2.30	0.42
kiste_m.wav	kiste	0.7	M	Gått at de med det hadde en stund, enda seg tok etter ei **kiste** i legge ham å for.			19	2.73	2.96	0.50
frakk_h.wav	frakk	0.9	HC	Legen hadde nettopp kommet på jobb og gikk for å ta på seg ren **frakk** før skiftet.	15	19	17	2.90	3.35	0.39
frakk_l.wav	frakk	0.9	LC	Mannen hadde nettopp kommet på jobb og gikk for å finne frem en **frakk** før skiftet.	15	19	16	2.61	2.77	0.31
frakk_m.wav	frakk	0.9	M	Jobb finne frem gikk for mannen og å hadde på kommet nettopp en **frakk** skiftet før.			16	3.27	3.46	0.26
kirurg_h.wav	kirurg	1.4	HC	Legen som skulle utføre operasjonen, jobbet som **kirurg** på et samarbeidende sykehus.	7	16	12	2.22	2.85	0.34
kirurg_l.wav	kirurg	1.4	LC	Den som var hovedansvarlig for arbeidet, jobbet som **kirurg** på et samarbeidende sykehus.	8	16	13	2.25	2.41	0.38
kirurg_m.wav	kirurg	1.4	M	Var hovedansvarlig som den arbeidet, for jobbet som **kirurg** et sykehus på samarbeidende.			13	2.48	2.65	0.42
gaffel_h.wav	gaffel	1.4	HC	Hun hadde bare fått kniv og spurte kelneren om å finne en **gaffel** til henne.	13	19	15	2.59	2.73	0.87
gaffel_l.wav	gaffel	1.4	LC	De lette etter noe lurt til vaktmesteren og fant til slutt en **gaffel** i sølv.	14	19	15	2.49	2.63	0.31
gaffel_m.wav	gaffel	1.4	M	Fant og etter lurt vaktmesteren lette noe de til til slutt en **gaffel** sølv i.			15	3.15	3.29	0.25
greve_h.wav	greve	1.7	HC	Han hadde kjøpt seg et ordentlig herskapshus og levde som en **greve** mens han nøt livet.	12	17	16	2.48	2.59	0.35
greve_l.wav	greve	1.7	LC	En dag i sommerferien oppdaget vi at det var en **greve** på besøk i slottet.	11	17	15	2.17	2.34	0.37
greve_m.wav	greve	1.7	M	Oppdaget sommerferien vi at var en dag det i en **greve** slottet på i besøk.			15	2.52	2.64	0.36
sprøyte_h.wav	sprøyte	2.1	HC	Helsesøster satte vaksinen i armen til barnet med ei **sprøyte** på helsestasjonen.	10	18	12	2.54	2.78	0.44
sprøyte_l.wav	sprøyte	2.1	LC	Den store mannen ble redd og begynte å gråte da han fikk ei **sprøyte** av sykepleieren.	13	18	16	2.50	2.62	0.50
sprøyte_m.wav	sprøyte	2.1	M	Ble store å den og redd gråte han da mannen fikk begynte ei **sprøyte** sykepleieren av.			16	2.92	3.04	0.40
appelsin_h.wav	appelsin	2.3	HC	Hun tok en pause på skituren og satte seg ned for å skrelle en **appelsin** ved bålet.	15	19	17	2.91	3.02	0.59
appelsin_l.wav	appelsin	2.3	LC	Hun satt på nattbussen hjem og hørte på musikk da hun fant frem en **appelsin** fra veska.	15	19	17	3.27	3.54	0.56
appelsin_m.wav	appelsin	2.3	M	Musikk nattbussen hjem da frem på og hørte på hun fant hun satt en **appelsin** veska fra.			17	3.65	3.79	0.47
plakat_h.wav	plakat	2.8	HC	Under demonstrasjonen sto det «Slipp ham ut!» på en stor **plakat** ved det gamle fengslet.	11	16	15	2.35	2.55	0.51
plakat_l.wav	plakat	2.8	LC	Senere den samme dagen fant en liten gutt en stor **plakat** ved det gamle fengslet.	11	16	15	2.61	2.79	0.53
plakat_m.wav	plakat	2.8	M	Liten samme den fant en dagen en senere gutt stor **plakat** det gamle ved fengslet.			15	3.07	3.33	0.33
nøkkel_h.wav	nøkkel	4.4	HC	Døra var låst da de kom frem til hytta, men de fant en **nøkkel** som passet i boden.	14	16	18	2.40	2.77	0.31

nøkkel_l.wav	nøkkel	4.4	LC	Da Ada kikket rundt seg, oppdaget hun at det stod en **nøkkel** i døra.	12	16	14	2.23	2.65	0.37
nøkkel_m.wav	nøkkel	4.4	M	At stod hun kikket det da seg, oppdaget Ada rundt en **nøkkel** døra i.			14	2.64	2.90	0.35
genser_h.wav	genser	4.6	HC	Selv om hun synes det er kjedelig å strikke armer, ble det til slutt **genser** av det.	15	19	17	2.59	2.75	0.32
genser_l.wav	genser	4.6	LC	Selv om hun synes det er kjedelig med store prosjekter, ble det **genser** til slutt.	13	19	15	2.43	2.55	0.39
genser_m.wav	genser	4.6	M	Hun selv om prosjekter, er synes kjedelig med ble det store det **genser** slutt til.			15	2.96	3.16	0.29
hjelm_h.wav	hjelm	5.5	HC	Gutten fikk ikke lov til å sykle til skolen uten **hjelm** og måtte hjem for å hente den.	11	17	18	2.00	2.10	0.24
hjelm_l.wav	hjelm	5.5	LC	Det ble så travelt at han glemte seg og dro av sted uten **hjelm** og måtte hjem og hente den.	13	17	20	2.62	2.77	0.26
hjelm_m.wav	hjelm	5.5	M	Glemte ble travelt sted dro han at så det og av seg uten **hjelm** hente og måtte og den hjem.			20	3.45	3.69	0.19
hjerne_h.wav	hjerne	5.6	HC	En robot er god å ha, men den har ikke hjerte og **hjerne** slik som oss mennesker	13	16	17	2.01	2.15	0.28
hjerne_l.wav	hjerne	5.6	LC	Noen steder i verden er det vanlig å spise rå **hjerne** fra dyr.	11	16	13	2.28	2.47	0.36
hjerne_m.wav	hjerne	5.6	M	Spise i er vanlig det å verden steder noen rå **hjerne** dyr fra.			13	2.91	2.95	0.32
sikring_h.wav	sikring	7.0	HC	Plutselig gikk strømmen i huset og mannen måtte skifte en **sikring** som var gått.	11	17	14	2.33	2.51	0.48
sikring_l.wav	sikring	7.0	LC	Katrine gikk målrettet bort dit og sjekket om det var en **sikring** som var gått.	12	17	15	2.58	2.74	0.48
sikring_m.wav	sikring	7.0	M	Bort sjekket gikk var målrettet om det dit og Katrine en **sikring** var som gått.			15	2.75	2.93	0.41
kjole_h.wav	kjole	7.7	HC	Hun likte ikke å gå med bukser, så hun kjøpte en **kjole** til hverdagsbruk.	12	16	14	1.82	2.12	0.35
kjole_l.wav	kjole	7.7	LC	Kari tenkte hardt og nøye før hun endelig fant en **kjole** hun kunne ha på.	11	16	15	2.37	2.64	0.39
kjole_m.wav	kjole	7.7	M	Fant og Kari nøye hardt hun før endelig tenkte en **kjole** på hun ha kunne.			15	2.50	2.79	0.41
stol_h.wav	stol	8.9	HC	Middagen var klar, så han gikk til bordet og trakk ut en **stol** for å sette seg sammen med de andre.	13	16	21	2.10	2.47	0.32
stol_l.wav	stol	8.9	LC	Middagen var klar, så han vasket hendene og tok en **stol** fra det andre rommet med seg til bordet.	11	16	19	1.96	2.16	0.36
stol_m.wav	stol	8.9	M	Tok vasket klar, hendene middagen så han var og en **stol** bordet seg til det fra rommet med andre.			19	2.60	2.76	0.31
advarsel_h.wav	advarsel	9.9	HC	Han skulle hatt bot for å kjøre for fort, men slapp med en kraftig **advarsel** denne gangen.	15	18	17	2.65	2.89	0.48
advarsel_l.wav	advarsel	9.9	LC	Det var favorittaktiviteten hans, men han fikk en heftig **advarsel** fra mor om å kjøre saktere.	15	18	16	2.46	2.72	0.50
advarsel_m.wav	advarsel	9.9	M	En han favorittaktiviteten men hans, det fikk var heftig **advarsel** fra å kjøre mor om saktere.			16	3.03	3.22	0.44
premie_h.wav	premie	10.5	HC	Han vant konkurransen og lurte på om han ville få **premie** etterpå.	11	16	12	1.92	2.04	0.40
premie_l.wav	premie	10.5	LC	Alle som kom frem før middagen ble servert, skulle få **premie** etterpå.	11	16	12	2.54	2.71	0.48
premie_m.wav	premie	10.5	M	Servert før ble kom frem middagen skulle som alle få **premie** etterpå.			12	2.49	2.67	0.49

ulv_h.wav	ulv	11.0	HC	Bonden lette etter lammene og så at de var tatt av **ulv** ute på beitet.	12	17	15	1.89	2.12	0.56
ulv_l.wav	ulv	11.0	LC	Karine gikk ut døra og oppdaget at det hadde vært **ulv** og tatt lammene.	11	17	14	2.37	2.51	0.33
ulv_m.wav	ulv	11.0	M	Hadde ut det og gikk oppdaget døra Karine vært at **ulv** og lammene tatt.			14	2.98	3.11	0.32
kunde_h.wav	kunde	24.2	HC	Butikkmedarbeideren var opptatt med å hjelpe en **kunde** med å finne riktig størrelse.	8	16	13	1.93	2.03	0.41
kunde_l.wav	kunde	24.2	LC	Det var en stille og rolig formiddag og ikke en **kunde** i hele butikken.	11	16	14	1.81	2.07	0.30
kunde_m.wav	kunde	24.2	M	Og ikke rolig formiddag en det og stille var en **kunde** butikken i hele.			14	2.15	2.33	0.29
handel_h.wav	handel	24.6	HC	På Black Friday er det mange muligheter for å gjøre en god **handel** i butikkene.	13	19	15	2.55	2.63	0.38
handel_l.wav	handel	24.6	LC	I bunn og grunn er det mange muligheter for å gjøre en god **handel** i butikkene.	14	19	16	2.36	2.53	0.40
handel_m.wav	handel	24.6	M	En er mange og å muligheter bunn i det gjøre grunn for god **handel** butikkene i.			16	2.84	2.99	0.34
klem_h.wav	klem	24.6	HC	Kari var trist så han gikk bort for å gi henne en god **klem**, men hun vridde seg unna.	14	16	19	2.26	2.88	0.37
klem_l.wav	klem	24.6	LC	Dette var slett ikke dagen for å komme med en god **klem**, og derfor gikk hun sin vei.	12	16	18	1.92	2.37	0.35
klem_m.wav	klem	24.6	M	Slett med var for dette dagen komme en ikke å god **klem** derfor og vei hun sin gikk.			18	2.36	2.68	0.31
skade_h.wav	skade	38.4	HC	Forsikringsselskapet ringte etter at hun hadde meldt om en **skade** på bilen.	10	18	12	2.47	3.66	0.42
skade_l.wav	skade	38.4	LC	Foreldrene ringte etter at de hadde sett at det var en **skade** på bilen.	12	18	14	2.13	2.37	0.46
skade_m.wav	skade	38.4	M	Ringte de var sett det foreldrene hadde etter at at en **skade** bilen på.			14	2.35	2.57	0.38
bolig_h.wav	bolig	40.0	HC	De ville bo nærmere skolen og lette etter en ny **bolig** i nærheten.	11	17	13	1.99	2.20	0.42
bolig_l.wav	bolig	40.0	LC	De lette rundt på nettet for å prøve å finne en ny **bolig** i nærheten.	13	17	15	2.24	2.46	0.45
bolig_m.wav	bolig	40.0	M	Å rundt en finne å lette prøve for nettet de på ny **bolig** nærheten i.			15	2.28	2.56	0.36
menneske_h.wav	menneske	45.0	HC	Det var helt tomt i alle gatene og ikke et eneste **menneske** å se ute den dagen.	12	18	17	2.04	2.27	0.40
menneske_l.wav	menneske	45.0	LC	På den deilige turen opp på fjellet var det fint å se et **menneske** igjen.	14	18	15	2.15	2.39	0.42
menneske_m.wav	menneske	45.0	M	Se på å fint den fjellet opp på turen var det deilige et **menneske** igjen.			15	2.89	3.21	0.37
gutt_h.wav	gutt	52.5	HC	De hadde fire jenter fra før og ønsket seg veldig en **gutt** denne gangen.	12	17	14	2.27	2.53	0.26
gutt_l.wav	gutt	52.5	LC	De hadde ventet lenge på dette og håpte det ble en **gutt** denne gangen.	12	17	14	2.10	2.23	0.32
gutt_m.wav	gutt	52.5	M	Håpte ble lenge på ventet hadde de dette det og en **gutt** gangen denne.			14	2.58	2.73	0.33
måned_h.wav	måned	54.2	HC	Det var begynnelsen av mars og påsken begynte om en knapp **måned** allerede.	12	18	13	2.20	2.36	0.41
måned_l.wav	måned	54.2	LC	Paret diskuterte stadig at de virkelig trengte en slapp **måned** fordi de var slitne.	10	18	14	2.49	2.60	0.38
måned_m.wav	måned	54.2	M	Stadig at diskuterte trengte de virkelig en paret slapp **måned** var fordi de slitne.			14	2.74	2.87	0.36
omgang_h.wav	omgang	65.3	HC	De kjempet godt og ledet fotballkampen etter første **omgang,** så vidt det var.	9	16	13	2.28	2.46	0.38
omgang_l.wav	omgang	65.3	LC	Han skyndte seg alt han kunne og rakk akkurat første **omgang**, så vidt det var.	11	16	15	2.16	2.35	0.39
omgang_m.wav	omgang	65.3	M	Alt rakk akkurat han han seg skyndte kunne og første **omgang**, var vidt det så.			15	2.48	2.66	0.36

sak_h.wav	sak	121.5	HC	Politikerne i kommunestyret hadde en vanskelig **sak** til behandling.	7	18	9	2.01	2.13	0.29
sak_l.wav	sak	121.5	LC	Line var klar over at dette ville bli en motbydelig **sak** å behandle.	11	18	13	2.12	2.14	0.32
sak_m.wav	sak	121.5	M	Over at bli en ville var dette Line klar motbydelig **sak** behandle å.			13	2.60	2.74	0.26
behov_h.wav	behov	144.5	HC	Gutten var utagerende i klassen og det var stort **behov** for ekstra ressurser.	10	16	13	2.22	2.50	0.21
behov_l.wav	behov	144.5	LC	De gikk en tur rundt vannet og snakket om at det var stort **behov** for opprydding der.	14	16	17	2.64	2.97	0.24
behov_m.wav	behov	144.5	M	Rundt de var at tur snakket gikk om en det vannet og stort **behov** opprydding der for.			17	3.05	3.45	0.24
navn_h.wav	navn	173.0	HC	Foreldrene skulle døpe barnet, men fant ikke på et **navn** og måtte få hjelp av fadderne.	10	17	16	2.28	2.60	0.34
navn_l.wav	navn	173.0	LC	Vi møttes helt tilfeldig, så jeg glemte å spørre om et **navn** jeg kunne henvise til.	12	17	16	2.31	2.66	0.26
navn_m.wav	navn	173.0	M	Spørre tilfeldig, om helt å jeg møttes så glemte vi et **navn** kunne til jeg henvise.			16	2.56	2.81	0.25
kommode_h.wav	kommode	0.4	HC	Huset ble mye ryddigere da de la tingene sine i hver sin skuff i en **kommode** som stod i gangen.	16	24	20	3.36	3.47	0.48
kommode_l.wav	kommode	0.4	LC	Alt ble så mye mer oversiktlig da de endelig gjorde alvor av å få en **kommode** til alle tingene.	16	24	19	3.10	3.49	0.42
kommode_m.wav	kommode	0.4	M	Ble så få endelig å oversiktlig alt alvor mye gjorde mer de da av en kommode tingene alle til.			19	3.54	4.19	0.47
møll_h.wav	møll	0.4	HC	Da hun fant frem vinterkåpa, var den støvete og full av små hull, og det fløy **møll** ut av lomma.	17	22	20	3.37	3.81	0.33
møll_l.wav	møll	0.4	LC	Da hun åpnet opp døra for første gang på lenge, oppdaget hun at det kom **møll** ut fra klærne.	16	22	19	3.07	3.72	0.30
møll_m.wav	møll	0.4	M	Lenge døra det oppdaget at første hun på for opp hun gang da åpnet kom **møll** fra ut klærne.			19	3.38	6.61	0.26
åker_h.wav	åker	0.9	HC	Bonden hadde veldig mange gulrøtter og poteter som han plantet i en **åker** på gården sin.	13	23	16	2.84	3.46	0.33
åker_l.wav	åker	0.9	LC	Tor hadde drømmer om vakre damer, aktive ferier og om å eie en **åker** om 10 år.	14	23	17	2.89	3.37	0.33
åker_m.wav	åker	0.9	M	Aktive vakre om Tor eie hadde ferier å og om drømmer damer en **åker** år 10 om.			17	3.73	3.96	0.35
frisyre_h.wav	frisyre	1.0	HC	Før bryllupet brukte hun flere timer på å få satt opp håret i en fin **frisyre** med pynt og blomster.	16	22	20	3.34	4.06	0.56
frisyre_l.wav	frisyre	1.0	LC	Hun gledet seg til å treffe vennene sine igjen og fikk ordnet en fin **frisyre** og nye klær til festen.	15	22	20	3.07	3.25	0.58
frisyre_m.wav	frisyre	1.0	M	Seg hun ordnet sine treffe gledet fikk en igjen til og vennene å fin **frisyre** festen nye og til klær.			20	3.86	4.11	0.45
bunad_h.wav	bunad	1.3	HC	Jenta fant frem nasjonaldrakten på søttende mai, og gledet seg til å gå med **bunad** i toget.	15	23	17	3.34	3.86	0.35
bunad_l.wav	bunad	1.3	LC	Det var tjueførste juni og full sommer, men jenta ville likevel ha med **bunad** til bestemors fest.	14	23	17	3.37	3.86	0.28
bunad_m.wav	bunad	1.3	M	Juni ha var jenta tjueførste sommer, ville likevel full det men og med **bunad** fest til bestemors.			17	3.47	3.58	0.28

kalkun_h.wav	kalkun	1.4	HC	På nyttårsaften liker de alltid å servere vennene en saftig **kalkun** til middag.	9	21	13	3.02	3.30	0.37
kalkun_l.wav	kalkun	1.4	LC	Noen ganger liker Jostein godt å overraske vennene med en god **kalkun** med stuffing.	12	21	14	2.80	3.22	0.41
kalkun_m.wav	kalkun	1.4	M	Godt en å noen Jostein liker vennene overraske ganger med god **kalkun** stuffing med.			14	3.07	3.50	0.37
kurv_h.wav	kurv	1.7	HC	Endelig var jordbærene her, så hun gikk bort til åkeren for å plukke en **kurv** med seg hjem.	15	23	18	3.05	3.53	0.26
kurv_l.wav	kurv	1.7	LC	Endelig var alle tantene her, og mamma dro til byen for å finne en **kurv** med jordbær til dessert.	15	23	19	3.12	3.50	0.25
kurv_m.wav	kurv	1.7	M	Mamma alle byen tantene dro å til finne og her, var endelig for en **kurv** til jordbær dessert med.			19	3.46	3.69	0.26
perm_h.wav	perm	1.9	HC	Hun ryddet i arkene på skrivebordet og fikk endelig satt dem inn i en **perm** som kunne stå i hylla.	15	23	20	2.86	3.04	0.25
perm_l.wav	perm	1.9	LC	Hun lette ganske desperat gjennom hele huset og fant den mystisk nok i en **perm** bak en støvete hylle.	15	23	19	3.45	3.95	0.31
perm_m.wav	perm	1.9	M	Hele gjennom huset lette hun den desperat mystisk og i ganske fant nok en **perm** en bak hylle støvete.			19	3.55	3.77	0.33
flis_h.wav	flis	1.9	HC	Hun fant frem sandpapir og begynte å pusse planken godt så ingen skulle få **flis** i fingeren.	15	23	17	3.16	3.28	0.35
flis_l.wav	flis	1.9	LC	Jentene gjorde et grundig forarbeid for å sørge for at ingen skulle få **flis** i fingeren da de snekret.	14	23	19	3.02	3.09	0.40
flis_m.wav	flis	1.9	M	Forarbeid for et ingen skulle sørge grundig at for jentene gjorde å få **flis** snekret de da fingeren i.			19	3.02	3.08	0.38
drage_h.wav	drage	2.0	HC	En dag det var passe sterk vind, gikk vi ut på et stort jorde for å fly med **drage** sammen med pappa.	19	21	22	3.10	3.16	0.34
drage_l.wav	drage	2.0	LC	Da jeg var barn, likte jeg å dra ut sammen med pappa for å leke med **drage** i vinden.	17	21	19	2.68	2.73	0.35
drage_m.wav	drage	2.0	M	Med da likte ut sammen for barn, å dra jeg var jeg pappa leke å med **drage** vinden i.			19	3.80	3.88	0.32
hummer_h.wav	hummer	3.0	HC	I oktober er det mange på Sørlandet som finner frem teiner for å fange **hummer** til høstens festmåltider.	15	23	18	3.30	3.41	0.39
hummer_l.wav	hummer	3.0	LC	Når familien endelig er samlet til jul, gleder de seg til å finne frem **hummer** fra fryseren og lage et festmåltid.	15	23	21	2.97	3.09	0.32
hummer_m.wav	hummer	3.0	M	Seg jul, samlet familien de til endelig finne gleder er å til når frem **hummer** fra fryseren og festmåltid et lage.			21	3.57	3.67	0.32
gris_h.wav	gris	5.3	HC	Hun hadde begynt å tenke på juleribba og gikk ut for å slakte en **gris** de hadde der.	15	22	18	2.69	2.74	0.36
gris_l.wav	gris	5.3	LC	Barna syntes det var spennende å besøke naboen for å se på en **gris** med små grisunger.	14	22	17	2.65	2.74	0.29
gris_m.wav	gris	5.3	M	Var å for besøke det syntes se naboen på barna å spennende en **gris** små grisunger med.			17	3.33	3.44	0.28
kanin_h.wav	kanin	5.4	HC	Selv om gulrot er sunt for mennesker, er løvetann mye bedre mat for en **kanin** i grunnen.	15	21	17	3.36	3.42	0.39
kanin_l.wav	kanin	5.4	LC	Selv om det høres koselig ut, er det ingen god løsning å kjøpe en **kanin** hvis du ikke har tid til den.	15	21	22	2.71	2.77	0.31

kanin_m.wav	kanin	5.4	M	Kjøpe det er ingen ut, det løsning selv god om høres å koselig en **kanin** du ikke den har til hvis tid.			22	2.85	2.92	0.32
elg_h.wav	elg	6.3	HC	Mange dyr forviller seg ut på veiene i høstmørket, og skrekken er å få en enorm **elg** på panseret.	17	26	19	3.34	3.48	0.29
elg_l.wav	elg	6.3	LC	Det han fryktet på veien hjemover i ferien, var at det plutselig skulle komme en **elg** rett foran bilen.	16	26	19	3.44	3.52	0.29
elg_m.wav	elg	6.3	M	Fryktet ferien, hjemover veien det komme i plutselig var på at han det skulle en **elg** foran bilen rett.			19	3.65	3.70	0.21
skap_h.wav	skap	6.7	HC	Det nye kjøkkenet hadde liten oppbevaringsplass, så de monterte et nytt **skap** på veggen.	12	23	14	3.43	3.73	0.36
skap_l.wav	skap	6.7	LC	De hadde mange planer for det nye huset og startet med å finne et nytt **skap** til kjøkkenet.	16	23	18	3.37	3.52	0.38
skap_m.wav	skap	6.7	M	Planer finne huset å og et nye mange de det for startet hadde med nytt **skap** kjøkkenet til.			18	4.21	4.39	0.34
dugnad_h.wav	dugnad	6.9	HC	Malejobben blir alltid mye gøyere hvis mange venner samles til **dugnad** og får alt gjort i en fei.	11	21	18	2.91	3.05	0.44
dugnad_l.wav	dugnad	6.9	LC	Vi hadde vært altfor lenge borte og samlet sammen mange venner til **dugnad** for å rydde hagen	13	21	17	2.77	2.85	0.50
dugnad_m.wav	dugnad	6.9	M	Borte og lenge vært altfor hadde vi venner sammen samlet mange til **dugnad** hagen å rydde for.			17	2.96	3.02	0.39
jeger_h.wav	jeger	7.9	HC	Jaktsesongen var i gang og de lette etter et rådyr som var skadeskutt av en **jeger** som satt på post.	16	24	20	3.40	3.51	0.37
jeger_l.wav	jeger	7.9	LC	Mannen hadde gått veldig langt og satte seg for å hvile da han plutselig så en **jeger** som kom ut av skogen.	17	24	22	3.24	3.34	0.31
jeger_m.wav	jeger	7.9	M	Å satte mannen han langt hvile så da og veldig hadde seg for gått plutselig en **jeger** skogen av kom som ut.			22	3.67	3.74	0.26
tvang_h.wav	tvang	8.6	HC	Den psykotiske mannen ville ikke legges inn frivillig, så de måtte bruke **tvang** for å få han med seg.	13	24	19	3.33	3.59	0.31
tvang_l.wav	tvang	8.6	LC	Mannen vandret på gaten en kald mandag morgen da noen plutselig måtte bruke **tvang** for å få han vekk fra stedet.	14	24	21	3.41	3.71	0.35
tvang_m.wav	tvang	8.6	M	Vandret gaten måtte da mandag plutselig morgen noen på en mannen kald bruke **tvang** vekk for han fra å få stedet.			21	3.16	3.43	0.31
hatt_h.wav	hatt	9.9	HC	Sola stekte på hodet hans og han skulle ønske han hadde tatt på seg en **hatt** før han gikk ut.	16	22	20	2.90	3.04	1.15
hatt_l.wav	hatt	9.9	LC	Den gamle vaktmesteren gikk aldri utenfor døra uten å sette en **hatt** på hodet.	12	22	14	2.88	3.11	0.21
hatt_m.wav	hatt	9.9	M	Gikk sette uten å døra vaktmesteren utenfor gamle den aldri en **hatt** hodet på.			14	3.25	3.50	0.21
dommer_h.wav	dommer	17.6	HC	Hvis siktede tilstår og samtykker til det, kan straffesaken avgjøres av en **dommer** alene.	13	23	14	3.44	3.63	0.37
dommer_l.wav	dommer	17.6	LC	Selv om alle sammen er enige om det, kan de ikke starte opp uten en **dommer** på banen.	15	23	18	3.06	3.21	0.33
dommer_m.wav	dommer	17.6	M	Alle uten er starte sammen ikke opp det, om enige kan om de selv en **dommer** banen på.			18	3.42	3.85	0.25

ansatt_h.wav	ansatt	34.1	HC	Daglig leder var sykemeldt, men nå hadde Kristina endelig fått en ny **ansatt** som kunne hjelpe henne.	13	22	17	3.07	3.30	0.38
ansatt_l.wav	ansatt	34.1	LC	På fredagen fant de på mye gøy etter at de hadde endelig fått en ansatt som organiserte dette.	15	22	18	3.30	3.58	0.42
ansatt_m.wav	ansatt	34.1	M	På etter gøy mye fått de fant på endelig at de hadde fredagen en **ansatt** dette organiserte som.			18	3.47	3.66	0.39
fengsel_h.wav	fengsel	36.5	HC	Den respektløse og utspekulerte mannen var skyldig og ble dømt til sju år i **fengsel** for noe han ikke hadde gjort.	15	24	21	3.48	3.90	0.39
fengsel_l.wav	fengsel	36.5	LC	Venninnen til Kristine ble litt lei seg da hun endelig forstod at hun skulle i **fengsel** for noe hun ikke hadde gjort.	16	24	22	3.38	3.77	0.44
fengsel_m.wav	fengsel	36.5	M	Skulle endelig ble hun venninnen at til lei forstod hun da Kristine seg litt i **fengsel** hadde noe for gjort hun ikke.			22	3.68	3.84	0.47
ferie_h.wav	ferie	42.0	HC	På grunn av COVID-19 kan man ikke reise til utlandet, så vi må ta årets **ferie** innenlands.	17	24	17	3.38	3.84	0.24
ferie_l.wav	ferie	42.0	LC	Situasjonen gjør at mye er annerledes dette året, så derfor må Siris **ferie** gå innenlands i år.	13	24	17	3.20	3.34	0.29
ferie_m.wav	ferie	42.0	M	Må at gjør året, mye dette annerledes er så derfor situasjonen Siris **ferie** i innenlands gå år.			17	3.59	3.71	0.29
verdi_h.wav	verdi	49.9	HC	Maleriene er nydelige, koster mye, og i snitt har de en **verdi** på en million kroner.	12	22	16	2.48	2.81	0.33
verdi_l.wav	verdi	49.9	LC	Vi diskuterte sakene i mange dager og ble enige om en **verdi** på en million kroner.	12	22	16	2.74	3.27	0.31
verdi_m.wav	verdi	49.9	M	Om i ble sakene dager og enige vi mange diskuterte en **verdi** kroner million en på.			16	2.98	3.16	0.30
retning_h.wav	retning	53.3	HC	Hun var forvirret over hvilken vei hun skulle gå og visste at de var på vei i feil **retning** bortover.	19	25	20	3.07	3.21	0.34
retning_l.wav	retning	53.3	LC	Opplæringen de fikk var veldig mangelfull og verktøyene de brukte viste helt feil **retning** i målingene.	14	25	16	3.78	4.10	0.36
retning_m.wav	retning	53.3	M	De veldig mangelfull verktøyene og helt opplæringen brukte de viste var fikk feil **retning** målingene i.			16	3.80	4.14	0.43
høst_h.wav	høst	57.9	HC	Sommeren var over, bladene skiftet farge og vi kunne endelig si at det var **høst** i bygda.	15	25	17	3.09	3.18	0.29
høst_l.wav	høst	57.9	LC	Skogen var fantastisk vakker, duften var deilig og vi kunne endelig si at det var **høst** i bygda.	16	25	18	3.95	4.08	0.28
høst_m.wav	høst	57.9	M	Si vi endelig var kunne deilig fantastisk det at og var vakker, skogen duften var **høst** bygda i.			18	4.42	4.87	0.34
vekt_h.wav	vekt	91.0	HC	Nå har mamma gått opp så mange kilo at hun ikke lenger kan bruke en vanlig **vekt** slik som jeg gjør.	17	24	21	3.69	3.71	0.24
vekt_l.wav	vekt	91.0	LC	Mamma ville gjerne ha noe annet i julegave i år siden hun fikk en **vekt** i fjor.	15	24	17	2.75	2.99	0.25
vekt_m.wav	vekt	91.0	M	Julegave ha mamma i siden ville noe annet fikk år gjerne i hun en **vekt** fjor i.			17	3.20	3.51	0.22
forslag_h.wav	forslag	144.4	HC	Etter lange diskusjoner kom endelig et av partiene opp med et nytt **forslag** til løsning.	13	23	15	2.88	3.11	0.40
forslag_l.wav	forslag	144.4	LC	Det endte med å gå mange måneder og fremdeles var det ikke kommet noe nytt **forslag** til løsning.	16	23	18	3.06	3.61	0.40

forslag_m.wav	forslag	144.4	M	Mange å kommet og med gå det endte ikke det fremdeles noe måneder var nytt **forslag** løsning til.			18	3.50	3.75	0.40
kamp_h.wav	kamp	149.0	HC	Fotballspillerne skulle til motstandernes arena for å spille søndagens **kamp**, og gikk inn i bussen.	10	23	15	3.86	4.14	0.34
kamp_l.wav	kamp	149.0	LC	De tre vennene skyndte seg for å rekke bussen hjem i tide til søndagens **kamp**, som gikk på TV.	15	23	19	3.13	3.37	0.36
kamp_m.wav	kamp	149.0	M	Bussen tre å tide seg vennene rekke skyndte for til i de hjem søndagens **kamp**, gikk TV som på.			19	3.25	3.50	0.35
ord_h.wav	ord	168.6	HC	Når livet er tungt og trist, er det virkelig godt å få høre noen gode **ord** til trøst.	16	22	18	2.81	3.11	0.21
ord_l.wav	ord	168.6	LC	De gikk innom en bekjent som alltid er så snill, og fikk med seg noen gode **ord** på veien.	17	22	19	2.94	3.18	0.25
ord_m.wav	ord	168.6	M	De alltid er med noen snill, og så fikk som bekjent innom seg en gikk gode **ord** veien på.			19	3.54	3.76	0.25
					10,36	**15,27**	**14,29**	**2.21**	**2.47**	**0.37**

NOTE:
HC = High-constraint, LC = Low-constraint, M = Mixed word order sentences
Changed target word is shown in **bold** font
D1 = measurement from start of file to end of speech
D2 = measurement from voice onset to end of speech
D3 = measurement from target word onset to target word end

Appendix I – Full Set of English Test Sentences

WAV	TARGET	FREQ		SENTENCE	TW word pos	TW syll pos	Tot. words	D1	D2	TW
spatula_h.wav	spatula	0.9	HC	I flipped the pancake with the **spatula** without breaking it.	7	8	10	1.35	1.65	0.62
spatula_l.wav	spatula	0.9	LC	I tried to find the correct **spatula** to flip the pancake without breaking it.	7	8	14	1.42	1.54	0.55
spatula_m.wav	spatula	0.9	M	Tried the find to I correct **spatula** without pancake it to flip the breaking.			14	1.60	1.83	0.59
thimble_h.wav	thimble	1.0	HC	The seamstress placed the silver **thimble** on her finger to avoid injury.	6	8	12	1.65	1.88	0.40
thimble_l.wav	thimble	1.0	LC	The man often placed an old **thimble** on the end of his cane in order to make a loud noise.	7	8	20	1.51	1.91	0.48
thimble_m.wav	thimble	1.0	M	Man often an the placed old **thimble** end a noise of to on his the make loud cane order in.			20	1.46	1.73	0.55
napkin_h.wav	napkin	2.0	HC	The food was messy, so he grabbed a **napkin** from the counter.	8	10	12	1.82	2.06	0.51
napkin_l.wav	napkin	2.0	LC	While walking down the street he dropped a **napkin** on the ground.	9	10	12	1.96	2.10	0.54

napkin_m.wav	napkin	2.0	M	Street while dropped he the down walking a **napkin** ground the on.			12	2.27	2.53	0.57
veil_h.wav	veil	2.8	HC	The bride covered her face with a **veil** made of silk.	8	9	11	1.87	2.49	0.33
veil_l.wav	veil	2.8	LC	The seamstress sewed two sheets and a **veil** made of silk.	8	9	11	2.07	2.66	0.37
veil_m.wav	veil	2.8	M	Sheets the and sewed two seamstress a **veil** of made silk.			11	2.29	2.73	0.41
shovel_h.wav	shovel	3.4	HC	He was digging with a **shovel** in the garden.	6	7	9	0.91	1.04	0.40
shovel_l.wav	shovel	3.4	LC	In the store he bought a **shovel** for the garden.	7	7	10	1.15	1.34	0.39
shovel_m.wav	shovel	3.4	M	He in the bought store a **shovel** garden the for.			10	1.23	1.51	0.38
broom_h.wav	broom	3.6	HC	He swept up the broken glass with the **broom** from the supply closet.	9	10	13	2.04	2.76	0.43
broom_l.wav	broom	3.6	LC	After school, the children used an old **broom** and pretended it was a horse.	8	10	14	2.03	2.49	0.40
broom_m.wav	broom	3.6	M	School an after children the used old **broom** a was and horse pretended it.			14	2.31	2.78	0.43
pumpkin_h.wav	pumpkin	4.1	HC	For Halloween, they carved out a large **pumpkin** at the Farmer's market.	8	10	12	1.93	2.53	0.60
pumpkin_l.wav	pumpkin	4.1	LC	Before the party, they bought a large **pumpkin** at the Farmer's market.	8	10	12	1.81	2.26	0.64
pumpkin_m.wav	pumpkin	4.1	M	Party bought before the a they large **pumpkin** the market Farmers at.			12	2.50	3.23	0.62
stove_h.wav	stove	4.2	HC	The hot pan was bubbling on the **stove** in the kitchen.	8	9	11	1.70	2.25	0.46
stove_l.wav	stove	4.2	LC	Jonathan couldn't turn on the **stove** in the kitchen.	7	9	9	1.56	1.78	0.53
stove_m.wav	stove	4.2	M	Turn couldn't Jonathan on the **stove** kitchen the in.			9	1.63	1.86	0.57
ink_h.wav	ink	7.6	HC	His green pen had just run out of **ink** in the office.	9	9	12	1.92	2.09	0.30
ink_l.wav	ink	7.6	LC	They discovered they'd run out of **ink** in the office.	8	9	10	1.67	1.87	0.37
ink_m.wav	ink	7.6	M	discovered run they out they'd of **ink** the in office.			10	1.73	1.95	0.40
drought_h.wav	drought	7.6	HC	The lake had dried up after the **drought** in California.	8	9	10	1.60	1.68	0.38
drought_l.wav	drought	7.6	LC	The men made a film about the **drought** in California.	8	9	10	1.43	1.66	0.40
drought_m.wav	drought	7.6	M	About a the film men made the **drought** California in.			10	1.84	2.05	0.52
towel_h.wav	towel	10.4	HC	She dried herself off with the **towel** hanging on the rack.	7	8	11	1.55	1.68	0.43
towel_l.wav	towel	10.4	LC	The department store has a **towel** sale through next Thursday.	6	8	10	1.25	1.47	0.43
towel_m.wav	towel	10.4	M	Department has store the a **towel** Thursday next sale through.			10	1.63	1.88	0.45
shelf_h.wav	shelf	10.5	HC	Sarah pulled the book off the **shelf** in the study.	7	8	10	1.40	1.63	0.39
shelf_l.wav	shelf	10.5	LC	Sarah saw the mouse on the **shelf** in the study.	7	8	10	1.37	1.56	0.41
shelf_m.wav	shelf	10.5	M	On saw mouse Sarah the **shelf** study in the .			10	1.22	1.29	0.37
carrot_h.wav	carrot	11.5	HC	The rabbit chewed on a **carrot** that looked wilted.	6	7	9	1.02	1.12	0.51
carrot_l.wav	carrot	11.5	LC	On the shelf she found a **carrot** that looked wilted.	7	7	10	1.03	1.18	0.51

carrot_m.wav	carrot	11.5	M	Shelf found she the on a **carrot** looked that wilted.			10	1.42	1.59	0.57
sponge_h.wav	sponge	12.7	HC	She wiped up the spilt milk with a **sponge** that she found under the sink.	9	9	15	1.76	1.98	0.64
sponge_l.wav	sponge	12.7	LC	Jim went over and bought a new **sponge** at the drugstore in the mall.	8	9	14	1.45	1.59	0.49
sponge_m.wav	sponge	12.7	M	Bought over went and a Jim new **sponge** the the mall at drugstore in.			14	1.78	1.91	0.68
throat_h.wav	throat	13.2	HC	The pill I swallowed is stuck in my **throat** which is uncomfortable.	9	10	12	1.67	1.82	0.43
throat_l.wav	throat	13.2	LC	They can't do anything to fix my **throat** which is uncomfortable.	9	10	11	1.64	1.70	0.56
throat_m.wav	throat	13.2	M	Anything to can't do fix they my **throat** is which uncomfortable.			11	1.90	1.84	0.58
spider_h.wav	spider	14.0	HC	The web had been spun by the large **spider** on our porch.	9	9	12	1.92	2.38	0.57
spider_l.wav	spider	14.0	LC	He was trying to catch the large **spider** on the porch.	8	9	11	1.76	2.21	0.60
spider_m.wav	spider	14.0	M	Trying the he catch was to large **spider** porch the on.			11	1.81	2.16	0.59
curtain_h.wav	curtain	14.5	HC	She pulled back the plastic shower **curtain** and stepped into the tub.	7	9	12	1.80	2.29	0.53
curtain_l.wav	curtain	14.5	LC	Sally sewed a fine hem on the **curtain** for her daughter's bedroom.	8	9	12	1.63	2.00	0.62
curtain_m.wav	curtain	14.5	M	A on sewed Sally hem fine the **curtain** daughters for bedroom her.			12	1.87	2.22	0.57
iron_h.wav	iron	23.2	HC	I smoothed the wrinkles with the new **iron** in the bedroom.	8	10	11	1.89	2.23	0.38
iron_l.wav	iron	23.2	LC	Water was coming out of the new **iron** in the bedroom.	8	10	11	1.56	1.91	0.47
iron_m.wav	iron	23.2	M	Out coming water the was of new **iron** in bedroom the.			11	1.88	2.23	0.49
smoke_h.wav	smoke	23.6	HC	The firefighter saw clouds of grey **smoke** coming out of the burning house.	7	10	13	1.86	2.46	0.56
smoke_l.wav	smoke	23.6	LC	When we got closer, we saw lots of grey **smoke** coming out of the burning house.	10	10	16	1.96	2.43	0.61
smoke_m.wav	smoke	23.6	M	Saw of when lots we closer we got grey **smoke** burning of house out the coming.			16	2.40	2.75	0.59
pool_h.wav	pool	32.5	HC	We went swimming in the **pool** two hours after lunch.	6	7	10	1.03	1.48	0.46
pool_l.wav	pool	32.5	LC	The girls walked into the **pool** to cool down on the hot day.	10	7	13	1.13	1.49	0.48
pool_m.wav	pool	32.5	M	The walked into girls the **pool** down hot the cool day on to.			13	1.25	1.61	0.45
army_h.wav	army	51.5	HC	The soldier decided to leave the **army** after Christmas.	7	10	9	1.55	1.88	0.41
army_l.wav	army	51.5	LC	The students were learning about the **army** after school.	7	10	9	1.67	2.11	0.35
army_m.wav	army	51.5	M	Were the learning about students the **army** school after.			9	1.70	2.18	0.34
frame_h.wav	frame	54.3	HC	She displayed the photo in a nice **frame** made of silver.	8	10	11	1.92	2.34	0.40
frame_l.wav	frame	54.3	LC	When in town she bought a really nice **frame** made of silver.	8	10	12	1.89	2.44	0.45
frame_m.wav	frame	54.3	M	A she when in really bought town nice **frame** silver of made.			12	2.12	2.40	0.54
beach_h.wav	beach	55.3	HC	The resort had a sandy, long **beach** and new tennis courts.	8	9	11	1.71	2.14	0.50
beach_l.wav	beach	55.3	LC	Kim and Susan drove to the long **beach** to have a swim.	8	9	12	1.89	2.28	0.43

beach_m.wav	beach	55.3	M	Drove to Kim the Susan and long **beach** a have swim to.			12	1.90	2.04	0.38
cheese_h.wav	cheese	60.1	HC	Cheddar is the best kind of **cheese** to put on a hot baked potato.	7	8	14	1.43	1.74	0.56
cheese_l.wav	cheese	60.1	LC	Ken usually puts lots of **cheese** on his hamburger as it is cooking on the grill.	6	8	16	1.22	1.97	0.46
cheese_m.wav	cheese	60.1	M	Lots put usually Ken of **cheese** hamburger his as is grill on cooking on it the.			16	1.48	1.96	0.44
truth_h.wav	truth	80.2	HC	No need to lie, John will tell me the **truth** about Sarah.	10	10	12	2.03	2.46	0.41
truth_l.wav	truth	80.2	LC	Jim wondered if he could find out the **truth** about Sarah.	9	10	11	1.68	2.02	0.49
truth_m.wav	truth	80.2	M	find if out wondered he could Jim the **truth** Sarah about.			11	1.89	2.24	0.55
star_h.wav	star	87.3	HC	Next to the moon, a bright **star** lit up the sky.	7	7	11	1.28	1.50	0.48
star_l.wav	star	87.3	LC	The two girls saw the first **star** that lit up the sky.	7	7	12	1.32	1.56	0.57
star_m.wav	star	87.3	M	Two the the saw girls first **star** up sky the that lit.			12	1.68	2.01	0.60
letter_h.wav	letter	106.9	HC	He put a stamp on the **letter** before he mailed it.	7	7	11	1.06	1.53	1.89
letter_l.wav	letter	106.9	LC	Her grandmother dropped the **letter** in the mailbox at the corner.	5	7	11	1.23	1.89	0.50
letter_m.wav	letter	106.9	M	Grandmother her dropped the **letter** the at corner in mailbox the.			11	1.33	1.62	0.53
floor_h.wav	floor	108.7	HC	Before mopping, he had to sweep the **floor** because the boss insisted.	8	10	12	1.70	2.31	0.44
floor_l.wav	floor	108.7	LC	After the party they helped clean the **floor** because the boss insisted.	8	10	12	1.72	2.16	0.46
floor_m.wav	floor	108.7	M	Clean after helped the party they the **floor** boss because insisted the.			12	1.76	2.29	0.53
kitchen_h.wav	kitchen	165.5	HC	The fridge and stove came with the **kitchen** but they had to buy the dishwasher.	8	8	15	1.51	2.35	0.62
kitchen_l.wav	kitchen	165.5	LC	Liz enjoyed working in the **kitchen** evenings and weekends.	6	8	9	1.36	2.63	0.57
kitchen_m.wav	kitchen	165.5	M	In enjoyed working Liz the **kitchen** and weekends evenings.			9	1.46	2.06	0.55
street_h.wav	street	158.9	HC	Always look both ways when crossing a **street** as busy as that one.	8	10	13	1.84	1.92	0.44
street_l.wav	street	158.9	LC	It was not bad advice to choose a **street** as busy as that one.	9	10	14	1.52	1.72	0.37
street_m.wav	street	158.9	M	Advice was not choose it to bad a **street** as that busy one as.			14	1.65	1.74	0.41
scripture_h.wav	scripture	0.8	HC	To read the prophecy, he unrolled an ancient **scripture** from Egypt.	9	13	11	2.43	2.73	0.67
scripture_l.wav	scripture	0.8	LC	A couple of researchers just found a recent **scripture** from Egypt.	9	13	11	2.40	2.75	0.68
scripture_m.wav	scripture	0.8	M	Researchers a found a couple just of recent **scripture** Egypt from.			11	2.45	2.73	0.63
bleach_h.wav	bleach	1.6	HC	To get your linen whiter, you should add a little **bleach** to the water.	11	14	14	2.41	2.50	0.45
bleach_l.wav	bleach	1.6	LC	To prepare the next sample, you should add a little **bleach** to the water.	11	14	14	2.39	2.46	0.42
bleach_m.wav	bleach	1.6	M	The to sample, you prepare add a next should little **bleach** the water to.			14	2.63	3.13	0.45
puddle_h.wav	puddle	2.4	HC	The water from her umbrella collected in a **puddle** on the floor.	9	14	12	2.14	2.36	0.46
puddle_l.wav	puddle	2.4	LC	The fizzy drinks that they didn't finish made a big **puddle** on the floor.	10	14	14	2.43	2.63	0.46

puddle_m.wav	puddle	2.4	M	Finish drinks a they that the didn't made fizzy big **puddle** on floor the.			14	2.76	3.07	0.42
paw_h.wav	paw	3.5	HC	The dog stepped on glass on his walk and was licking his **paw** to clean the cut.	13	14	17	2.84	2.98	0.32
paw_l.wav	paw	3.5	LC	The poor injured animal was trying to clean his **paw** which had a wound.	10	14	14	2.44	2.65	0.42
paw_m.wav	paw	3.5	M	Animal clean to the trying was injured poor his **paw** had wound which a.			14	2.77	2.95	0.45
hose_h.wav	hose	3.5	HC	To water the huge garden, they needed a long **hose** with an attachment.	10	13	13	2.26	2.40	0.38
hose_l.wav	hose	3.5	LC	Over at the loading dock, they needed a strong **hose** with an attachment.	10	13	13	2.19	2.45	0.39
hose_m.wav	hose	3.5	M	Loading the at over a needed dock, they strong **hose** an with attachment.			13	2.67	2.82	0.39
couch_h.wav	couch	4.0	HC	Lauren turned on the TV and laid down on the **couch** in the den.	11	13	14	2.54	2.66	0.53
couch_l.wav	couch	4.0	LC	Before starting to paint the roof we covered the **couch** with a tarp.	10	13	13	2.37	2.43	0.48
couch_m.wav	couch	4.0	M	We paint covered the before to roof starting the **couch** tarp a with.			13	2.63	2.73	0.45
dice_h.wav	dice	4.7	HC	To take her turn at Monopoly, Helen rolled the **dice** and moved the token.	10	14	14	2.32	2.51	0.48
dice_l.wav	dice	4.7	LC	While cleaning out the cluttered closet, Helen found the **dice** and put it in the box.	10	14	16	2.58	2.90	0.45
dice_m.wav	dice	4.7	M	Out the found closet, cleaning while Helen cluttered the **dice** in box it put the and.			16	2.84	3.38	0.45
shield_h.wav	shield	4.9	HC	The warrior blocked the spear thrust with his metal **shield** covered in spikes.	10	13	13	2.73	3.12	0.57
shield_l.wav	shield	4.9	LC	The famous young artist designed the new metal **shield** on the building.	9	13	12	2.48	2.62	0.49
shield_m.wav	shield	4.9	M	Designed the new famous the artist young metal **shield** building the on.			12	2.59	2.70	0.57
cart_h.wav	cart	5.3	HC	At the supermarket, the toddler wanted to push the **cart** near the tall shelves.	9	12	14	2.66	3.49	0.36
cart_l.wav	cart	5.3	LC	At work, the assistant needed to find the **cart** near the tall shelves.	9	12	13	2.30	2.99	0.44
cart_m.wav	cart	5.3	M	needed at find work, to the assistant the **cart** shelves near tall the.			13	2.29	2.81	0.46
pillow_h.wav	pillow	5.3	HC	The little girl was tired and laid her head on the **pillow** and fell asleep.	12	14	15	2.39	2.90	0.46
pillow_l.wav	pillow	5.3	LC	Her wallet was missing, but she found it under her **pillow** in the bedroom.	11	14	14	2.39	2.95	0.46
pillow_m.wav	pillow	5.3	M	But missing, she found it her under wallet was her **pillow** the in bedroom.			14	2.38	2.91	0.47
chalk_h.wav	chalk	6.8	HC	The teacher walked up to the board, grabbed a piece of **chalk** and started writing.	12	13	15	2.62	3.39	0.45
chalk_l.wav	chalk	6.8	LC	While cleaning the garage, the man found a piece of **chalk** hidden in a corner.	11	13	15	2.38	2.54	0.48
chalk_m.wav	chalk	6.8	M	Found a while the piece the garage, man cleaning of **chalk** in corner hidden a.			15	2.79	3.59	0.57
attic_h.wav	attic	10.1	HC	They stored all of the Christmas tree decorations up in the **attic** at home.	12	16	14	3.18	3.79	0.45
attic_l.wav	attic	10.1	LC	The young accountant put all of the old documents in the **attic** at home.	12	16	14	2.84	3.45	0.48
attic_m.wav	attic	10.1	M	All of put old the in young the accountant documents the **attic** home at.			14	3.33	4.12	0.44
slice_h.wav	slice	11.1	HC	The birthday boy didn't want frosting on his **slice** of cake after all.	10	12	13	2.13	2.49	0.45
slice_l.wav	slice	11.1	LC	My husband saw that he could not finish his **slice** of cake after all.	10	12	14	2.05	2.45	0.42

slice_m.wav	slice	11.1	M	My could he finish that saw husband not his **slice** after of all cake.			14	2.45	3.41	0.50
spell_h.wav	spell	12.5	HC	Merlin needed his magic wand to cast the **spell** for some reason.	9	12	12	2.57	3.10	0.45
spell_l.wav	spell	12.5	LC	The princess could not be awakened by the **spell** for some reason.	9	12	12	2.17	2.51	0.41
spell_m.wav	spell	12.5	M	Be the awakened by not could princess the **spell** reason for some.			12	2.32	2.96	0.54
lane_h.wav	lane	15.5	HC	Many highways in Norway only have one **lane** in each direction.	8	12	11	2.27	2.90	0.37
lane_l.wav	lane	15.5	LC	The sixteen runners had to cross more than one **lane** to get to the other side.	10	12	16	2.24	2.77	0.35
lane_m.wav	lane	15.5	M	Cross to sixteen than more had runners the one **lane** to other the to get side.			16	2.52	3.42	0.44
lawyer_h.wav	lawyer	16.8	HC	When the company sued him, he decided to hire a **lawyer** right away.	11	15	13	2.50	2.85	0.46
lawyer_l.wav	lawyer	16.8	LC	After reading the letter, he decided to call a **lawyer** right away.	10	15	12	2.40	2.92	0.53
lawyer_m.wav	lawyer	16.8	M	Call he the reading decided letter, after to a **lawyer** away right.			12	2.87	3.67	0.58
library_h.wav	library	17.6	HC	The book was overdue so Billy returned it to the **library** down the street.	11	15	14	2.57	2.97	0.61
library_l.wav	library	17.6	LC	After finishing up at the store, they went into the **library** down the street.	11	15	14	2.31	2.61	0.63
library_m.wav	library	17.6	M	Went the they after store, into at up finishing the **library** street the down.			14	3.29	3.92	0.56
farmer_h.wav	farmer	19.0	HC	Because he loved to work the land, Jim became a **farmer** in his hometown.	11	13	14	2.45	2.91	0.55
farmer_l.wav	farmer	19.0	LC	When he returned from his travels, Jim became a **farmer** in his hometown.	10	13	13	2.37	2.94	0.58
farmer_m.wav	farmer	19.0	M	From returned Jim became travels, he his when a **farmer** hometown his in.			13	2.77	3.26	0.62
flour_h.wav	flour	22.9	HC	To keep the dough from sticking, she dusted her hands with **flour** from the store.	12	14	15	2.73	3.47	0.50
flour_l.wav	flour	22.9	LC	At the end of the day, all her clothes were covered with **flour** from the store.	13	14	16	2.43	3.03	0.51
flour_m.wav	flour	22.9	M	Her the day, covered all clothes were end of at the with **flour** store the from.			16	2.67	3.08	0.56
nest_h.wav	nest	24.4	HC	Before laying its eggs, the robin had to build a **nest** made of twigs.	11	14	14	2.36	2.97	0.46
nest_l.wav	nest	24.4	LC	While cleaning up outside, Jennifer came across a **nest** made of twigs.	9	14	12	2.61	3.42	0.54
nest_m.wav	nest	24.4	M	Across Jennifer up while outside, came cleaning a **nest** of made twigs.			12	2.71	3.21	0.50
paint_h.wav	paint	29.4	HC	The young artist dipped her brush into a fresh can of **paint** for the mural.	12	14	15	2.69	3.08	0.50
paint_l.wav	paint	29.4	LC	Eric had always wanted to try a new type of **paint** for the mural.	11	14	14	2.43	2.94	0.42
paint_m.wav	paint	29.4	M	Wanted a try to had type new Eric always of **paint** mural the for.			14	2.24	2.48	0.42
suit_h.wav	suit	30.0	HC	To dress up for the wedding, he needed to buy a **suit** that fitted properly.	12	14	15	2.23	2.40	0.46
suit_l.wav	suit	30.0	LC	Simon wanted to look good and needed to buy a **suit** that fitted properly.	11	14	14	2.28	2.58	0.42
suit_m.wav	suit	30.0	M	Good to needed Simon and wanted look to buy a **suit** fitted that properly.			14	2.50	2.76	0.40
border_h.wav	border	36.8	HC	The immigrants left Mexico and tried to cross the **border** into Texas.	10	14	12	2.73	2.84	0.48
border_l.wav	border	36.8	LC	The teenagers were afraid to fail when crossing the **border** into Texas.	10	14	12	2.68	2.83	0.51

border_m.wav	border	36.8	M	Crossing teenagers when afraid the fail to were the **border** Texas into.			12	2.95	3.30	0.49
wood_h.wav	wood	46.3	HC	At the sawmill they slice logs into long planks of wood with smooth edges.	11	13	14	2.85	3.11	0.30
wood_l.wav	wood	46.3	LC	At the old burial site they found weapons made of wood with smooth edges.	11	13	14	2.77	2.94	0.34
wood_m.wav	wood	46.3	M	Site made at burial they the weapons found old of wood smooth with edges.			14	3.13	3.24	0.34
sugar_h.wav	sugar	52.9	HC	The children had many cavities in their teeth because they ate a lot of **sugar** all the time.	15	15	18	3.23	3.43	0.42
sugar_l.wav	sugar	52.9	LC	The hotel didn't have coffee, so instead they asked for **sugar** with their tea.	12	15	14	2.74	2.90	0.36
sugar_m.wav	sugar	52.9	M	Have didn't so they coffee, hotel the asked instead for **sugar** tea their with.			14	3.02	3.22	0.44
farm_h.wav	farm	55.0	HC	Old McDonald had plenty of animals on his **farm** in Pennsylvania	9	14	11	2.36	2.42	0.30
farm_l.wav	farm	55.0	LC	My uncle is installing solar panels on his **farm** in Pennsylvania.	9	14	11	2.51	2.56	0.38
farm_m.wav	farm	55.0	M	Panels solar installing uncle on is my his **farm** Pennsylvania in.			11	2.67	3.07	0.39
sauce_h.wav	sauce	60.7	HC	On the mashed potatoes she poured a delicious **sauce** that tastes great.	9	13	12	2.15	2.22	0.48
sauce_l.wav	sauce	60.7	LC	The restaurant was famous for their delicious **sauce** that tastes great.	8	13	11	2.01	2.15	0.51
sauce_m.wav	sauce	60.7	M	Restaurant their for the famous was delicious **sauce** great tastes that.			11	2.39	2.88	0.47
court_h.wav	court	90.0	HC	Eric sued the taxi driver and took him to **court** on Tuesday.	10	13	12	2.34	2.45	0.38
court_l.wav	court	90.0	LC	Eric picked up his grandfather and brought him to **court** on Tuesday.	10	13	12	2.52	2.65	0.44
court_m.wav	court	90.0	M	Picked grandfather brought his Eric him up and to **court** Tuesday on.			12	2.63	2.73	0.48
election_h.wav	election	115.9	HC	The senator campaigned in order to win the **election** that was weeks away.	9	13	13	2.11	2.45	0.57
election_l.wav	election	115.9	LC	My new roommate needed to learn more about the **election** that was weeks away.	10	13	14	2.42	2.81	0.57
election_m.wav	election	115.9	M	About to needed learn new more my roommate the **election** was away weeks that.			14	2.65	2.81	0.55
south_h.wav	south	117.6	HC	Lines of longitude go from the north to the **south** I think.	10	12	12	2.31	2.40	0.45
south_l.wav	south	117.6	LC	On their long vacation, they traveled to the **south** I think.	9	12	11	2.31	2.38	0.41
south_m.wav	south	117.6	M	To traveled vacation, their they on long the **south** think I.			11	2.64	2.72	0.44
nappy_h.wav	nappy	2.1	HC	The parent sensed a strange smell from the crib and checked the baby's **nappy** for accidents.	14	17	16	3.74	4.38	0.44
nappy_l.wav	nappy	2.1	LC	Before leaving the maternity ward, someone checked the baby's **nappy** for accidents.	10	17	12	3.20	3.42	0.47
nappy_m.wav	nappy	2.1	M	The leaving ward, the maternity someone before checked baby's **nappy** accidents for.			12	3.54	3.89	0.58
turtle_h.wav	turtle	5.9	HC	The beautiful little pond had a few fish and a small green **turtle** swimming near the shore.	13	16	17	3.32	3.69	0.51
turtle_l.wav	turtle	5.9	LC	The town had a beautiful park with a statue of a small **turtle** sitting in a little pond.	14	16	18	2.99	3.78	0.51
turtle_m.wav	turtle	5.9	M	Beautiful a statue park of a town a the had with small turtle a in sitting pond little			18	3.26	3.59	0.45
glove_h.wav	glove	6.0	HC	At the hospital, the doctor took off his sterile rubber **glove** because it was broken.	11	16	15	2.88	3.56	0.44

glove_l.wav	glove	6.0	LC	Just before the feast, grandmother needed to buy one thicker **glove** for the oven.	11	16	14	3.10	3.52	0.47
glove_m.wav	glove	6.0	M	Buy one the feast, to just needed grandmother before thicker **glove** oven the for.			14	3.12	3.67	0.47
candy_h.wav	candy	6.8	HC	On Halloween, children in costumes grabbed several pieces of **candy** with nuts.	10	17	12	3.23	3.85	0.61
candy_l.wav	candy	6.8	LC	The food scientists were trying to develop a new type of **candy** with nuts.	12	17	14	2.90	3.50	0.58
candy_m.wav	candy	6.8	M	Were scientists develop food a the new type to trying of **candy** nuts with.			14	3.29	3.62	0.53
lawn_h.wav	lawn	8.4	HC	The nice old woman next door offered to pay the child to mow the **lawn** in front of her house.	15	17	20	3.52	4.00	0.35
lawn_l.wav	lawn	8.4	LC	He suddenly saw the man he needed to talk to and left the **lawn** to catch up with him.	14	17	19	2.89	3.56	0.44
lawn_m.wav	lawn	8.4	M	He to the saw and he to needed left man talk suddenly the **lawn** him with catch up to.			19	3.34	3.88	0.51
liar_h.wav	liar	8.9	HC	Because Peter never told the truth, everyone knew he was a **liar** with real issues	12	17	15	3.12	3.49	0.45
liar_l.wav	liar	8.9	LC	After Peter got out of prison, everyone knew he was a **liar** with real issues.	12	17	15	2.80	3.36	0.47
liar_m.wav	liar	8.9	M	Out he after of was everyone prison, Peter knew got a **liar** issues real with.			15	3.23	3.63	0.50
coin_h.wav	coin	11.2	HC	We argued about who should go first and agreed to flip a **coin** to decide.	13	16	15	3.01	3.38	0.57
coin_l.wav	coin	11.2	LC	He was carrying so much stuff in his hands that he dropped a **coin** on the ground.	14	16	17	2.96	3.29	0.44
coin_m.wav	coin	11.2	M	Stuff much was so his he hands in that he dropped carrying a **coin** ground the on.			17	3.29	3.56	0.51
tooth_h.wav	tooth	11.3	HC	He made an appointment at the dentist to extract his broken **tooth** that was infected.	12	17	15	3.39	3.89	0.40
tooth_l.wav	tooth	11.3	LC	After some discussion, they decided to remove the broken **tooth** that was infected.	10	17	13	2.96	3.54	0.42
tooth_m.wav	tooth	11.3	M	Some remove the discussion, decided after they to broken **tooth** infected was that.			13	3.16	3.50	0.37
spoon_h.wav	spoon	16.3	HC	After the evening meal, she ate her ice cream with a small metal **spoon** with a long handle.	14	17	18	3.49	3.95	0.47
spoon_l.wav	spoon	16.3	LC	At the flea market in Sacramento he bought a small metal **spoon** with a long handle.	12	17	16	3.21	3.84	0.59
spoon_m.wav	spoon	16.3	M	A Sacramento bought flea he small market at in the metal **spoon** handle long a with.			16	3.32	3.67	0.57
leaf_h.wav	leaf	17.3	HC	He was walking through the autumn forest and saw a falling **leaf** landing on the path.	14	16	16	3.05	3.57	0.40
leaf_l.wav	leaf	17.3	LC	He was walking through the streets one evening and saw a falling **leaf** landing on the path.	13	16	17	3.09	3.79	0.39
leaf_m.wav	leaf	17.3	M	Saw he through the a and walking one was streets evening falling **leaf** the on landing path.			17	3.82	4.23	0.43
snake_h.wav	snake	20.3	HC	A boa constrictor is a very dangerous type of **snake** in the jungle.	10	16	13	2.68	3.19	0.58
snake_l.wav	snake	20.3	LC	My little sister had never in her life seen that type of **snake** in the jungle.	13	16	16	2.88	3.14	0.58
snake_m.wav	snake	20.3	M	Her life seen my that in had sister never type little of **snake** jungle the in.			16	2.53	2.59	0.43
desk_h.wav	desk	21.5	HC	Late at the office, Victor can always be found sitting at his **desk** near the window.	13	17	16	3.12	3.64	0.40
desk_l.wav	desk	21.5	LC	When I came home yesterday, I saw that Victor was fixing his **desk** near the window.	13	17	16	2.99	3.47	0.43

desk_m.wav	desk	21.5	M	That was saw yesterday, I home when I fixing came Victor his **desk** window the near.			16	3.68	4.34	0.44
sentence_h.wav	sentence	21.7	HC	Susan forgot to put a question mark at the end of the **sentence** in the essay.	13	16	16	2.75	2.96	0.62
sentence_l.wav	sentence	21.7	LC	The English teacher was pretty impressed by the length of the **sentence** in the essay.	12	16	15	2.92	3.11	0.63
sentence_m.wav	sentence	21.7	M	The length the by of impressed pretty was teacher English the **sentence** the in essay.			15	3.30	3.59	0.67
possession_h.wav	possession	23.0	HC	This pen that my old grandfather gave me happens to be my most treasured **possession** and it brings back lots of memories.	15	17	22	3.57	3.89	0.69
possession_l.wav	possession	23.0	LC	Sarah could not believe this would end up being her most hated **possession** and it brings back lots of memories.	14	17	20	2.70	3.03	0.64
possession_m.wav	possession	23.0	M	Most would end Sarah up being believe this her could not hated **possession** it lots back and brings of memories.			20	3.12	3.44	0.70
nurse_h.wav	nurse	26.7	HC	My medical records are accessible to the doctor and the **nurse** at the clinic.	11	18	14	3.05	3.25	0.34
nurse_l.wav	nurse	26.7	LC	Afterwards, she had to be interviewed by both the lawyer and the **nurse** at the clinic.	13	18	16	3.22	3.74	0.39
nurse_m.wav	nurse	26.7	M	She both had lawyer and the be by afterwards, interviewed to the **nurse** at clinic the.			16	3.42	3.45	0.29
flower_h.wav	flower	28.3	HC	Pam received a rose, but really preferred any other type of **flower** according to Alan.	12	17	15	3.16	3.41	0.51
flower_l.wav	flower	28.3	LC	Charlotte just finished reading a good book about a rare kind of **flower** according to Alan.	13	17	16	3.13	3.14	0.56
flower_m.wav	flower	28.3	M	Just good book a finished a Charlotte rare kind about reading of flower according to Alan.			16	3.31	3.52	0.59
relief_h.wav	relief	29.7	HC	During her nasty headache, she took some painkillers to get some **relief** like we suggested.	12	17	15	3.40	3.60	0.50
relief_l.wav	relief	29.7	LC	She decided they should take a longer vacation to get some **relief** like we suggested.	12	17	15	3.09	3.36	0.50
relief_m.wav	relief	29.7	M	Take longer they get she to a should vacation decided some **relief** suggested we like.			15	3.45	3.54	0.41
equipment_h.wav	equipment	33.4	HC	Every major hospital always has quite a lot of special **equipment** for medical purposes.	16	17	14	3.03	3.33	0.69
equipment_l.wav	equipment	33.4	LC	Every time they came together for rehearsals, they used special **equipment** to get the effect they wanted.	16	17	17	3.11	3.49	0.74
equipment_m.wav	equipment	33.4	M	Every used came they rehearsals, time they together for special **equipment** effect get the to they wanted.			17	3.36	3.66	0.68
vision_h.wav	vision	37.9	HC	If you keep staring directly at the bright light, you can damage your **vision** for good.	14	18	16	3.70	4.18	0.48
vision_l.wav	vision	37.9	LC	If you avoid seeing a doctor about this, you can damage your **vision** for good.	13	18	15	3.29	3.64	0.46
vision_m.wav	vision	37.9	M	Damage you if doctor seeing this, a about avoid you can your **vision** good for.			15	3.87	4.12	0.39
memory_h.wav	memory	38.0	HC	Ben was great at remembering long numbers because he had a good **memory** since childhood.	13	18	15	3.50	3.84	0.52
memory_l.wav	memory	38.0	LC	Ben was always an excellent employee because he had a good **memory** and worked efficiently.	12	18	15	2.87	3.21	0.59
memory_m.wav	memory	38.0	M	Was had a because excellent he always employee an Ben good **memory** efficiently and worked.			15	3.33	3.56	0.59

plane_h.wav	plane	38.4	HC	The airport was crowded, and the passengers couldn't board the **plane** on the runway.	12	16	14	2.84	3.38	0.41
plane_l.wav	plane	38.4	LC	After a three hour wait, the men could finally see the **plane** on the runway.	11	16	15	2.72	3.09	0.34
plane_m.wav	plane	38.4	M	Hour could three see finally wait, the a men after the **plane** the on runway.			15	2.90	3.45	0.41
vegetable_h.wav	vegetable	39.8	HC	It is a fact that the potato is the most popular **vegetable** in this country.	12	16	15	2.72	3.11	0.58
vegetable_l.wav	vegetable	39.8	LC	He was often reminded that this country's most popular **vegetable** is the potato.	10	16	13	2.94	3.17	0.61
vegetable_m.wav	vegetable	39.8	M	Most he often country's reminded was that this popular **vegetable** the is potato.			13	2.79	3.02	0.62
speech_h.wav	speech	48.6	HC	The politician stood at the podium and gave a long **speech** about slavery.	11	16	13	2.58	3.01	0.42
speech_l.wav	speech	48.6	LC	Harry and his friends were chatting together after the long **speech** about politics.	11	16	13	2.83	3.24	0.47
speech_m.wav	speech	48.6	M	After and his were chatting the friends together Harry long **speech** politics about.			13	2.74	3.04	0.42
rubbish_h.wav	rubbish	50.3	HC	Susana walked over to the bin to throw away all the **rubbish** that had been cluttering up the basement.	12	16	19	2.77	2.94	0.51
rubbish_l.wav	rubbish	50.3	LC	They drove through the street and saw that the empty lot was filled with **rubbish** from the construction work.	15	16	19	3.20	3.65	0.46
rubbish_m.wav	rubbish	50.3	M	Drove the filled lot was street through and empty they the that saw with **rubbish** construction the work from.			19	3.67	4.21	0.43
collection_h.wav	collection	59.6	HC	Rachel bought yet another pair of new shoes to add to her **collection** and had to expand her wardrobe.	13	16	19	2.83	3.24	0.71
collection_l.wav	collection	59.6	LC	Amanda had to expand the bedroom to make room for her **collection** of shoes she had aquired.	12	16	17	2.78	2.92	0.64
collection_m.wav	collection	59.6	M	Bedroom to had room to Amanda expand make for the her **collection** aquired she of had shoes.			17	3.30	3.78	0.65
sign_h.wav	sign	63.1	HC	When exiting the highway, they had trouble reading the small **sign** in the distance.	11	16	14	3.18	3.54	0.51
sign_l.wav	sign	63.1	LC	When driving along the highway, they suddenly saw a small **sign** in the distance.	11	16	14	2.78	3.22	0.50
sign_m.wav	sign	63.1	M	When suddenly along saw highway, the a driving they small sign the in distance.			14	2.96	3.64	0.51
island_h.wav	island	65.7	HC	The sailors saw a single palm tree in the center of the **island** in Bermuda.	13	16	15	3.24	3.43	0.48
island_l.wav	island	65.7	LC	The rescue workers just learned that the captain had died on the **island** in Bermuda.	13	16	15	3.28	3.47	0.50
island_m.wav	island	65.7	M	That died the the just on captain workers had learned rescue the **island** Bermuda in.			15	3.46	3.63	0.48
goal_h.wav	goal	93.8	HC	The football team celebrated after their player scored a **goal** during the game.	10	16	13	2.72	3.31	0.32
goal_l.wav	goal	93.8	LC	All the young children knew that it was important to have a **goal** during the game.	13	16	16	2.83	3.29	0.35
goal_m.wav	goal	93.8	M	Young important was to have knew all the children that it a **goal** the during game.			16	3.00	3.57	0.37
art_h.wav	art	112.0	HC	My sister enjoys poetry, painting, and other forms of **art** from the past.	10	16	13	2.90	3.12	0.41
art_l.wav	art	112.0	LC	They hired the consultant because of her wide knowledge of **art** from the past.	11	16	14	2.85	3.19	0.32
art_m.wav	art	112.0	M	Of her knowledge hired consultant wide they because the of **art** the from past.			14	3.04	3.49	0.36

animal_h.wav	animal	184.4	HC	The little bumblebee bat is officially the world's smallest **animal** and is about the size of a thumb.	10	16	18	2.97	3.33	0.64
animal_l.wav	animal	184.4	LC	All the scientists were asked questions about the world's smallest **animal** which is the bumblebee bat.	11	16	16	3.05	3.37	0.53
animal_m.wav	animal	184.4	M	Were the asked scientists the world's questions about all smallest **animal** is the bat which bumblebee.			16	3.56	4.21	0.46
utensil_h.wav	utensil	0.8	HC	I searched among all the ladles and whisks in the drawer to find a suitable **utensil** for my purpose.	15	21	19	3.84	4.25	0.66
utensil_l.wav	utensil	0.8	LC	I searched through a huge number of drawers to see if I could find a suitable **utensil** for my purpose.	17	21	20	3.39	4.23	0.59
utensil_m.wav	utensil	0.8	M	Through I find drawers a number if could a searched huge I of see to suitable **utensil** my for purpose.			20	4.48	5.38	0.63
squid_h.wav	squid	3.8	HC	The impressive creature they saw was either an octopus or an enormous **squid** with long tentacles.	13	21	16	3.56	4.17	0.39
squid_l.wav	squid	3.8	LC	The museum display had some very impressive pictures of an enormous **squid** with long tentacles.	12	21	15	3.51	3.94	0.36
squid_m.wav	squid	3.8	M	Pictures of museum an impressive some display very the had enormous **squid** long tentacles with.			15	3.79	4.57	0.44
chimney_h.wav	chimney	7.9	HC	Every Christmas Eve, Santa Claus lands on the roof with his sleigh and comes down through the **chimney** of the house.	18	21	21	4.39	5.26	0.42
chimney_l.wav	chimney	7.9	LC	Every spring, we go up to our summer house and clean out the basement and the **chimney** properly.	16	21	18	3.83	4.24	0.41
chimney_m.wav	chimney	7.9	M	House go the our spring, summer clean and we and to basement out every up the **chimney** properly.			18	4.30	5.08	0.44
poison_h.wav	poison	8.2	HC	In the famous play, Romeo and Juliet died after drinking a cup of **poison** in despair.	14	21	16	3.84	4.11	0.54
poison_l.wav	poison	8.2	LC	The naive young woman next door didn't realize that she was served a cup of **poison** last night.	17	21	18	3.35	3.61	0.57
poison_m.wav	poison	8.2	M	Naive didn't cup realize was she a woman served the door young that next of **poison** night last.			18	4.20	4.60	0.68
witch_h.wav	witch	9.9	HC	The kids started to believe that the scary old woman next door was probably a **witch** after all.	16	22	18	4.14	4.55	0.34
witch_l.wav	witch	9.9	LC	She finally decided that she would never write a children's story about a **witch** after all.	14	22	16	4.10	4.41	0.34
witch_m.wav	witch	9.9	M	Write children's would that she about she never a finally decided story a **witch** all after.			16	4.09	4.56	0.29
revenge_h.wav	revenge	10.0	HC	When she suddenly discovered that her husband was unfaithful, she decided to get **revenge** on him as soon as possible.	14	23	20	4.01	4.99	0.49
revenge_l.wav	revenge	10.0	LC	When she finally came home from her long trip to Australia, she decided to get **revenge** on him for being unfaithful.	16	23	21	4.02	4.79	0.49
revenge_m.wav	revenge	10.0	M	From finally decided she Australia, she came when home to to long her trip get **revenge** on being him unfaithful for.			21	4.68	5.68	0.58

cave_h.wav	cave	12.4	HC	The biologists at the local university knew that there were bats living in the **cave** in the woods.	15	24	18	4.00	4.38	0.37
cave_l.wav	cave	12.4	LC	The biologists at the local university knew that there were animals in the **cave** in the woods.	14	24	17	3.59	3.78	0.39
cave_m.wav	cave	12.4	M	In animals were the local biologists knew university that at there the the **cave** the in woods.			17	4.25	4.60	0.49
hook_h.wav	hook	13.3	HC	The fisherman ankered his boat in the middle of the sea and attached the worm to the **hook** with the sharp point.	18	23	22	4.11	4.60	0.40
hook_l.wav	hook	13.3	LC	Young James was crying and feeling upset because he didn't have enough money for the **hook** with the sharp point.	16	23	20	3.97	4.26	0.33
hook_m.wav	hook	13.3	M	Was and because feeling young crying he have enough upset James didn't for money the **hook** point with sharp the.			20	4.54	4.99	0.43
shark_h.wav	shark	14.4	HC	He was swimming in the Atlantic Ocean when he was attacked by a scary **shark** in the ocean.	15	21	18	3.59	3.97	0.48
shark_l.wav	shark	14.4	LC	The men were walking along the path talking when they suddenly saw a scary **shark** in the ocean.	15	21	18	3.60	3.85	0.46
shark_m.wav	shark	14.4	M	Talking the along suddenly path saw the men when a walking were they scary shark ocean in the.			18	4.12	4.45	0.52
shelter_h.wav	shelter	15.0	HC	In the blizzard, the shivering family came across a small cabin where they could find **shelter** from the storm.	16	23	19	4.18	4.85	0.53
shelter_l.wav	shelter	15.0	LC	They kept on walking in the same direction for another hour and managed to find **shelter** the from blizzard.	16	23	19	4.13	4.50	0.54
shelter_m.wav	shelter	15.0	M	Another same direction managed on the kept and in walking hour for to they find **shelter** from blizzard the.			19	4.18	4.62	0.53
valley_h.wav	valley	16.6	HC	The beautiful little village of Willingdon lies right between two hills in a **valley** somewhere in Canada.	14	21	17	4.14	7.71	0.41
valley_l.wav	valley	16.6	LC	The beautiful little girl lives in a house which sits right between two shops in a **valley** somewhere in Colorado.	17	21	20	3.82	4.29	0.41
valley_m.wav	valley	16.6	M	Two shops house in lives right sits a beautiful little which the between in girl a **valley** Colorado in somewhere.			20	4.56	4.98	0.48
rope_h.wav	rope	19.7	HC	When climbing up the mountain, the climbers and guide were attached to each other by a **rope** made of nylon.	17	22	20	4.05	4.71	0.44
rope_l.wav	rope	19.7	LC	To prepare for his adventures, Simon went to the sports equipment store and bought a **rope** made of nylon.	16	22	19	4.18	4.77	0.47
rope_m.wav	rope	19.7	M	Sports his store went prepare bought for to the adventures, to equipment Simon and a **rope** nylon of made.			19	4.62	5.24	0.39
mountain_h.wav	mountain	36.3	HC	The fearless hikers climbed all the way up to the top of the **mountain** in the Alps.	14	21	17	2.77	3.23	0.49
mountain_l.wav	mountain	36.3	LC	All the eager students in my class learnt the fascinating history of the **mountain** in the book.	14	21	17	3.67	4.55	0.50

mountain_m.wav	mountain	36.3	M	History my students the eager in learnt fascinating all class of the the **mountain** the in book.			17	4.06	4.76	0.55
forest_h.wav	forest	38.2	HC	Many fairy tales describe quite frightening stories about how children get lost in the **forest** and need to be rescued by a hero.	15	23	23	4.50	5.30	0.58
forest_l.wav	forest	38.2	LC	The new state senator was elected because she supported a bill to protect the **forest** and endangered species.	15	23	18	3.93	4.71	0.61
forest_m.wav	forest	38.2	M	State a the was senator because protect to bill supported she elected new the **forest** species and endangered.			18	4.42	5.26	0.62
attempt_h.wav	attempt	42.4	HC	We had repeatedly tried to get in contact with Mr Smith and decided to make another **attempt** before giving up.	17	26	20	4.89	5.35	0.55
attempt_l.wav	attempt	42.4	LC	Mr Smith had been away for a long time, so we decided that it was time to make another **attempt** to contact him.	20	26	23	4.40	4.83	0.40
attempt_m.wav	attempt	42.4	M	Mr time it we been away was make Smith decided a for that time, long had so to another **attempt** him to contact.			23	6.10	7.33	0.47
recipe_h.wav	recipe	44.2	HC	When planning the dinner for his girlfriend's birthday, he decided to try out a brand new **receipe** she had found online.	17	23	21	4.58	5.44	0.58
recipe_l.wav	recipe	44.2	LC	When planning an activity for the weekend, he decided to try out a brand new **recipe** he had found online.	16	23	20	4.12	4.62	0.60
recipe_m.wav	recipe	44.2	M	Activity when to try decided planning a new brand an he the weekend, for out **recipe** found he had online			20	4.85	5.57	0.52
bike_h.wav	bike	47.5	HC	It would be better for the environment if more people parked their car and started using a **bike** to get to work.	18	25	22	4.32	5.10	0.40
bike_l.wav	bike	47.5	LC	In order to see the lights on our last holiday abroad we decided to try using a **bike** to get around.	18	25	21	4.27	4.78	0.42
bike_m.wav	bike	47.5	M	Activity when to try decided planning a new brand an he the weekend, for out **bike** get to around.			19	4.82	5.20	0.51
favour_h.wav	favour	49.5	HC	I needed help and went over to the neighbour to ask if she would do me a **favour** that afternoon.	18	21	20	3.35	4.12	0.48
favour_l.wav	favour	49.5	LC	When I got home from work that evening, the neighbour came over and asked about a **favour** I had done for his brother.	17	21	23	3.56	4.08	0.47
favour_m.wav	favour	49.5	M	When I home evening the got from work that came neighbour asked over about and a **favour** had done I for brother his.			23	4.26	4.65	0.54
vehicle_h.wav	vehicle	50.0	HC	The police officer asked the driver whether she was the registered owner of the **vehicle** she was driving.	15	23	18	3.89	4.41	0.50
vehicle_l.wav	vehicle	50.0	LC	The curious neighbour asked the young woman whether she was the lucky owner of the **vehicle** she was driving.	16	23	19	3.64	4.38	0.51
vehicle_m.wav	vehicle	50.0	M	Young curious was neighbour the lucky she whether of owner the woman asked the the **vehicle** driving was she.			19	4.18	5.21	0.53
advantage_h.wav	advantage	51.3	HC	I know your mother has offered to babysit, but I don't want her to think we're taking **advantage** of her.	18	23	20	4.05	4.77	0.62

advantage_l.wav	advantage	51.3	LC	During our holiday we were driving from cost to cost in the United States and the **advantage** of prebooking became so clear.	17	23	22	4.07	4.79	0.55
advantage_m.wav	advantage	51.3	M	Our in holiday United States driving cost were to and cost the during we from the **advantage** clear of prebooking so became.			22	4.82	5.35	0.71
skin_h.wav	skin	56.4	HC	If you forget to put on plenty of sunscreen at the beach, you can damage the **skin** quite badly.	17	21	19	3.87	4.69	0.49
skin_l.wav	skin	56.4	LC	The large factory nearby produces noxious chemicals that can damage the **skin** quite badly.	12	21	14	3.92	4.33	0.46
skin_m.wav	skin	56.4	M	Nearby chemicals damage that noxious the large produces factory can the **skin** badly quite.			14	4.24	5.07	0.47
bottle_h.wav	bottle	60.0	HC	The fascinating fairy tale tells about a genie who is stuck inside a **bottle** and cannot escape.	14	21	17	3.78	4.28	0.35
bottle_l.wav	bottle	60.0	LC	The fascinating story tells about the life of man who lives inside a **bottle** because he is a genie.	15	21	19	3.92	4.37	0.45
bottle_m.wav	bottle	60.0	M	The the story fascinating tells inside of life lives who man about a **bottle** genie he is a because.			19	4.05	4.61	0.46
voice_h.wav	voice	71.5	HC	Only minutes before the show started, the sick opera singer suddenly lost her **voice** and couldn't speak.	14	22	17	4.24	4.50	0.39
voice_l.wav	voice	71.5	LC	Only minutes before leaving for an important meeting, she suddenly lost her **voice** and couldn't speak.	13	22	16	3.88	3.94	0.34
voice_m.wav	voice	71.5	M	Before she an minutes meeting, leaving lost suddenly important only for her **voice** and speak couldn't.			16	4.02	4.12	0.33
teacher_h.wav	teacher	77.3	HC	The graduate student went straight to school where he entered the classroom to ask the **teacher** for help with his assignment.	16	21	21	4.03	4.30	0.46
teacher_l.wav	teacher	77.3	LC	Mary was very confused about what she had just heard and wanted to ask the **teacher** for help after class.	16	21	20	3.85	4.32	0.47
teacher_m.wav	teacher	77.3	M	She wanted what and heard confused Mary was ask just very had about to the **teacher** class after help for.			20	4.14	4.65	0.52
wedding_h.wav	wedding	88.2	HC	The bride was so disappointed in her father that she refused to invite him to the **wedding** for some reason.	17	23	20	4.35	4.52	0.46
wedding_l.wav	wedding	88.2	LC	Her sister's lazy teenage son decided to stay at home and refused to go to the **wedding** for some reason.	17	23	20	3.85	4.32	0.47
wedding_m.wav	wedding	88.2	M	At to decided to stay lazy son refused home sister's to teenage and her go the **wedding** reason some for.			20	5.14	5.49	0.47
office_h.wav	office	95.2	HC	We have been working hard to establish our company abroad and have recently opened a new **office** in London.	17	26	19	4.75	5.23	0.41
office_l.wav	office	95.2	LC	After spending a relaxing weekend at the beach, we went to visit the recently opened new **office** nearby.	17	26	18	5.05	5.81	0.43
office_m.wav	office	95.2	M	Visit after opened at weekend went relaxing to we the beach recently a spending the new **office** nearby.			18	5.38	5.84	0.50

bed_h.wav	bed	128.5	HC	When I arrived at the mountain cabin, I helped my grandmother change the sheets on the **bed** in the guestroom.	17	22	20	4.48	4.61	0.23
bed_l.wav	bed	128.5	LC	When I arrived at the mountain cabin, there was a pile of presents waiting on the **bed** in the guestroom.	17	22	20	3.71	3.85	0.33
bed_m.wav	bed	128.5	M	Waiting was I at when pile of there a mountain presents arrived the on cabin the **bed** guestroom in the.			20	4.92	5.12	0.36
air_h.wav	air	149.2	HC	In some of the world's most polluted cities, it is barely possible to breathe the **air** outside the building.	16	22	19	4.27	4.43	0.28
air_l.wav	air	149.2	LC	The scientists at the university suspected there was something wrong with the **air** outside the building.	18	22	16	3.91	4.13	0.33
air_m.wav	air	149.2	M	Something with scientists at wrong the suspected the there university was the **air** building the outside.			16	4.49	4.75	0.26
stage_h.wav	stage	150.5	HC	The disappointed audience kept shouting "boo!" until the poor actor walked off the **stage** all by himself.	14	22	17	4.96	5.07	0.49
stage_l.wav	stage	150.5	LC	When we stepped inside the building and entered the room, we all saw Jonathan on the **stage** all by himself.	17	22	20	4.20	4.25	0.56
stage_m.wav	stage	150.5	M	the we the all room stepped when on and Jonathan inside building entered saw we the stage himself by all.			20	4.96	5.11	0.52
garden_h.wav	garden	202.6	HC	Several beautiful varieties of colourful tulips were growing in the **garden** in the spring.	11	23	14	3.96	4.19	0.63
garden_l.wav	garden	202.6	LC	She loved to immerse herself in the abundance of beautiful colours all over the **garden** in spring.	15	23	17	4.03	4.21	0.53
garden_m.wav	garden	202.6	M	All to in herself over of she immerse colours beautiful the loved abundance the **garden** spring in.			17	4.50	4.63	0.51
					11,55	**15,32**	**14,90**	**2.87**	**3.28**	**0.49**

NOTE:
HC = High-constraint, LC = Low-constraint, M = Mixed word order sentences
Changed target word is shown in **bold** font
D1 = measurement from start of file to end of speech
D2 = measurement from voice onset to end of speech
D3 = measurement from target word onset to target word end

Appendix J: Norwegian Practice and Filler Items

Practice Items

*Constraint**	*Target Word*	*No-Response Sentences***
HC	forsøk	Prøven var vanskelig, men hun gjorde en **innsats** uansett.
HC	etasje	For å komme til leiligheten måtte hun ta **trappene** opp et stykke fordi heisen var ødelagt.
HC	sykkel	Hun mislikte bilkøen på vei til jobb, så for å bli mer miljøvennlig kjøpte hun en brukt **båt** på finn.no.
HC	mynt	Han lette etter penger i lommeboken og fant bare sedler, men ingen **pollett** til automaten.
HC	jern	Kubeinet var laget av **plast** og var egentlig en leke.
HC	krok	Hun hang opp bildet på en **spiker** på veggen og tok et skritt tilbake.
HC	tann	Tannlegen oppdaget et hull i **tunga** og sendte ham til legen.
HC	spreder	På grunn av tørken er det bare lov å vanne plenen med en håndholdt **kanne** om sommeren.
LC	brev	Jeg gikk for å hente en **pose** i postkassa fra min tante.
LC	flaske	To gamle venner som kom på overraskelsesbesøk, hadde med en fin **årgang** vin i gave.
LC	seng	De to søsknene ville ikke ha hver sin **madrass** i julegave i år.
LC	hage	Hun bestemte seg for å kjøpe en fin **hund** fra naboens valpekull.
LC	ost	På benken lå det mange biter med **mat** som skulle i musefellene.
LC	blomst	Han hadde vært i byen og funnet en fin **sopp** som var av porselen.
LC	gulrot	Jentene spiste opp en **løvetann** de fant i hagen.
LC	hule	Min eldste bror dro på tur for å finne visdom i en **landsby** oppi fjellene.
M	vase	I gikk **bilder** både så inn rommet ligge og på og gulvet duk hun.
M	prinsesse	De seg til og som kledd en som hadde var ekte sett hadde jenta pyntet bursdagen **heks** TV på ut.
M	hanske	Hun at på hadde **bok** oppdaget plutselig mistet kom inn matbutikken og hun tidligere en.
M	edderkopp	**Flue** det som ikke i hjørnet lenger fly innerst satt en orket å.
M	gardin	Gikk skapene kunne nøye brukes **laken** gjennom de som men et fant alle ikke.
M	krus	Hyggelige stort i mennesker et god en **rom** å liker frokost jeg med nyte.
M	fakkel	**Sigar** ned kvelden og demonstrasjonstoget til sin seg med tok møttes de hver om.
M	jeksel	Meg frem det stor på når at jeg **byll** vokser er jeg det verste kjenner vet går på ikke hull som.

Filler Items

	Early-Response Sentences
forsøk	Gode **forsøk** på å stupe fra timeteren gikk rett i vasken da tårnet stengte tidlig.
hage	Vakker **hage** er det eneste jeg ønsker meg når jeg flytter.
etasje	Første **etasje** er litt mer upopulær på grunn av innsyn.
kylling	Stekt **kylling** kan brukes i utrolig mange middagsretter.
avis	Våt **avis** er ikke lett å lese fordi sidene klistrer seg sammen.
forhold	Mange **forhold** er med på å bestemme hva som er best å gjøre.
maur	Mange **maur** i blomsterbed og plener skaper mye bryderi om sommeren.
kurv	Stor **kurv** er nødvendig for å få plass til alt vi skal ha med.
utvalg	På dekke er som mange settes pris kan behov noe et som **utvalg**.
spørsmål	**Spørsmål** intervjuer kan både man og åpent når være noen lukket et.
hjem	Og er **hjem** familien godt hele sted et et trygt for.
hule	Dyr **hule** skogen i inneholde en kan forskjellige.

* HC = High-constraint, LC = Low-constraint, M = Mixed word order sentences

** Changed target word is shown in bold font

Appendix K: English Practice and Filler Items

Practice Items		
Constraint*	***Target Word***	***No-Response Sentences***
HC	pig	In the story, the wolf chased the three little **frogs** behind the house.
HC	ballet	The girl bought a pink tutu because she wanted to learn **painting** from an expert.
HC	barking	The neighborhood dog always kept her awake by **whining** through the night.
HC	beak	The animal in the zoo enclosure was trying to clean its **toes** and fur.
HC	boring	Because the work was repetitive, he thought it was **exciting** and not dull.
HC	brake	Instead of the accelerator, Maria stepped on a **rock** next to the pedal.
HC	card	The cashier asked the customer to swipe his **thumb** once again.
HC	coffee	Melissa asks for decaf when ordering her cup of **tea** at the restaurant.
LC	axe	My father scared away the burglars with his **sword** which he had inherited.
LC	band	After several rounds of auditions, she never heard back from the **team** again at all.
LC	bowl	Jan accidentally dropped her things into her **lap** at the meeting.
LC	storm	We watched my nephew try to ride his bike after the **rain** stopped.
LC	choir	Elizabeth didn't want to attend the church **festival** this year.
LC	compass	The boyscout always carried a first-aid kit and a **GPS** on his trips.
LC	elves	Timmy wanted to hear another bedtime story about the **workers** in Santa's workshop.
LC	book	The man who lived downstairs bought a new **diary** for his daughter.
M	dog	Checked away the but outside see that little **kitten** Bill ran couldn't.
M	snoring	Knew time **singing** they that awake her all Harry by the kept.
M	mouse	Visited around he crawling **rat** saw a catacombs the and.
M	bag	Security the inspect his needed **pockets** at properly to guards.
M	drone	The replaced the for heist battery **robot** trip in the their after they bank.
M	life	Rule were learning another **monopoly** of important they that evening.
M	hat	Mother wear that adamant every to has her **scarf** day a she was.
M	pudding	Didn't dessert wife **soup** she for that said kind of that my like.

Filler Items		
		Early-Response Sentences
	hammer	The **hammer** was lost and she had been looking everywhere for it.
	juice	The **juice** poured out of the bottle and over the table.
	ice	The **ice** on the floor made the family shiver as they huddled in the cold cottage.
	editor	The **editor** had a change of heart and decided to switch the pictures of the front page.
	goose	After the **goose** injured its wing, it could no longer fly or move around.
	visitor	The **visitor** said hello, but refused to shake my hand at the office.
	sandwich	The **sandwich** made with peanut butter and lots of jelly was delicious.
	meeting	Before the **meeting**, she put on black eyeliner and some red lipstick that looked nice.
	honey	The **honey** year particularly this delicious tasted and sweet.
	bird	In **bird** of corner saw was the his the eye he badly saw hurt.
	body	Was **body** burned down building in the next the discovered door.
	breakfast	The **breakfast** day on to his way that the lost was cafeteria.

* HC = High-constraint, LC = Low-constraint, M = Mixed word order sentences

** Changed target word is shown in bold font

Appendix L: Full LMM Model Syntax

```
lmer(depM ~ 1 + language   + basel.nonPred + nonPred.Pred +   frequency +
+basel.nonPred:frequency + nonPred.Pred:frequency+ language:basel.nonPred +
language:nonPred.Pred   + (1 | subj) + (1 | item) + (0 + language | subj), data = dataset, control =
lmerControl(optimizer ="Nelder_Mead"))
```