UNIVERSITETET I AGDER

Tip-of-the-tongue states among Norwegian-English bilinguals

Investigating the bilingual disadvantage in word finding and its relationship to the bilingual language profile

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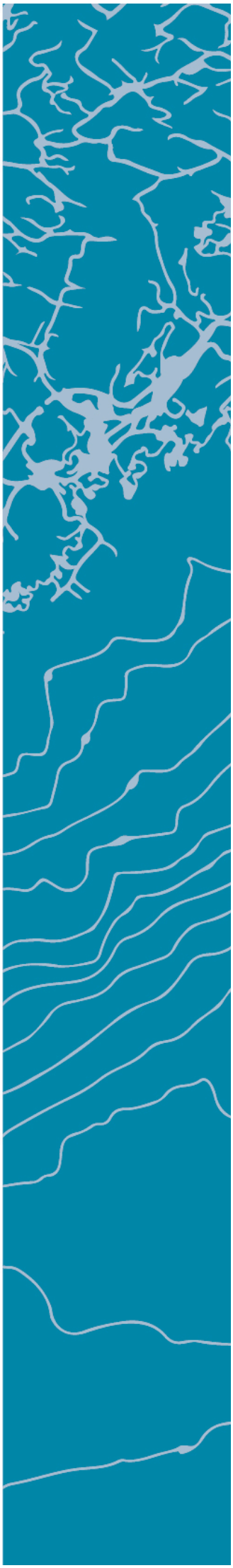

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Abstract

The objective of this study was to investigate how the bilingual disadvantage of word finding relates to the bilingual language profile. In two experiments 30 Norwegian-English bilinguals were presented with definitions of four different types of low frequent target words, to try to induce tip-of-the-tongue states: common noun cognates, common noun non-cognates, proper noun cognates, and proper noun non-cognates. If the participants experienced the feeling of knowing the target word, but had trouble finding it, they reported being in a tip-of-the-tongue state (TOT).

One experiment was in English, the other in Norwegian. The participants also did a vocabulary test for each language as well as answering a comprehensive language experience and proficiency questionnaire (LEAP-Q) adapted from Marian and colleagues (2007).

There was only a significant effect for the TOT proportions between the languages as a whole, where the TOT proportions in English were higher than in Norwegian. The factor analysis showed that increased TOT proportions related to factors such as proficiency, competition input from both English and Norwegian, and language competition in general (exposure, language switching and use). Additionally, it did not seem like there was a cognate facilitation effect on tip-of-the-tongue states among our group of bilinguals. Results were discussed in relation to the two hypotheses for the underlying mechanism of TOTs - the Weaker Links- and Competition for Selection Hypothesis. Even though there were also indications of support for the Weaker Links Hypothesis, the results from the regression analyses on TOT proportions seemed to gear most towards support for the competition account.

The results of the study are not clear-cut and do not show many significant effects due to the low number of participants and their similar bilingual language profiles (they do not vary much). Also, the similarity between the English and Norwegian language plays a role here. But there are some interesting patterns worth discussing and looking at to possibly integrate into future research (e.g. patterns connected to access of phonology during TOT states).

1. Introduction

The bilingual disadvantage refers to the problems bilinguals experience having to manage two languages in their mind at once. Although, initially speaking language production was thought to be a selective process for bilinguals, much research now suggest that a bilingual's language production is a non-selective process where several alternatives in both languages are active at the same time (e.g. Hermans, Bongaerts, De Bot & Schreuder, 1998; Gollan & Acenas, 2004). A number of studies have investigated which aspects of a person's bilingual profile and language relationships might relate to the bilingual disadvantage. Much of this work has focused on problems with word finding where bilinguals as opposed to monolinguals experience more tips-of-the-tongue (TOTs) (e.g. Gollan & Acenas, 2004; Kroll & Gollan, 2014). Bilinguals differ in language age of acquisition (AOA), dominance, proficiency, the frequency with which they use their languages and the ways in which they use them (code-switching[1] or language switching[2]). These aspects are interesting parts of the bilingual profile that might relate to the frequency of occurrence of TOT states. Two separate hypotheses have been forwarded as to why bilinguals experience more TOTs: one, called the weaker links hypothesis[3], suggests that due to the bilingual's less frequent use of each language, one might struggle with coming up with the correct word in a given context (Gollan, Montoya, Cera, & Sandoval, 2008; Gollan, Slattery, Van Assche, Duyck, & Rayner 2011). Another, called competition for selection hypothesis[4], argues that the appearance of two competing word alternatives for production (one for each language) causes a slowing of word access leading a person into a TOT state (Green, 1998; Kroll, Bobb, & Wodniecka, 2006). The current study will investigate the relationship between TOTs and aspects of bilingual profile in Norwegian-English bilinguals. The way to do so is to compare their bilingual profile including a vocabulary test in both their languages to the results of a within participant experiment where we try to induce tip-of-the-tongue states.

The focus of this thesis is the bilingual disadvantage in word finding and its relationship to bilingual profile. In what follows I will first present the modeling of bilingual language processing and then discuss the bilingual disadvantage more in detail. Moving on, I will

[1] Switching between languages voluntarily because both parties understand both languages.
[2] Having to switch to the other language because the other party does not understand the first language.
[3] i.e the frequency-lag hypothesis or transmission deficit hypothesis.
[4] i.e dual activation hypothesis.

discuss the bilinguals in our study, Norwegian-English bilinguals in Norway. Norwegian and English are closely related languages and language similarity can affect language processing. I will therefore, in that section, also compare Norwegian and English in language structure to evaluate the potential effects of language similarity in relation to the issue of word finding difficulties. After that I will present the current study including our manipulations and finally write the predictions that the weaker links- and competition for selection hypothesis make.

1.1 Modeling bilingual language processing

Several models have been put forward to try to explain bilingual language processing. I will now discuss five of them along with some evidence for what they show and claim. One called the BIA+ model focuses on perception while another model from Costa (2005) focuses on production. Three others called RHM, ICM and the Adaptive Control Hypothesis focus on how bilinguals differ and they all take into account effects of language experience.

1.1.1 Bilingual Interactive Activation + Model (BIA+) and Costa's language production model

The BIA+ model is a model that focuses on bilingual language perception of input. It is an expanded version from the original BIA model by Dijkstra & van Heuven (1998). Shown in Figure 1 on this page, the model starts with the identification system, with visual input at the bottom indicated by the arrowhead pointing upwards, where a string of letters is put in.

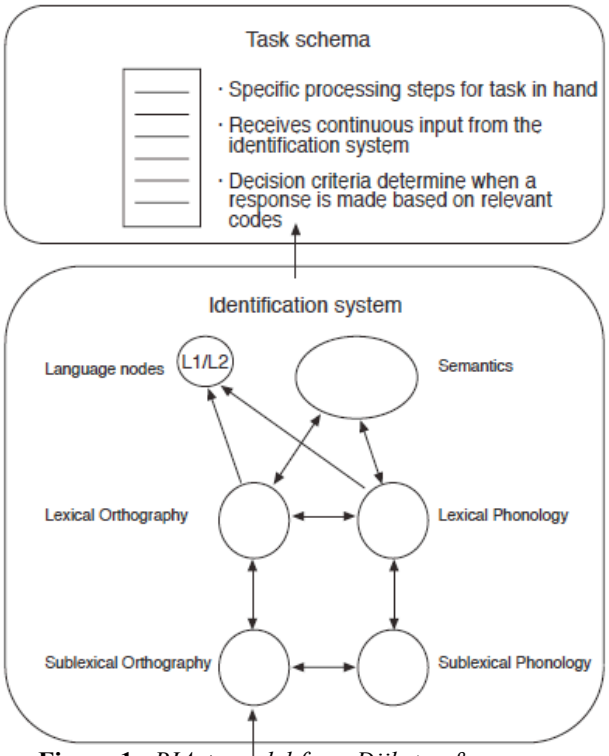


Figure 1 . *BIA + model from Dijkstra & van Heuven (2002).*

The visual input activates certain orthographical and phonological sublexical candidates that are similar to the input string and are above a certain value of resting level (depending on frequency of use, recency of use, proficiency in L1 and L2) (Dijkstra & van Heuven, 2002). Further on, activation is spread onto word- and sound candidates that contain those features. The candidates from the input then activate the language node connected to each of them and the semantic relation, which feeds that

information back to the candidates. The word and sound candidate relating to the input becomes most active and is recognized.

The task schema in the BIA+ model receives continual input from the identification system. This schema does not directly influence the activation of words, but does control how the information from the identification system is used. Linguistic sentence context might influence the word recognition system, both semantically and linguistically, priming activation of lexical candidates.

The model assumes that all bilinguals have one single integrated lexicon for all their languages, lexical access being non-selective and parallel (i.e. all language alternatives are active during the stages of the comprehension process). In other words, the BIA+ predicts that the presentation of a word in one language activates the orthographical, phonological and semantic representations in all known languages (Dijkstra & van Heuven, 2002).

Costa (2005) proposes a model for bilingual language processing that takes into account the different access stages for both selective (part a) and non-selective activation (part b). The model presents as a schematic process of a person's production planning from the first thought all the way to the point before the utterance. Part (a) is shown in Figure 2 on this page and part (b) in Figure 3 on the following page. The squares in Figure 2 and 3 indicate the lexical nodes of the language one is not using (Spanish) and the circles the lexical nodes of the language one is using (English). The arrows indicate the flow of activation, while the thickness of the circles/squares indicates the level of activation of the representations. In Figure 2, the rectangle is a language-specific selection mechanism. That means that the only lexical nodes this mechanism considers are the ones belonging to the response language, and renders all other nodes in the non-response language irrelevant for selection. Then, the

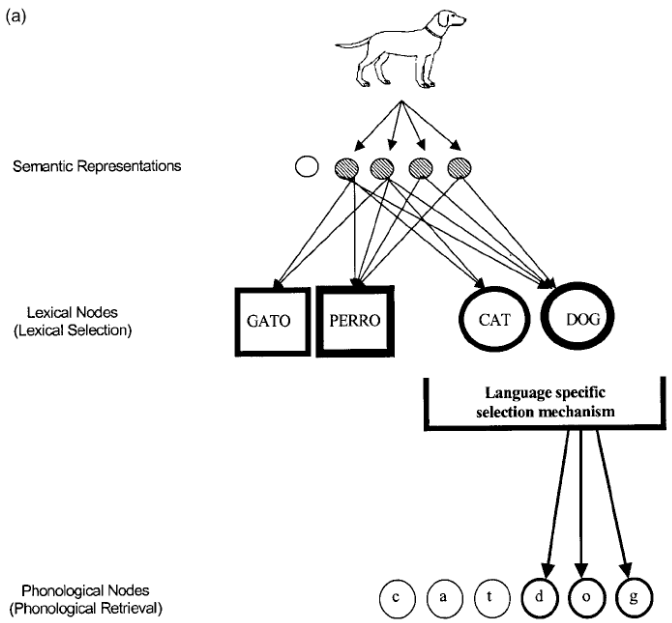


Figure 2. *Bilingual language-selective production model from Costa (2005).*

mechanism selects the highest activated lexical node of the response language, in this case the node that reads “DOG”.

Language production starts with the thought about a concept (the picture of the dog). The concept activates certain semantic representations. These again activate lexical nodes with words that are semantically related to the concept in the known languages, for instance gato/cat or perro/dog, but the nodes are activated to a different degree. At the same time, the phonological nodes belonging to the lexical node alternatives are activated. We then reach a language specific selection mechanism that selects the lexical node, within the response language, with the highest activation. When a lexical node (word) is selected, this node has specific phonological nodes connected to it. This is the level of phonological retrieval in the production process.

In Figure 3 everything is similar to Figure 2 until we reach the rectangle with the selection mechanism. Here the mechanism is language non-specific selection, rendering all other active lexical nodes relevant for selection regardless of the language to which they belong. After that the selected lexical node again activates the phonological nodes connected to it, which then facilitate phonological retrieval. There are two possible solutions to how the selection process progresses in the language non-specific mechanism. One is that the mechanism selects the highest activated lexical node, whether it is part of the response language or the non-response language. Poulisse (1999) calls this the differential amount. The differential amount secures that the lexical nodes with the highest activation are the ones belonging to the language currently in use. The other suggestion of how the mechanism selects lexical nodes is that there are certain inhibitory processes suppressing the lexical nodes from the non-response language. This also secures

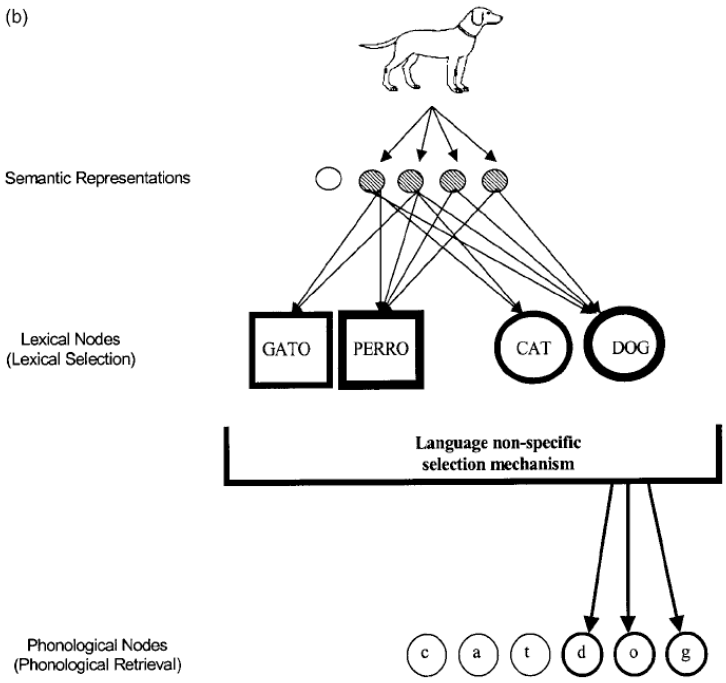


Figure 3. *Bilingual non-selective language production model from Costa (2005).*

that the lexical nodes of the response language are always more activated than those of the non-response language (Costa, 2005). Costa (2005) does not state whether phonological activation is as clearly non-specific like he states with lexical activation. What he does say is that it depends on the similarity of the two languages in question. If they have a certain overlap in phonological features, this will most likely impact the ease of phonological retrieval (Costa 2005).

Both BIA+ and part (b) of Costa's production model assume, as mentioned, non-selective activation in bilingual language processing. When Kroll & Tokowicz (2005) discuss BIA+ processing in light of two languages that have many strong orthographic similarities, they state that there will most likely be parallel activation of candidates that create competition at lexical and sublexical levels. This is the case with pairs of cognates (translation equivalents similar in form, meaning and phonology), interlingual homographs (similar in form but not translation equivalents, like "false friends") and orthographic neighbors (all words in each language that are similar in form, but slightly different than the target word).

A lot of evidence for BIA+ model and Costa's non-selective production model comes from studies testing cognate processing. Lemhöfer & Dijkstra (2004) performed generalized lexical decision tasks with interlingual homographs in experiment 3 and homographic cognates in experiment 4 in their study of Dutch-English bilinguals. The bilinguals were given the instructions to press the "yes" button if the presented item was a word in at least one of their languages (English or Dutch) and "no" if it was a non-word in either of the languages. They did not find an effect for interlingual homographs being accessed faster compared to the matched English and Dutch control conditions, but that cognates indeed were recognized faster. They further stated that it seemed like the effect for cognates appeared to depend on their overlap in meaning across languages, which led to facilitation. So only shared orthography did not lead to facilitation relative to the fastest recognized controls (Dutch), but if you added semantic overlap (like in the case with cognates), it did. They suggested that the cognates between English and Dutch were maybe represented in a special way, with semantic and orthographic representations being strongly linked (Lemhöfer & Dijkstra, 2004).

I have now explained and discussed some models that take non-selective bilingual language processing into account both by comprehension and production. But all bilinguals differ in

their language experience, that is, they differ for instance in proficiency, dominance, modes of use (dual language context, code-switching or monolingual context) and frequency of use in general.

1.1.2 Revised Hierarchy Model (RHM)

One of the models that focus on language experience is the Revised Hierarchy Model (shown in Figure 4) by Kroll & Stewart (1994; earlier version(s) Potter, Eckhardt & Feldman, 1984). This model takes into account the language proficiency of a bilingual person. In Figure 4 the bigger L1 box represents language 1, the mother tongue, and the smaller L2 box represents language 2. The concept box represents a person's stored concepts for language use. The two straight lines between the L1 and L2 boxes represent the lexical links between the two languages, while the diagonal lines represent the conceptual links between language and concepts. Dashed lines mean a weaker link, while solid lines mean stronger links. The arrows indicate which way the association goes.

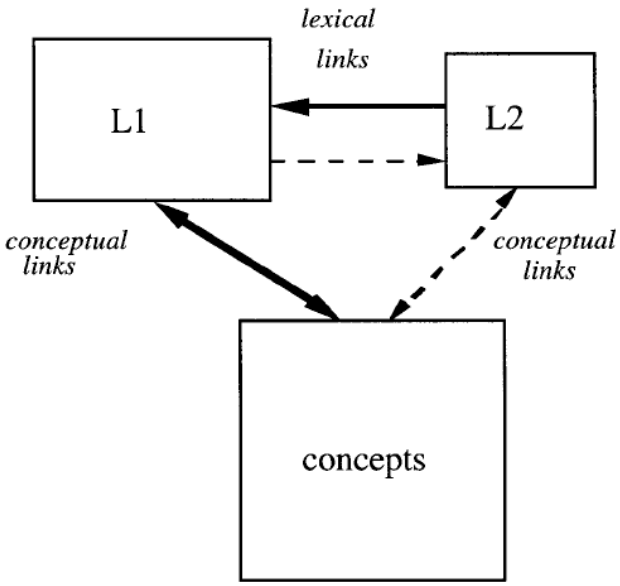


Figure 4. *The Revised Hierarchical Model from Kroll & Stewart (1994).*

The RHM claims that there are stronger lexical bonds of association from L2 to L1 than vice versa. That is because most learners of a second language start off their associations with an L2 through word translations from their L1. Also, the links between words and concepts are on the other hand considered to be stronger for L1 than for L2. So the RHM makes two assumptions on the connection of words and concepts in bilingual memory. Firstly, L1 words are more connected to concepts as opposed to L2 words. Secondly, L2 words are more connected to corresponding translation equivalents in L1 than L1 words are connected to L2 translation equivalents (Kroll and Tokowicz, 2005). The model assumes that both lexical and conceptual links are active in a bilingual's memory during language processing, but that the strength of the links depend on the fluency of L2 and relative dominance of L1 to L2. In other words, this model predicts that as your proficiency increases

in your L2, you will be able to access concepts right away in the L2 without having to translate through lexical links (Kroll & Stewart, 1994 reference).

Evidence for the RHM model comes from studies on translation performance (Sunderman & Kroll, 2006). The studies show how language proficiency can impact the connections between our conceptual memory and both our language. For instance, Sunderman & Kroll (2006) tested two groups of English-Spanish bilinguals in a translation recognition task (first used by De Groot, 1992). One group was less proficient and the other more proficient in Spanish. The task was to decide whether two presented words were translation equivalents or not, for example the words *cara-face*. There was also a critical condition were the words were not translation equivalents, but similar in form or meaning to the correct translation, for instance *cara-card*. The tasks in the critical condition needed a "no" response. It was hypothesized that the less proficient bilingual group, compared to the more proficient group, would spend more time rejecting the word pairs that were not translation equivalents (like *cara-fact*) as the word *fact* was similar in form to the L1 translation equivalent of the L2 word *cara* (*face)*. This rejection would be slower because the RHM hypothesizes that the less proficient English-Spanish bilinguals would, in order to access the concept of *cara*, go through the lexical link *face*. When there was a distractor in form, like *fact*, this would confuse the less proficient participant. The more proficient participants would have a stronger link with the concept of the word *cara*. They would not be distracted by the word *fact*, because they would not have to go through the word *face* to access the words meaning.

The tests showed that the less proficient learner were significantly slower to respond to the word pairs that were not translation equivalents. It also showed that the more proficient learners were not distracted by form similarity to the form-related translation neighbor (Sunderman & Kroll, 2006). The results from this study show that degree of proficiency in L2 indeed influences how a bilingual processes words in the L2, and serves as support for the proficiency related processing put forward by the RHM.

Except from part of a solution for non-specific language selection in Costa's (2005) production model, little focus of the before-mentioned models has been devoted to the issue of how the cognitive system actually manages to resolve the competition of multiple active lexical and candidates across a bilingual's two languages. The next section discusses this

with Green's (1998) Inhibitory Control Model followed by the proposal of an expansion of the ICM called The Adaptive Control Hypothesis (Green & Abutalebi, 2013).

1.1.3 Inhibitory Control Model (IC) & Adaptive Control Hypothesis (ACH)

As a mechanism to modulate the resulting competition in bilingual language processing, Green (1998) proposed the Inhibitory Control mechanism that uses the output of the lexical system to achieve proficient performance and can be seen in Figure 5.

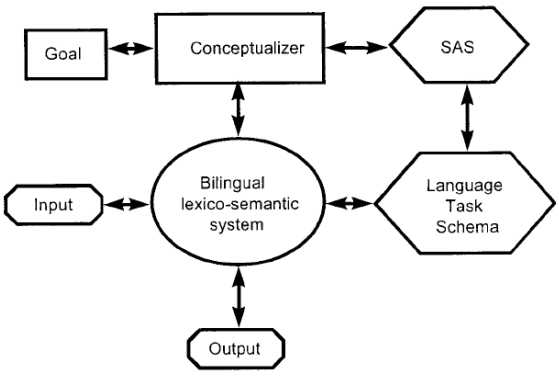


Figure 5. *The Inhibitory Control Model from Green (1998).*

When planning language production is that you set a goal. That goal then activates your conceptual memory, the base you connect all meaning to, and one that is common to both your languages. The conceptual representation for your goal then activates your bilingual lexico-semantic system, where the words connected to your concept representations lie. The conceptual representation also activates something Green (1998) calls the supervisory attentional system (SAS). SAS controls the activation of language task schemas to achieve certain language processing goals (Kroll & Tokowicz, 2005). For instance, a task schema for naming a picture in L1 would be different from the schema for the same action in L2 or translating a word from L1 to L2. What is critical with the task schemas is that they activate lemmas (uninflected word forms) in the target language and inhibit lemmas in the non-target language. Each lemma is marked with a language tag that specifies the language it belongs to. The inhibitory control will differ in degree depending on how active other non-intended lemmas are. Therefore, if a bilingual, while attempting to name something in their L2, experiences a high activation of competitive lexical alternatives in their more dominant L1, the inhibitory control mechanism needs to operate in a larger degree to suppress the L1, than would be necessary to suppress the L2 during naming in L1.

The IC model predicts that there will be a switch cost when a less balanced bilingual, having first spoken in his or her second language, is required to switch into L1 again. It will in other words take much longer for an unbalanced bilingual to switch into L1, because one has just suppressed the L1 a lot to be able to speak in L2. Therefore it takes longer to re-activate the L1 than to activate L2 when having to switch from L1 to L2.

Green & Abutalebi (2013) proposed an expansion of the inhibitory control model. This is called the Adaptive Control Hypothesis. The theory focuses on how individuals have certain control processes when dealing with language. Figure 6 contains four boxes that comprise the architecture of the ACH with arrows depicting the control connections between them. Filled arrows indicate that the control processes are internal, the empty ones being external. The interactional context refers to how the language is used while the speech pipeline comprises all conceptual, affective, linguistic and sensorimotor (involving senses and motor functions) representations incorporated in the production and comprehension of speech (Green & Abutalebi, 2013). Control processes are the ones that control the representations in the speech pipeline in the working memory to make sure that the goal is reached. Finally, the meta-control process sets the parameters of the control processes. The interactional context controls externally which parts of the speech pipeline need to be controlled and which ones need to be active. The control between the speech pipeline and the different control processes controls the same thing, but internally. The control between the meta- and general control processes is also internal.

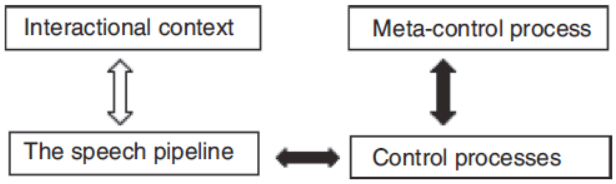


Figure 6. *The architecture of the Adaptive Control Hypothesis from Green & Abutalebi (2013).*

The control processes adapt themselves depending on the demands of the interactional context the individuals are in. Green & Abutalebi (2013) suggest 8 different control processes: (1) goal maintenance, (2) conflict monitoring, (3) interference suppression, (4) salient cue detection, (5) selective response inhibition, (6) task disengagement, (7) task engagement and (8) opportunistic planning, and 3 interactional contexts: (1) single language, (2) dual language and (3) dense code switching (Green & Abutalebi, 2013)[5].

Green & Abutalebi (2013) also state in which interactional contexts different language control processes demand more or less control, or if it is neutral on that account. They propose that during single language use, more demand is put on the processes of goal maintenance, conflict monitoring and interference suppression. Demand for control is neutral for the five other control processes (almost non-existent). In a dual language context, more language control is demanded for all control processes except for opportunistic planning

[5] For more detailed explanation of the eight control processes and three interactional contexts, see Green & Abutalebi (2013).

(neutral). In dense code switching the demand of control is neutral on all control processes except for opportunistic planning; opportunistic planning requires more control. The hypothesis suggests the highest demand of control is in dual language situations for goal maintenance, control monitoring and interference suppression, and in dense code switching situations for opportunistic planning.

In other words, what the adaptive control hypothesis proposes is that individuals that speak in dual language situations are the ones that have had the most training of adaptive control (in 7 out of 8 control processes). Dual language speakers are better at controlling their language because they almost constantly need to inhibit their other language. The hypothesis considers them more experienced controllers of their two languages compared to code switchers because regular bilinguals *have to* change their language depending on the people they talk to, while code switchers do not. Code switchers are in an environment where all the people in their surroundings understand both of their languages; there is little effort made to inhibit the non-target language alternatives because there are indeed two target languages.

A lot of evidence for the ICM and ACH comes from research done on language switching tasks. Meuter & Allport (1999) tested how dependent on the direction of the switch the language switching was. Different language speaking bilinguals were given the task of naming nine digits repeated in lists. The color on the screen per trial instructed which language the digit was supposed to be named in. One specific color represented one language, and another a different language. The latencies of the digit naming for trials preceded by a same-language response (no-switch), or by a different language response (switch) were measured. The naming latencies for switch trials were slower than for no-switch trials – giving a language switching cost. Also, the language switching cost appeared to be greater when asked to switch from the less dominant to the dominant language than vice versa. In other words, after naming in L2, when the following word has to be produced in L1, the system requires a longer time to re-activate the newly suppressed lexical nodes because they have been strongly inhibited (Meuter & Allport, 1999). This is consistent with the predictions of the IC model by Green (1998). Other research confirms these predictions as well (e.g. Mosca & de Bot, 2017, argue that switching costs are dominance-related).

The inhibitory processes of our bilingual system require a lot of cognitive attention. Since bilinguals constantly have to inhibit a non-target language, they have shown to possess an

advantage with better control in cognitive demanding non-verbal tasks. For instance research findings from Bialystok, Craik, Klein, & Viswanathan (2004) show that for older bilinguals who have spent their lives in environments where their two languages have been used very often, there is some sort of protection from decline in executive cognitive function. This protection seems to be related to their active bilingualism.

1.2 The bilingual disadvantage

Bilinguals suffer some bilingual disadvantages when having to juggle two languages in the mind at once. For instance, even though bilinguals clearly know more words than monolinguals across their two languages, they are shown to have significantly smaller language-specific vocabulary compared to them. This is shown through vocabulary testing in children (Bialystok, Luk, Peets & Yang, 2010) and adults (Bialystok, Craik & Luk, 2008). Also, bilinguals often show a slower naming of pictures in picture-naming tasks (Ivanova & Costa, 2008).

1.2.1 The tip-of-the-tongue phenomenon

The focus of this study is another bilingual disadvantage called the tip-of-the-tongue phenomenon (TOT phenomenon). It is described by Brown & NcNeill (1966) as a state where one cannot come up with the name for a familiar word, but can think of related words with similar form and meaning. Brown (1991) also adds to the description of the TOT state that we are sure that we can remember the word we are searching for, but at the time we are unable to retrieve it.

Several papers have addressed the question of why TOT states occur. First, Brown & McNeill (1966) suggested that TOT states are just like any other search for a word, it is just slowed by not having enough information to recall the word at the beginning. This theory is called the incomplete activation hypothesis. On the other hand, others have suggested that in a TOT state, you are in search through your memory after a word, and suddenly another related word gets in the away of the search and serves as a blocker (Burke, Worthley & Martin, 1988; Reason & Lucas, 1984).

Jones & Langford (1987) tested the blocking hypothesis up against the incomplete activation hypothesis. Under the incomplete activation hypothesis, the related words would serve as a guidance to find the target word and thus result in fewer TOT states. Under the blocking hypothesis the related words would interfere and serve as blockers and thus results in more

TOT states. They found that priming with semantic related words did not give any effects one way or the other, but that priming with phonologically related words led to more TOT states compared to what unrelated priming words did. This is evidence for the blocking hypothesis, but against the incomplete activation hypothesis. Jones (1989) tested this again with even more similar and related words to the target, and again found support for the blocking- and evidence against the incomplete activation hypothesis.

Tip-of-the-tongue states is a type of word retrieval failure that happens with everyone, but much more often in bilinguals than with monolinguals (Pyers, Gollan & Emmorey, 2009) and more often in your non-dominant language compared to your dominant language (Gollan & Silverberg, 2001; Gollan & Acenas, 2004). Two hypotheses have been put forward to suggest an answer to why bilinguals experience more TOT states in general than monolinguals. One relates to a generally lower frequency of use of each language and the other to competition from each language during language production.

1.2.2 The weaker links hypothesis assumes that bilinguals might struggle with word finding because each of them use their two languages less than a monolingual would use his only language. The process is therefore exercised less frequently, leading the bilingual to become less practiced than a monolingual in gaining access to the same word, thus accessing it more slowly (Gollan & Silverberg, 2001). Less access to both languages means that bilinguals, in addition to in their L2, struggle more with word finding in their L1 than do monolinguals (Gollan & Brown, 2006). Over time, using each language less will lead to weaker links between the semantic and the phonological system, hence the name weaker links (Gollan et al. (2008).

Gollan et al. (2008) provided evidence for the weaker links hypothesis in their first experiment by comparing English picture naming latencies across participant groups with one group of English speaking monolinguals and another group of English dominant Spanish-English bilinguals. Additionally, they compared picture-naming latencies in Spanish with naming latencies in English within the bilingual group. The predictions were that the bilinguals would show slower naming latencies in English than the monolinguals because they used English less often. They also predicted that the bilinguals would show slower naming latencies in Spanish than in English because they were English dominant and therefore assumed to have a higher frequency of English use. The participants were to name

the pictures that appeared on the screen as fast as possible. The bilinguals named pictures in each lists in English only, Spanish only, or by using either language depending on which language from which they first came up with the word. The monolinguals named all lists only in English. The results from Gollan et al.'s (2008) first experiment directly confirmed the weaker links hypothesis as the bilinguals indeed showed slower naming latencies than did the monolinguals, particularly with low-frequency names (same effects in Gollan et al., 2011; Ivanova & Costa, 2008).

More important support for the weaker links was found when Pyers et al. (2009) tested unimodal bilinguals (speak two languages), bimodal bilinguals (speak one language, sign another) and monolinguals (speak one language). They tested bimodal bilinguals because they could help figure out whether TOT states occur at the semantic- and/or, phonological level, or because bilinguals use each language less frequently than monolinguals. This is because bimodal bilinguals cannot experience phonological competition between the two languages. They tested 22 American Sign Language (ASL)-English bilinguals, 22 English monolinguals and 11 Spanish-English bilinguals by having them name 52 pictures in English that represented low-frequency words. All bilinguals, but one S-E and one ASL-E, reported English as their dominant language. All participants from each group were individually matched for age, education level and self-reported English proficiency (skills).

The set of six dependent variables were GOT (correct retrieval), +TOT (failed or self-resolved retrieval), True TOT[6] (dividing +TOTs by +TOTs and GOTs to find the TOT proportion; that is the amount of TOTs experienced divided by the opportunity to experience TOTs – the total number of words you know), -TOT (failed or self-resolved incorrect retrieval), notGOT (failed retrieval and later recognized words), and postDK (didn't know after being told the target word).

The results showed significant findings where the both the unimodal (Spanish-English) and bimodal bilinguals (ASL-English) experienced more +TOTs, more True TOTs, more postDKs, and less GOTs than monolinguals. Unimodal and bimodal bilinguals did not differ in number of +TOTs and proportion of True TOTs. This confirms that there is a common

[6] This is based on the fact that the opportunity of experiencing a TOT state is only there when the activation of a word reaches a level that could result in either a TOT or a correct retrieval (GOT). By calculating it like explained in the text, you get the proportion of TOTs experienced out of all all opportunities to have a TOT. In this text, the TOT proportion is called True TOTs (Pyers et al., 2009).

mechanism creating the increased number of TOTs in uni- and bimodal bilinguals (Pyers et al., 2009). Therefore, Pyers et al. (2009) state that the study clearly shows that increased TOT experiences are not just due to competition between phonological forms, since bimodal bilinguals cannot experience competition at this stage. Because TOT unimodal bilinguals name cognates faster (e.g. Gollan & Acenas, 2004) and bimodals do not have the advantage of cognitive control due to lemma competition (Emmorey, Luk, Pyers & Bialystok, 2008), Pyers et al. (2009) suggest that TOTs happen because there is a less frequent use of words in each of the languages (support for the weaker links hypothesis).

1.2.3 The competition for selection hypothesis assumes that there are alternatives, from both languages active during a bilingual's production process, that compete for selection even when the bilingual is specifically planning in one of the two languages. Word alternatives will always, at least briefly, become active regardless of the language you are planning to use. So when a bilingual is planning the production of a word in one specific language, translation equivalents in the other language will also be active, increasing the competition for selection and slowing lexical access (Green, 1998; Kroll, Bobb & Wodniecka, 2006).

Evidence for the competition for selection hypothesis comes from, among others, using something called the phono-translation testing paradigm (Hermans et al. 1998; Costa, Colomé, Gómez & Sebastián-Gallés, 2003). Testing using phono-translation is when participants are given the task to name pictures in their L2 while receiving auditory distractor words in L1 phonologically related or unrelated to the L2 target word.

Klaus, Lemhöfer & Schriefers (2018) used a reversed version of this testing paradigm to investigate if a less dominant L2, reached activation up to the phonological level during production in the L1. They tested Dutch-English bilinguals in their L1 (Dutch) to check if the L2 translation of L1 non-cognate words were activated up to the phonological level. In Experiment 1, the participants named pictures in their L1 (Dutch) out loud while ignoring auditory distractor words from their L2 (English) that were phonologically or not phonologically related to the L2 translation of the target word. The distractor words were presented at two different times (SOAs), in one block at the same time as the picture (SOA= 0 ms), the next block 150 ms seconds before (SOA = -150 ms). All the instructions during Experiment 1 were held in Dutch (L1). They found that related distractors, only at the early SOA (-150 ms), made the participants spend longer time naming the pictures then when they

were presented with unrelated distractors – i.e. there was a phono-translation effect. They did the same in Experiment 2, but now the instructions were given in English (L2) and with a second set of participants. This was thought to increase the activation of L2 to check if this resulted in increased competition between L1 and L2 at the phonological level. If so, there would be an even larger phono-translation effect here compared to Experiment 1. The results from Experiment 2 did not show any phono-translation effect.

After both Experiment 1 and 2, Klaus et al. (2018) administered several proficiency measures, including a questionnaire asking the participants to write down the English names of all the pictures used throughout the experiment (controlling for translatability). This was to check if they knew all the words also in their L2. Due to the participants' difficulty with naming the L2 translation of many of the picture names (15%), they had to remove many of their observations from Experiment 1 and 2. For Experiment 3, to prevent further data loss, they used an improved set of targets and distractors where the participants were more likely to know the picture names. The experiment was identical to Experiment 1, except performed with a third set of participants, the improved target-distractor set, and SOAs only at -150 ms (the phono-translation effect had been strongest there in Experiment 1). Results from Experiment 3 showed that the related distractors made the participants spend longer time naming the pictures than when presented with unrelated distractors.

Klaus et al. (2018), with Experiment 1 and 3 in their study, were the first ones to show phono-translation effect in L1 naming, as earlier studies using phono-translation only with L2 naming. It shows that during L1 production, a person's L2 has enough influence to affect naming times by co-activating L2 translation. This supports the theory that both languages in a bilingual compete for selection during the language production process.

1.3 Norwegian-English bilinguals in Norway

In the current study we investigate TOTs in Norwegian-English bilinguals and how this might relate to their bilingual profile. Norwegian and English also have a common language history, belonging to the same language family. Also, the words in these languages are similar on many levels, both phonologically (sound) and morphologically (form), resulting in a lot of Norwegian-English cognates. This might have an effect on the occurrence of TOTs and therefore one needs to consider the history and these similarities in order to possibly

evaluate their impact on the results of the study. This section describes the nature of many Norwegian-English bilinguals in Norway and moves on to compare the two languages.

1.3.1 Nature of most Norwegian-English bilinguals

Although Norway is a very small country in this world, it is heavily internationally connected. Norway's young generation of today is exposed to English on a daily basis through all different kinds of media - such as music, TV, movies, streaming, gaming (video gaming and Internet gaming), the Internet in general etc. All English TV shows are subtitled in Norwegian, not dubbed, compared to for instance TV shows in Latin America, unless they are children's TV shows. Therefore, Norwegians are continually hearing the English language through media. Even though the children's shows are dubbed, Norwegian children are exposed to English through other media, like music, from a very early age. These circumstances open up for the possibility that Norwegians start acquiring English at a relatively early age. Age of acquisition might have an impact on language learning, comprehension and production as Lenneberg (1967) proposed in his critical period hypothesis (CPH) where he stated that the ability to learn a language will decrease after a certain point of age.

All things mentioned also extend to the issue of language proficiency skills. The contemporary generation of youths and young adults in Norway are generally considered to have a high proficiency of comprehension, speaking, reading and writing in English. In Norway we officially start learning English at school in first grade (six years old), but as mentioned, many children start their learning process even earlier than this. Starting to learn English early on, at least as early as six years old when starting school, might impact the general English proficiency of the Norwegian population, leading to a generally increased proficiency level.

Another important thing about Norwegian-English bilinguals is that even though they mainly find themselves in monolingual Norwegian language contexts, the contexts almost never are strictly monolingual Norwegian. Because of the globalized society we live in, and all the English language impact through the media and the Internet, there is indeed a lot of Norwegian-English code switching. When speaking to for instance friends, it is normal for a Norwegian teenager or young adult to intentionally put English words into the utterances. Some might even do it without even thinking about it. The code switching is seamless and

because the audience are used to the English language, mostly all of them understand what is said without any further need for translation. The code switching does not just happen in real life, but also very often virtually, over the Internet. The majority of Norwegians today below the age of 40 would normally not consider it too challenging if they found themselves in a dual language context either, where they are required to use English because another person in the audience does not understand Norwegian.

As discussed in this section, the globalization of the world and Norway's strong international connections through media, Internet etc. all provide Norwegians with a lot of English language exposure. All this exposure, including English formal learning from first grade at school, might have an impact on the proficiency of each individual. The similarity of Norwegian and English might also have an impact on the results in our study. I will dicuss this more in detail in the following section.

1.3.2 Language comparison: Norwegian vs. English.

Norwegian and English are two languages that are very similar in nature. They both stem from the same language family, Germanic. Germanic language has three subcategories: West Germanic languages, North Germanic languages and East Germanic languages. East-Germanic languages are now extinct (such as Gothic, Burgundian and Vandalic). English is a West Germanic language along with for instance Dutch, German and Yiddish and Norwegian is a North Germanic language together with Danish, Swedish, Faroese and Icelandic (Moulton & Bucchini, 2018).

It has recently been claimed that English actually should be classified as a North Germanic language (Emonds & Faarlund, 2014). Emonds & Faarlund (2014) claim that many words thought to stem from Old English, actually are borrowed from North Germanic languages. For instance, compare[7]:

English	Norwegian
egg	egg
sister	søster
skirt	skjørt

[7] All Norwegian used in this thesis is Bokmål.

Moreover, the fact that English and Norwegian are both Germanic languages, means that they share traits such as similar phonological inventories, similar syntactic structure and have common words. A lot of words across these languages are cognates, with same or very similar phonetic, orthographic and semantic properties. It is important to clarify the sense in which I use the word cognates in this thesis. There has been some discussion on what classifies as cognates and Sunderman & Schwartz (2008) state that there are two related meanings of the word. In its original sense, coming from Historical Linguistics, cognates are words that have the same historical origin (Germanic). For Norwegian and English, that would mean only the original Germanic words that they both have in common. The second meaning of the word, coming from psycholinguistics, is as I have just explained in this comparison section. So when I say that English and Norwegians have many cognates, these are psycholinguistic cognates, which means that English and Norwegian have borrowed many of the same words from the same sources – e.g. Latin, Greek, French – such as, "chocolate/sjokolade" and "tomato/tomat." There are also many historical cognates that stem from their common Germanic stock of words such as, "bowl/bolle" and "milk/melk."

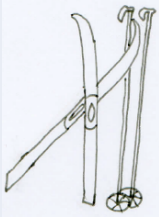
Cognates			
Norwegian	English	Meaning (semantics)	Origin
tre /tre:/	tree /tri:/		Germanic
regn /ræin/	rain /reɪn/		Germanic
ski /ʃi:/	ski /ski:/		Old Norse
glass /glas:/	glass /glɑ:s/		Germanic

Table 1. *Illustration of cognates in Norwegian and English showing their shared orthographical, phonological and semantic properties as well as their etymological origin.*

The aspect of Norwegian-English cognates is necessary to look closer at to consider its impact on TOT states in the current study, as the weaker links hypothesis predicts that

cognates facilitate TOT resolution. Table 1 shows examples of four Norwegian-English cognates and their phonological, orthographical and semantic properties.

1.4 The current study

1.4.1 Overview and reasons for components

The study consisted of three components: (1) a bilingual profile questionnaire, (2) tip-of-the-tongue experiments, (3) vocabulary tests. Components 2 and 3 were pairs of one Norwegian and one English variant.

The questionnaire was adapted from the LEAP-Q (Language Experience and Proficiency Questionnaire) by Marian, Blumenfeld, & Kaushanskaya (2007). It was a self-report questionnaire where the subjects rated themselves on several aspects concerning language history, experience and proficiency, including dialects and accents. Marian et al. (2007), in relation to the finalization of the LEAP-Q, performed two studies first establishing internal validity within the questionnaire and then, more importantly establishing criterion-based validity. The aim of the second study was to establish criterion-based validity by comparing self-rated and objective measures of proficiency. Their results showed strong positive correlations between objective measures (reading fluency, passage comprehension, productive vocabulary, oral comprehension, and grammaticality judgments) and self-ratings of understanding, speaking, and reading L1 and L2. The objective measures were also related to self-reported L2 proficiency (Marian et al. 2007).

The questionnaire was included in the current study to be able to connect different aspects of a participant's bilingual profile to the amount of TOTs in both languages, and his or her performance on the vocabulary tests. Using this LEAP-Q gives us various possibilities to connect the results from the experiments and from the vocabulary tests to the participant's bilingual profile.

The vocabulary tests were administered as objective tests, to evaluate the role of proficiency in relation to both the bilingual profile and the results of the TOT experiments. They could also serve as a tool to validate for the self-proficiency measures of the LEAP-Q. The tests were also a way to check if objective proficiency predicted some of the findings in the TOT

results. Finally, the TOT experiments in English and Norwegian, give us the opportunity to look at one of the disadvantages bilinguals experience when juggling two languages.

1.4.2 Manipulations and critical measures

The stimuli for the TOT experiments were manipulated in two steps: first, the stimuli of 80 target words comprised of 40 proper nouns and 40 common nouns, and secondly, within each of these groups, there were 20 cognates and 20 non-cognates. Most proper nouns are similar (cognates) across both languages, but sometimes they are changed to something dissimilar in the other language, especially for TV shows and movies for children. The proper-/common nouns were manipulated to check for differing TOT measures specifically connected to proper-/common nouns. The cognate/non-cognate words were manipulated to check for possible cognate facilitation effects, previously observed in research of TOTs (Gollan & Acenas, 2004; Costa, Caramazza, & Sebastian-Gallés, 2000). Another measure we did, was checking for access to phonology. When the participants were experiencing a TOT, they were asked whether they could guess the initial or final letter, phoneme, or sound of the target word, and also if they could guess the number of syllables.

1.5 Predictions

The aim of the study is to investigate the factors that are related to TOT frequency in both languages of a bilingual. Every bilingual differs in language dominance, proficiency, the frequency use of both languages and in the ways in which the languages are used, such as code switching[8] and language switching.[9]

The two theories (weaker links and the competition account) attempting to explain the mechanism underlying the occurrence of TOT states are on many levels similar, but differ on some points. Gollan, Ferrieira, Cera & Flett (2014) suggest that the mechanism might even be controlled by a combined frequency of use of each language and competition for selection (partial support for both theories). So, the theories do not exclude each other completely, and the cause of TOT states may not be explained simply one way or the other. Before the description of our methodology, I will discuss how each theory predicts how different aspects of the bilingual profile might affect word finding and tip-of-the-tongue states.

[8] Voluntary switching between the languages because the other party knows them both.
[9] Required switching because the other party only knows one of the two languages.

1.5.1 Predictions from weaker links hypothesis

The weaker links hypothesis claims that TOTs occur after lexical access and that it happens because we fail to access phonology due to a weaker link between the lexical and phonological level in the production process. This link is weaker for bilinguals because their frequency of language use, in this case, is divided across the Norwegian and English languages, resulting in less frequent use of each language.[10] The theory predicts the following:

1. There will be more TOTs in English than in Norwegian for the participants who spend more time using and being exposed to Norwegian, because the amount of TOT states will be related to the frequency of use of a language and other related factors depicting frequency of use.
2. During a TOT state, there will be greater access to correct phonology in Norwegian than in English for those who spend more time using and being exposed to Norwegian compared to English.
3. There will be a cognate facilitation effect yielding less TOT states for cognate target words. According to Costa et al. (2000) cognates will facilitate word retrieval because there is access to shared phonology. They claim that cognates only have one shared phonological representation in our mind, as opposed to non-cognates who will have two representations of the same concept. Therefore, non-cognates will not facilitate word retrieval, consequently yielding a higher amount of TOTs compared to cognates.
4. Because Costa et al. (2000) assume that cognates only have one phonological representation in both languages for the same word; the frequency of use should not affect the cognates, because they use that same representation the every time, thus no frequency difference. Therefore, it is predicted that this will result in the same amount of cognate-related TOTs across English and Norwegian TOT experiments.
5. Proper nouns that do not change across English and Norwegian (proper noun cognates) should also yield the same amount of TOTs for English and Norwegian TOT experiments because these also have the same phonological representation in the mind of the bilinguals. They would therefore not be affected by the frequency of use.

[10] This can also be seen as lag due to frequency of use, hence the other name for the same hypothesis – the frequency-lag. The word lag is defined as ”a failure to keep up with others in development”. In this case, the failure to keep up with monolinguals in their development of language learning/acquistion.

6. On the other hand, there will be a higher number of TOTs for proper nouns that do not change across Norwegian and English (proper noun non-cognates) because they are less frequently accessed between the two phonological representations.
7. There might also be an effect of proficiency related to the TOTs, but this is harder to predict because higher proficiency often is connected to higher frequency of use or early age of acquisition?

1.5.2 Predictions from competition-for-selection hypothesis

The competition for selection hypothesis assumes that TOTs occur during lexical selection because there are translation equivalents from both languages competing for selection (i.e TOTs are not affected by phonology). The theory predicts the following:

1. There should be an equal amount of TOTs for cognates and non-cognates within languages because word selection is not affected by phonology.
2. If cognate proper names share lexical representation, they should yield the fewest TOTs because they have no other competitor at the lexical level. On the other hand, non-cognate proper names should yield more TOTs because of two clear competing alternatives at the lexical level.
3. The number of TOTs should be related to language dominance and other factors related to language dominance (such as frequency and proficiency for instance). This would mean that if you were more dominant in one of your languages, you would experience fewer TOT states in that very language.
4. The amount of experienced TOTs should relate to factors that involve inhibitory control. Such that there should be fewer TOTs for those reporting more language switching (code switching or required language switching), because they are more used to controlling the competition of the lexical candidates. More TOTs should occur for those who experience language intrusions, as they are not as experienced with controlling the competition of the lexical candidates (Green & Abutalebi, 2013).
5. Highly proficient bilinguals will experience fewer TOTs because when you are highly proficient in a language, you are more trained in suppressing the competing non-target language during language production. Consequently, there will not be as high an activation of the competing lexical alternative as there would have been had you been less proficient (Green, 1998).

2. Method

2.1 General method

Participants. 29 out of 30 participants completed the study (23 women – 6 men). They were mainly recruited from the University of Agder by hanging up flyers and advertising in person in different classes at the university. All participants were between 18 and 40 years old, native speakers of Norwegian with no other home languages (except from English), and had a reasonable proficiency in English as a second language. They also had normal or corrected-to-normal vision and no other diagnosed language impairments such as dyslexia or stuttering. Our participants also took part in another study on sentence production in Norwegian-English bilingual processing. Upon completion, every participant was debriefed on the study and received a gift card for 200 NOK, either at Kvadraturen (city center in Kristiansand) or at Sørbok (the book store at University of Agder). The study was covered by an ethics approval from NSD (Norwegian Centre for Research Data) with reference code 158894.

General procedure. All components were completed on an offline Windows computer. All participants completed all parts of the study on two separate days. The order of languages in vocabulary and TOT tests were counterbalanced across participants with half completing the Norwegian day before the English and vice versa. The screening questions on the questionnaire were always completed before the first round of testing, and the rest of the questionnaire completed after the second round of testing. Norwegian and English TOT and vocabulary testing was never held on the same day. TOT tests in both languages were always run first, before vocabulary tests in the respective languages. In addition, participants completed a sentence production task, held in English, which was executed for the other previously mentioned study. This was always completed on a separate day or the same day as the English TOT and vocabulary test after a 90-120 minutes pause. All three rounds of testing took around 3.5 hours to complete.

2.2 Task Methods

2.2.1 Bilingual Profile Questionnaire

Materials and design. The questionnaire was adapted from the LEAP-Q from Marian et al. (2007). Our bilingual profile questionnaire consisted of four sections comprising (1)

screening questions, (2) language background questions, (3) Norwegian and English proficiency questions and (3) dialect and accent questions. Screening questions comprised all the inclusion criteria and gathered some general information about each participant such as date of birth, gender, academic education level and years of education. Details on how we adapted the questionnaire from Marian et al.'s LEAP-Q are discussed after the following description of the different questionnaire sections.

Questions about language background sought to record which languages the participant speaks, exposure to the different languages, percentage-time of speaking and reading each language, daily usage, their own identification with the languages and the different cultures related to them.

The questions about Norwegian and English proficiency mapped each participant's immersion in their Norwegian and English language environments. The section contained questions about the participant's understanding of how much different factors such as interaction with friends, colleagues and family; reading; school and education; self-instruction; watching TV and streaming; and listening to music and media have contributed to both their Norwegian and English language learning. This section also contained questions about recent exposure and the participants' self-rated proficiency and start age of hearing and reading and age of acquired fluency in both languages.

The dialect and accent questions recorded each participant's relation to their own accent both in English and Norwegian. Here they were asked about their perception of their own accents and whether or not they felt their English pronunciation and vocabulary was affected by their Norwegian mother tongue and how their Norwegian pronunciation and vocabulary might be affected by their English second language speaking. It also asked participants to rate the importance of correct pronunciation and their effort on how to improve their pronunciation. At last it also asked about how often or if the participant code-switches between Norwegian and English accidentally and/or intentionally.

The bilingual profile questionnaire was, as previously mentioned, based on Marian et al.'s LEAP-Q (2007). For screening questions we excluded questions about date of birth and date of immigration to the U.S. and added the following questions: Are you a native speaker of Norwegian; Is Norwegian the only language you speak at home (aside from perhaps English);

Are you a reasonably good speaker of English; Are you left or right handed; What is your country of birth; and What is your current country of residence?

For language background questions we added the following: the percentage of time spent speaking each language; the percentage of time spent reading each language; if they felt that they had once been better in one of their languages; if yes, in which language and at what age; in what language they do simple maths, dream, express anger or affection and talk to themselves.

For the proficiency section we only included questions about Norwegian and English proficiency, and not all other languages they knew (like with the Marian et al.'s LEAP-Q). On the question of immersion in each language environment, we changed the questions on school and working place to when the language is spoken ALL of the time and added when the language is also spoken SOME of the time. For how much different factors contributed to the learning of each language, we added the factor school and education. On the proficiency rating we excluded understanding spoken language and added pronunciation, writing, grammar, vocabulary and spelling in addition to speaking, and reading which was already there.

In the dialect and accent section we added the following questions; Which dialect of Norwegian do you speak; How important is speaking your own dialect for you; To what extent would you say you modify your own dialect when speaking to a person with a different dialect; Have you ever lived in an environment where you have been exposed to other dialects than your own for a longer period; If yes, which dialect and for how long; In your opinion, how strongly regional is your spoken Norwegian; What kind of accent do you think your spoken English has; How important is it for you to have a good accent when speaking English; How much effort have you put into improving your accent when speaking English; How would you rate your ability to imitate foreign accents and dialects; Are there any sounds in the English language you find difficult to pronounce; If yes, which one(s); Have you noticed any English speech sounds that are difficult for other Norwegians when speaking English; If yes, which one(s); When you are speaking English, do you ever find yourself accidentally mixing words or sentences from Norwegian and English; If yes, how often does English intrude to your Norwegian and vice versa; When you are speaking with a person who knows both Norwegian and English, do you ever find yourself intentionally

mixing words or sentences from Norwegian and English; If yes, how often do you do it when speaking English and vice versa. We also added rating of agreement with the following statements: it is important to me to speak grammatically correct English; I pay attention to how people pronounce words and sounds; I want to improve my pronunciation of English; If it were possible I would like to pronounce English like a native speaker; Pronunciation is not important to me because it does not affect how well I can communicate. At last we also asked about which form of written Norwegian they had predominantly been using, in case we were to control for that statement later on. All the questions were added to the original LEAP-Q to be able to build up a profile of each participant suited to both the Norwegian-language-mother-tongue-culture and English language culture.

2.2.2 Tip-of-the-tongue Experiments

Materials and design. We made two ToT-experiments: one for the English language and another for the Norwegian language. One stimuli set for English and one for Norwegian was made each comprising 80 target words with different definitions and questions. 40 were common nouns and 40 proper nouns. Within each of the 40 common nouns and 40 proper nouns there were 20 cognates and 20 non-cognates. All 80 target words chosen for stimuli

Table 2. *Table of means for Norwegian target words. M= means, R= range.*

Target word type	**Frequency pr. million (NoWaC)**		**No. of syllables**		**No. of phonemes**		**No. of characters**	
Common noun cognates	M	R	M	R	M	R	M	R
	0.695	0.6-5.2	2.85	1-4	6.95	3-12	7.25	4-12
Common noun non-cognates	0.690	0.09-2.1	2.25	1-4	5.90	3-10	6.45	4-11
Proper name cognates	0.679	0.02-2.5	2.65	1-5	6.85	4-12	7.65	5-14
Proper name non-cognates	0.682	0.003-3.01	2.85	2-5	7.10	4-12	8.20	5-13

Table 3. *Table of means for English target words. M= means, R= range.*

Target word type	**Frequency pr. million (CELEX)**		**No. of syllables**		**No. of phonemes**		**No. of characters**	
Common noun cognates	M	R	M	R	M	R	M	R
	2.43	0.57-12.75	3.00	1-5	6.85	3-12	7.60	5-13
Common noun non-cognates	2.31	0.46-7.16	2.60	2-4	6.70	4-10	8.10	5-12
Proper name cognates		NA	2.25	1-4	5.70	4-9	6.80	4-11
Proper name non-cognates		NA	2.30	1-4	6.10	3.9	7.15	4-11

were given 3 foils/alternatives, to be used at the end of the questioning if participants answered 3 for TOT during the experiment. The foil words per trial were created based on phonological similarity, semantic similarity, and the last foil word was a random word in the same word class as the target word.

Each target had to be a single low frequent word. This lead us to exclude all compounds in Norwegian, as these are most of the time constructed as single words compared to English two-or-more-word compounds. Additionally, the targets could not have any synonyms, as it was crucial that only one word would be available for retrieval each time. All the stimuli in both the English and Norwegian TOT test had to be matched as far as possible in frequency per million, number or letters and number of syllables. Table 2 and Table 3 on the previous page show a table of means and range for each target word condition. We revised our target words several times for these all to be matched in the best possible way.
When finding proper noun non-cognate target words for stimuli we used names from children's shows, Zodiac signs, islands, children's books and figures, Harry Potter, the Hobbit, and Lord of the Rings. In the English ToT test, proper noun target words were internationally known. In the Norwegian ToT test, proper nouns were both known internationally and nationally in Norway.

To be able to fulfill the criteria of low frequent target words in the Norwegian test, we used one of the few available web corpora named Norwegian Web as Corpus (NoWaC v 1.0) to check for word frequency (Guevara, 2010). The corpus consists of 700 million words found by scouring through and processing all documents found in the ".no-domain" on the Internet between November 2009 and January 2010, made by the University of Oslo, Norway. For the English TOT test, we used the corpus Centre for Lexical Information (CELEX) to check for word frequency (Baayen, Piepenbrock, & Gulikers, 1995). When searching for the frequency of possible target words to use for the TOT test, we had to take into account that there may be more of those words out there than both the English and Norwegian corpora say. Some words might have been misspelled, and the exact same word orthographically might be used in another context with another meaning. The NoWaC corpus is starting to age, so the frequency of various words might be different now than they were in 2009/2010, as we are now almost 10 years later. This is also the case for CELEX, which dates back to 1993, even older than NoWaC. Some target words were therefore discarded, as the word frequency reported by NoWaC would not be accurate according to the actual frequency today (e.g.

frequency of the proper noun Markle, as in Megan Markle now vs. 2009). The frequency for proper nouns was not applicable in CELEX, as CELEX only measures frequency for common nouns. Also, something to bear in mind is that it was not possible for us to compare English and Norwegian words any better than we did, as NoWaC and CELEX are two different types of corpora based on two languages that vary greatly in frequency and collected data size. Norwegian is a much smaller language than English both in frequency of use and vocabulary.

Procedure. Various trials of definitions and questions written black and centered on a white computer screen were used as stimuli. The target words were not known for the participants from before, and were meant to prime word-finding difficulties within each participant. By giving them definitions and questions with one low-frequent target word per trial, the participants might experience a tip-of-the-tongue state having trouble with coming up with the target word.

Participants were put in a chair in front of the screen while the experimenter sat on a separate chair on the participant's right-hand side. The experimenter operated the keyboard at all times during testing to not let any typing mistakes go unnoticed. The experimenter was also holding a tick sheet to make sure that all possible mistakes were recorded on a hard copy in case a wrong button was pressed or in case the participant answered something else than the correct word when pressing YES to knowing the word. Records from the tick sheets could be altered manually in the result files after ended testing. The 80 trials of stimuli per ToT test were divided into four blocks with 20 trials per block, with a planned non-restricted pause in between each block. The order of blocks was counterbalanced across participants using a Latin square design: 1234, 2341, 3412, and 4123. The order of definitions/target words within each block was the same.

An instruction page at the beginning of the experiment surfaced on the screen in front of the participants. They were asked to read through and tell the experimenter to continue when ready. At the beginning of each trial, a definition appeared on the screen. If the participant recognized the word at once, they were to tell the experimenter to press 1 for YES. Then they had to say the word out loud. The experimenter pressed c/r for correct answer, or w/f for the wrong answer. If the participant did not know the word, they had to tell the experimenter to press 2 for NO, and the experimenter pressed space. Then the test would move on to the next

trial. If the participants knew the word but experienced trouble with accessing it, they had to tell the experimenter to press 3 for TOT (tip-of-the-tongue). If button 3 was pressed for TOT, the participant was asked if they could guess which sound or letter the word started with. The next question asked if they could guess which sound or letter the word ended with. Both of these also had NO as an alternative. Then the trial moved on to asking if they knew how many syllables the word contained. The last element during alternative 3 for TOT asked if the word they were thinking of was one out of four listed alternatives. If not, there was a fifth alternative saying "None of the above." If they were indeed thinking of one of them, they had to ask the experimenter to press one of alternatives 1-4. After this, the test would continue with the next trial.

2.2.3 Vocabulary Tests

Materials and design. All target words in the vocabulary test had to be non-cognates in English/Norwegian so that the other language would not affect their knowledge about the target word. The target words in this part of the study had to have even lower frequency than those in the TOT experiments, as these words were meant to really test the participants' vocabulary in both English and Norwegian. Word frequencies on targets words were checked with corpus Subtlex-UK(Walter, van Heuven, Mandera, Keuleers & Brysbaert, 2014). The word frequencies in this corpus is based on subtitles from British television programs.

The vocabulary tests had 40 non-cognate target words per Norwegian and English test. 20 of these were synonyms, the other 20 antonyms. There was a mixture of verbs, nouns and adjectives. The English test comprised eight adjectives, six nouns, four verbs and two noun/verbs for synonyms; seven adjectives, six nouns, six verbs and one adjective/verb for the antonyms. The Norwegian test comprised eight adjectives, six nouns and six verbs for synonyms and the same for the antonyms. The mean length for the English vocabulary test was 6.9 characters for the 20 synonyms and 7.2 characters for the 20 antonyms. For the Norwegian the mean length of characters was 7.4 for both synonyms and antonyms. Thus, the Norwegian vocabulary test was the most matched in length and word class.

The frequency for the target words in the English vocabulary test had a mean of 2.7 in Subtlex-UK (van Heuven et al., 2014). It was not possible to look up the frequency for the target words in the Norwegian vocabulary test, as these words are very low frequent and very rarely used in the Norwegian language. We had to choose target words that were very low

frequent because, like with the issue for the TOT tests, there are many single words in Norwegian that are compounds, which in English form two words. There are also many cognates (words that share phonological, orthographic and semantic traits).

Each target word in the vocabulary tests had three foils. There was no apparent system used in creating the foils, but some were similar in form. For instance, on the target word vocation, one of the foils was vocabulary. This word starts with the same three letters as vocation, but has a very different meaning than the target word. Another example was the target word ponderous, a word easily confused with ponder, which means think. Thoughtful was one of the foils for ponderous.

Procedure. Participants were put in a chair in front of the screen while the experimenter sat on a separate chair on the participant's right-hand side. The experimenter operated the keyboard at all times during testing to not let any typing mistakes go unnoticed. An instruction page surfaced on the screen, and asked the participant to let the experimenter know when they had understood and wanted to continue. The next page gave the participant a word on top with four alternatives beneath it. It then asked the participant to choose the word among the alternatives 1-4 that was similar or closest in similarity (a synonym) to the word on top and ask the experimenter to press the corresponding button on the keyboard. There was also a fifth alternative saying "I don't know". After the experimenter pressed the alternative told by the participant, the next trial appeared on screen. The order of all trials for synonyms in the vocabulary tests was randomized.

Halfway through the test, after 20 trials, a new instruction page surfaced. The shift from the synonym to the antonym test served as a natural pause for the participants to take a break away from the screen if necessary. Thus, this break was not restricted either, like with the breaks during the TOT tests. Participants were now given the same instructions as before, except now they were to choose the word that was the most dissimilar to the one on top (an antonym). They were presented with the same amount of alternatives as before, including a fifth if they did not know. Also here, the order of all trials for antonyms was randomized.

3. Results

Language history measures	Norwegian history		English history	
	M	Range	M	Range
Self-reported general exposure (1-100%)	55.7	30-85	42.2	14-70
Language use (1-100%)				
Speaking	74.7	10-99	24.3	1-90
Reading	42.2	5-94	57	5-95
Preferred language	80.1	45-100	19.3	0-60
Self-reported proficiency[1] (0-10)				
Speaking (general fluency)	9.4	8-10	7.9	4-10
Pronunciation (accent)	9.4	7-10	7.4	3-10
Reading	8.9	4-10	7.8	3-10
Writing	8.0	3-10	7.2	2-10
Grammar	8.0	5-10	7.0	5-10
Vocabulary	7.7	4-10	6.8	2-10
Spelling	8.1	4-10	7.0	3-10
Age milestones (years)				
Started hearing	0	0	6.4	0-14
Became fluent in speaking	4.4	1-10	12.6	6-20
Started reading	5.1	3-7	7.3	4-10
Became fluent in reading	8.3	5-20	11.6	6-20
Start of fluency decline in earlier acquired language (N=23)	18.2	9-22		
Immersion (years)				
In a country	22.3	16-30	1.1	0-16.5
In a family	23.2	19-32.7	2.0	0-32.7
Contribution to language learning[2] (0-10)				
Interacting with friends/colleagues	6.5	0-10	5.6	0-10
Interacting with family	9.3	6-10	3.0	0-10
From reading (books, magazines, online)	6.4	2-10	7.7	3-10
From school and education	7.4	0-10	8.0	1-10
From self-instruction (apps or videos)	0.8	0-5	2.0	0-10
From watching TV or streaming	3.6	0-10	7.2	3-10
From listening to music/media	2.3	0-10	6.5	1-10
Extent of current language exposure[3]				
Interacting with friends	8.4	3-10	3.1	0-7
Interacting with family	9.0	1-10	1.2	0.9
From reading (books, magazines, online)	3.7	1-10	7.6	2-10
From self-instruction (apps or videos)	0.4	0-7	1.0	0-10
From watching TV or streaming	2.6	0-10	8.1	3-10
From listening to music/media	2.2	0-10	8.0	3-10
Language intrusions/-switching[4] (0-10)				
Accidentally				
English into Norwegian	3.1	0-8		
Norwegian into English			1.4	0-4
Intentionally				
English into Norwegian	4.3	0-10		
Norwegian into English			1.8	0-10

Note.
[1] 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*.
[2] 0 = *not a contributor*; 5 = *moderate* contributor; 10 = *most important contributor*.
[3] 0 = *never*; 5 = *half the time*; 10 = *almost always*.
[4] 0 = *never*; 5 = *half the time*; 10 = *almost always*.

Table 4. *Self-reported language history and proficiency for participants in the study.*

3.1 Participant descriptions (LEAP-Q)

All of our participants had Norwegian and English as their main languages. 29 out of 30 participants completed the study. Our participants were between 19 and 36 years of age, with

a mean age of 23.5 years. There were 23 women and 6 men; 25 being right handed. The mean of total years of education was 16.4. Most of the participants reported having spent more or less all their lives in a Norwegian environment. All but two participants reported their most dominant language to be Norwegian, and all participants identified first with the Norwegian culture; 15 of them also reported identification with a second culture.

All 29 participants spoke two languages, 24 spoke three languages, 7 spoke four languages and 1 spoke five languages. Across participants 11 languages were represented: Norwegian, English, Spanish, French, Swedish, Latin, Thai, Japanese, German, Italian, and Chinese. All participants but one reported the same order of language dominance as language acquisition order (Norwegian dominance). The majority of the participants reported calculating math, dreaming and expressing anger mostly in Norwegian (N=22). 17 participants reported talking to themselves in Norwegian; the other 12 mostly in English. All but one participant reported being born in Norway (the other USA) and all participants currently live in Norway.

Participants' self-reported language history and proficiency scores can be found in Table 4. The participants report a higher exposure and speaking activity in Norwegian than in English. On the other hand, they report a higher reading activity in English than in Norwegian. Most participants also report preferring to speak Norwegian in a context 80% of the time when given the option to speak any of their reported languages. Concerning proficiency, participants rated themselves highest in Norwegian speaking and pronunciation and lowest in Norwegian vocabulary, highest in English speaking and reading and lowest in English vocabulary. Overall, the participants' self-reported proficiency score was high across both Norwegian and English, but highest in Norwegian. Every participant stated that they started hearing Norwegian on a regular basis from birth. They spoke Norwegian fluently from a range of 1-10 years with a mean of 4.4 years. Start of Norwegian reading ranged from 3-7 years with a mean of 5.1 years. They acquired fluency in Norwegian reading from a range of 5-20 years, with a mean of 8.3 years. Recent exposure from Norwegian happened mostly through interaction with family, which also is the environment that contributed the most to their learning of Norwegian. Their start of speaking English ranged from 0-14 years, with a mean of 6.4. They reached fluency in speaking English from a range of 6-20 years and a mean of 12.6. They started reading English at ages ranged from 4-10, with a mean of 7.3 years, and reached fluency in reading English from the range of 6-20 years and a mean of

11.6. There were a few simultaneous[11] bilinguals among our participants, but most of them were sequential[12]. Recent exposure from English has happened mostly through watching TV/streaming and listening to music/media and reading. The factors contributing most to the learning of English was that of reading and school/education. Almost all participants stated that they intentionally mix words from English and Norwegian when speaking either language, more often mixing English words into their Norwegian than vice versa (mean of 4.3 out of 10, 43% of the time vs. mean of 1.8 out of 10, 18% of the time, respectively). Out of the participants that experience intrusions from either of their languages, they accidentally mix English into Norwegian at a mean of 31% of the time (3.1 out of 10). They accidentally mix Norwegian into English at a mean of 14% of the time (1.4 out of 10).

To sum up our participant descriptions, the participants are dominant in Norwegian, and English is their non-dominant language (except for two participants). The average age is relatively low. They generally prefer speaking in Norwegian if given the choice between Norwegian and English. The participants mostly speak in Norwegian compared to English, but read more in English than in Norwegian. Most of them have spent their whole lives within a Norwegian country or family, meaning that a lot of them have learnt their other languages in Norway, outside of a native environment. For Norwegian, their language learning has mostly been through speaking with family and learning it at school, while for English, their learning has mostly been through school, reading and recent exposure through TV, music and media (this also includes gaming for some of them). They report an overall high English proficiency (means ranging from 6.8-7.9 out of 10 on all aspects, see "Self-reported proficiency in Table 4). Recently, before testing, they have mostly used Norwegian interactively when speaking to friends and family, and mostly used English comprehension skills when reading, listening to music and watching TV/streaming. Almost all participants report that they language switch (intentionally mix words) between English and Norwegian during conversations. They mix English words in their Norwegian nearly half of the time (M=43%), and Norwegian words in their English much less often (M=18%). Those who experience intrusions when speaking either language sometimes have intrusions from English into their Norwegian (30 %) and less often intrusions from Norwegian into their English (14%).

[11] Simultaneous bilinguals start learning both languages from birth.
[12] Sequential bilinguals learn one language from birth, then another language at a later point in life.

3.2 Vocabulary tests results

The vocabulary results show a strikingly similar objective mean proficiency of both languages. The mean correct response rate in English and Norwegian was 35.4% and 35.2% respectively. The range was from 7.5% to 67.5% correct in English and from 10% to 70% correct in Norwegian. Thus, the percentage mean correct scores and range from both tests are more or less the same.

3.3 Factor analysis (LEAP-Q)

The data collected in the LEAP-Q was subjected to a factor analysis. For statistical analyses, non-numerical descriptive variables and any variables showing little variation were removed. For instance, all participants identified mostly with Norwegian culture. A correlation matrix was made for the remaining 77 variables. After this, we took out all variables that correlated higher than 0.8 with another variable. All variables that correlated more than 0.3 with at least one other variable and no correlations above 0.8 remained. This led to the removal of the following four variables, while leaving in their English counterpart: general exposure to Norwegian, Norwegian speaking time, the preference of speaking Norwegian, exposure to Norwegian through family. The three variables English pronunciation proficiency, English reading proficiency and English spelling proficiency were also removed because they correlated 0.8 or higher with another variable.

A parallel analysis was run on the remaining 70 variables, which calculated the optimal number of factors to be 8. These can be seen in Table 5 two pages down, listing all variables loading positively or negatively onto the different factors.

3.3.1 Factor descriptions

Factor 1 is *English Proficiency*. The highest positively loading variables onto it are related to different aspects of English proficiency, -use, -exposure and -learning. This means that the more you get of each of those variables, the better your English Proficiency is. The negatively loading variables are related to Norwegian accent, -exposure, and –use. The less you have of each of the negatively loading variables, the better your English proficiency is.

Factor 2 was named *Norwegian Informal Learning*. The seven most positively loading variables are related to Norwegian exposure and learning in informal settings such as self-instruction, music/media, TV/streaming and reading.

Factor 3 was given the name *Norwegian Proficiency*. The seven highest positively loading variables here were all related to different aspects of Norwegian proficiency, such as writing, grammar, vocabulary, spelling and reading. The more you get of each of these variables, the better your Norwegian proficiency gets.

Factor 4 is *Late English Fluency*. 7/8 positively loading variables relate to obtaining fluency in English at a later point, such as obtaining English fluency at a later age, being in a Norwegian environment, a later start of hearing English, a later starting age for fluent English reading and a Norwegian accent when speaking English.

Factor 5 is called *Improve English Pronunciation*. 8/10 positively loading variables relate to the improvement of English Pronunciation, for instance the wish to improve it, considering English accent important, wanting native accent and considering grammar important.

Factor 6 we named *Language Competition.* The highest positively loading variables are language competition, such as intrusion from Norwegian when speaking English, a higher starting age for reading English, more modifying of your own Norwegian dialect, higher age of reaching English reading fluency. All those variables may lead to an increase in language competition between Norwegian and English.

Factor 7 was named *Mixed Language Exposure*. The highest positively loading factors are the importance of speaking your own Norwegian dialect, having an obvious non-native English accent, Norwegian exposure through friends, English TV/streaming exposure, and attention to English pronunciation. All these variables may relate to experiencing a mix of English and Norwegian language exposure.

Factor 8 is *Late Norwegian Fluency*. The two most positively loading variables are a later starting age for reading Norwegian and a later age of reaching Norwegian reading fluency.

Table 5. Factors in our study.

Factor 1 **English Proficiency**	*Loading values*	**Factor 2** **Norwegian Informal Learning**	*Loading values*	**Factor 3** **Norwegian Proficiency**	*Loading values*	**Factor 4** **Late English Fluency**	*Loading values*
ENG Reading Time	0.81	NOR Exposure through Self-instruction	0.84	NOR Writing Proficiency	0.90	ENG Age of Fluent Speaking	0.82
ENG Vocabulary Proficiency	0.79	NOR Learning through Music/Media	0.83	NOR Reading Proficiency	0.89	NOR Environment Immersion	0.70
ENG Recent Reading Exposure	0.78	NOR Exposure through Music/Media	0.80	NOR Spelling Proficiency	0.84	ENG Starting Age Hearing	0.69
ENG Speaking Proficiency	0.76	NOR Learning through TV/Streaming	0.77	NOR Vocabulary Proficiency	0.72	ENG Age of Fluent Reading	0.68
ENG Grammar Proficiency	0.71	NOR Exposure through TV/Streaming	0.71	NOR Speaking Proficiency	0.68	ENG Starting Age Reading	0.57
ENG General Exposure	0.70	NOR Learning through Self-instruction	0.69	NOR Grammar Proficiency	0.49	ENG Obvious Non-native Accent	0.34
ENG Speaking Time	0.70	NOR Recent Reading Exposure	0.60	NOR Pronunciation Proficiency	0.43	ENG Norwegian Accent	0.32
ENG Writing Proficiency	0.67	ENG Learning through Self-instruction	0.41	NOR Environment Immersion	0.42	ENG Wish to Improve Pronunciation	0.30
ENG Exposure through Friends	0.61	ENG Learning through TV/Streaming	0.40	NOR Dialect Modification	0.41	ENG Attentive to Pronunciation	-0.44
ENG Learning through Reading	0.56	ENG Learning through Music/Media	0.40	ENG Writing Proficiency	0.40	ENG Exposure through Family	-0.54
ENG Speaking Preference	0.53	NOR Learning through School	0.36	ENG Grammar Proficiency	0.35	NOR Code switch with English	-0.58
ENG Learning through Friends	0.51	ENG Starting Age Reading	0.35	ENG Learning through Music/Media	-0.37	ENG Learning through Family	-0.67
ENG Grammar Important	0.49	NOR Learning through Reading	0.34	NOR Regional Accent	-0.38	ENG Code switch with Norwegian	-0.69
ENG Accent Important	0.46	NOR Exposure Other Dialects	0.33	NOR Intrusion from English	-0.45		
NOR Age of Fluent Speaking	0.46	ENG Learning through School	0.32				
ENG Music/Media Exposure	0.43	ENG Self-instruction Exposure	0.32				
ENG Exposure through Self-instruction	0.42						
ENG TV/Streaming Exposure	0.40						
NOR Age of Fluent Reading	0.33						
NOR Regional Accent	-0.34						
ENG Want Native Accent	-0.40						
NOR Exposure through Friends	-0.44						
ENG Learning through School	-0.50						
NOR Recent Reading Exposure	-0.60						
ENG Norwegian Accent	-0.75						
NOR Reading Time	-0.82						
Proportion Variance	0.15	Proportion Variance	0.09	Proportion Variance	0.09	Proportion Variance	0.08
Cumulative Variance	0.15	Cumulative Variance	0.24	Cumulative Variance	0.32	Cumulative Variance	0.41
Factor 5 **Improve English Pronunciation**	*Loading values*	**Factor 6** **Language Competition**	*Loading values*	**Factor 7** **Mixed Language Exposure**	*Loading values*	**Factor 8** **Late Norwegian Fluency**	*Loading values*
ENG Wish to Improve Pronunciation	0.75	ENG Intrusion from Norwegian	0.65	NOR Speaking Dialect Important	0.75	NOR Starting Age Reading	0.82
NOR Culture Identity	0.68	ENG Starting Age Reading	0.58	ENG Obvious Non-native Accent	0.59	NOR Age of Fluent Reading	0.68
ENG Accent Important	0.69	NOR Intrusion from English	0.51	NOR Exposure through Friends	0.45	NOR Speaking Proficiency	0.49
ENG Effort Improving Accent	0.57	NOR Dialect Modification	0.45	NOR Learning through School	0.44	Age	0.48
ENG Want Native Accent	0.50	ENG Age of Fluent Reading	0.40	ENG TV/Streaming Exposure	0.39	NOR Pronunciation Proficiency	0.46
NOR Pronunciation Proficiency	0.45	ENG Want Native Accent	0.39	ENG Attentive to Pronunciation	0.38	ENG Starting Age Hearing	0.36
ENG Grammar Important	0.33	NOR Learning through Family	0.39	ENG Grammar Important	0.35	NOR Age of Fluent Speaking	0.31
ENG TV/Streaming Exposure	0.32	ENG Music/Media Exposure	0.33	ENG Learning through School	0.33	NOR Exposure through Music/Media	-0.30
ENG Learning through TV/Streaming	0.30	ENG Learning through Friends	0.31	NOR Exposure through TV/Streaming	0.32	ENG Attentive to Pronunciation	-0.31
ENG Attentive to Pronunciation	0.33	NOR Regional Accent	-0.43	NOR Learning through Reading	0.31	ENG Learning through Reading	-0.32
NOR Learning through Reading	-0.35	ENG Speaking Time	-0.43	NOR Learning through Family	-0.40	NOR Grammar Proficiency	-0.33
ENG Learning through Friends	-0.43	ENG Self-instruction Exposure	-0.54	ENG Speaking Preference	-0.46	NOR Dialect Modification	-0.41
NOR Exposure Other Dialects	-0.44	ENG Learning through Self-instruction	-0.57	ENG Speaking Time	-0.48	NOR Learning through Reading	-0.44
Age	-0.59	NOR Age of Fluent Speaking	-0.57	NOR Learning through Friends	-0.52	NOR Exposure Other Dialects	-0.63
ENG Pronunciation Not Important	-0.72			ENG Exposure through Friends	-0.56		
Proportion Variance	0.07	Proportion Variance	0.07	Proportion Variance	0.06	Proportion Variance	0.06
Cumulative Variance	0.48	Cumulative Variance	0.55	Cumulative Variance	0.61	Cumulative Variance	0.67

8/14 variables relate to obtaining Norwegian fluency at a later age. 3 variables positively loading onto the factor is a later starting age for hearing Norwegian, a later age of obtaining Norwegian reading fluency and a later age of obtaining Norwegian speaking fluency. 4 variables negatively loading onto the factor are lower Norwegian grammar proficiency, less Norwegian dialect modification, less Norwegian learning through reading and less exposure to other Norwegian Dialects.

3.4 Experimental data (TOT experiments)

Statistical analyses were executed over raw numbers of TOTs and over the proportion of TOTs. The TOT experiments were analyzed across four conditions: Common noun cognates$_1$, Common noun non-cognates$_2$, Proper noun cognates$_3$, and Proper noun non-cognates$_4$. Table 6 on this page shows the TOT experiment scores with simple counts of TOTs, number of known and unknown words for each condition in both languages, and the proportion of TOTs.

As you can see, participants in total knew more words in Norwegian than in English. In Norwegian, they knew much more common noun non-cognates$_2$ and proper noun non-

Number											
	Norwegian				Norwegian total	English				English total	Grand Total
Conditions	Common noun	Common noun	Proper noun	Proper noun		Common noun	Common noun	Proper noun	Proper noun		
Response	cognates[1]	non-cognates[2]	cognates[3]	non-cognates[4]		cognates[1]	non-cognates[2]	cognates[3]	non-cognates[4]		
Known	184	265	151	260	**860**	155	137	83	127	**502**	1362
Unknown	370	287	409	299	**1365**	387	413	484	422	**1706**	3071
ToT	26	28	20	21	**95**	38	30	13	31	**112**	207
Correct phonological answer	39	36	40	29	**144**	29	36	11	31	**107**	
					Average					**Average**	
Tip-of-the-tongue proportion	0.12	0.10	0.12	0.07	**0.10**	0.20	0.18	0.14	0.20	0.18	
Total sum	580	580	580	580	2320	580	580	580	580	2320	4640

Table 6. *TOT experiment scores.*

cognates$_4$ than common noun cognates$_1$ and proper noun cognates$_3$. In English, they knew much less proper noun cognates$_3$, compared to common noun cognates$_1$, common noun non-cognates$_2$, and proper noun non-cognates$_4$.

Also, the participants in total had more unknown words in English than in Norwegian. In Norwegian they had less unknown common noun non-cognates$_2$ and proper noun non-cognates$_4$ than common noun cognates$_1$ and proper noun cognates$_3$. In English the participants had more unknown proper noun cognates$_3$ than common noun cognates$_1$, common noun non-cognates$_2$, and proper noun non-cognates$_4$.

The participants experienced fewer TOTs in Norwegian than English. They had more TOTs for common noun cognates$_1$ and proper noun non-cognates$_4$ in English than in Norwegian. There was a similar number of TOTs for common noun non-cognates$_2$ across languages. They had fewer TOTs for proper noun cognates$_3$ in English than Norwegian.

Within Norwegian, the participants experienced a similar number of TOTs across all conditions, while in English they experienced far fewer TOTs for proper noun cognates$_3$ than common noun cognates$_1$, common noun non-cognates$_2$, and proper noun non-cognates$_4$.

The proportion of TOTs was calculated by dividing the number of TOTs by the total number of known words (Knows and TOTs).[13] The total proportion of TOTs was greater in English than in Norwegian. It was also greater in English than Norwegian for common noun cognates$_1$, common noun non-cognates$_2$, and specifically greater for proper noun non-cognates$_4$. For English proper noun cognates$_3$, the TOT proportion was almost equal to that of proper noun cognates$_3$ in Norwegian.

Within Norwegian, the participants had the lowest proportion of TOTs for proper noun non-cognates$_4$. For the three other conditions, common noun cognates$_1$, common noun non-cognates$_2$ and proper noun cognates$_3$, the TOT proportion was similar.

Additionally, Table 6 shows the sum of correct phonological information access during TOTs in each condition and language. There were more correct phonological answers in Norwegian than in English. The number of correct phonological answers in Norwegian was lowest for proper noun non-cognates$_4$. For the conditions common noun cognates$_1$, common noun non-cognates$_2$, and proper noun cognates$_3$, the number of phonological correct answers was

[13] The formula was like this: TOTs/(Known+TOTs)= tip-of-the-tongue proportion. For instance with the Norwegian common noun cognates, that would be 26/(184+26)=~0.12.

similar. In English the number was lowest for proper noun cognates$_3$, while for the other conditions, the number was similar.

The number of phonological correct answers was equal across languages for common noun non-cognates$_2$ and almost equal across languages for proper noun non-cognates$_4$ (29 for Norwegian, 31 for English). They had fewer correct answers for common noun cognates$_1$, and far fewer correct answers for proper noun cognates$_3$ in English than in Norwegian.

We ran ANOVAs in the TOT experiment findings per response type (TOT, TOT proportion, Known and Unknown) The ANOVAS were two-way crossed with the factors of language (Norwegian, English) and condition (Common noun cognates$_1$, Common noun non-cognates$_2$, Proper noun cognates$_3$, Proper noun non-cognates$_4$). The ANOVA tested for two main effects (language and condition) and one interaction (language by condition).

No significant effects were found for the simple counts of TOTs. On the other hand, we did see a significant difference in the proportion of TOTs between Norwegian and English (p<.01).

For Known responses we found a significant difference between languages as a whole *(*p<.001) and a significant interaction between language and condition (p<.01). Common noun cognates$_1$ and Proper noun cognates$_3$ are the only conditions that significantly differ in English (p<.01). For Norwegian, both Common noun non-cognates$_2$ and Proper noun non-cognates$_4$ differ from Common noun cognates$_1$ and Proper noun cognates$_3$ (ps<.01).

For Unknown responses we also found a significant difference between the languages a whole (p>.001) and a significant interaction between language and condition (p<.01). Only Proper noun cognates$_3$ significantly differs from all other conditions in English (p<.01). Both Common noun non-cognates$_2$ and Proper noun non-cognates$_4$ differ from Common noun cognates$_1$ and Proper noun cognates$_3$ (ps<.01) (like with the “Know” responses, just in the opposite direction).

3.4.1 Regression analyses

Linear multiple regression analyses were run for TOT proportions and Unknown responses with the vocabulary scores and factors as predictors. The dependent variables from these

analyses are shown in Table 7, showing us which variables have a significant relationship with the TOT proportions and Unknown responses during the TOT experiments.

Predictors of TOT proportions

For English one variable showed a significant relationship. Mixed exposure to Norwegian and English was positively related to a higher proportion of English TOTs, such that more exposure of a mixture of English and Norwegian would result in a higher proportion of English TOTs. There were also two borderline predictors: the English vocabulary test that related negatively, and English proficiency that related positively, to English TOT proportions. This means that first, scoring lower on the English proficiency test would lead to a higher proportion of TOTs; second, participants with a higher proficiency in English would experience a higher proportion of TOTs in English.

For Norwegian there were four significant predictors: English proficiency related positively, Norwegian proficiency related negatively, and Language competition and Mixed language exposure, both related positively to Norwegian TOT proportions. This means that participants with a higher English proficiency, lower Norwegian proficiency, more language competition and more mixed language exposure would all experience a higher proportion of TOTs in Norwegian.

Predictors of Unknowns

Three factors significantly related to the number of English unknowns: the English vocabulary test related negatively, and late English fluency and language competition related positively to English unknowns. This means that participants that scored lower on the English vocabulary test, reached English fluency at a later point and experienced more language competition would know fewer words in the English TOT experiment.

English Unknowns			**Norwegian Unknowns**		
factor	*t-value*	*proportion value*	*factor*	*t-value*	*proportion value*
English Vocabulary Test	t=-3.490	p=0.00261 **	Norwegian Proficiency	t=-2.562	p=0.0196 *
Late English Fluency	t=2.222	p=0.03937 *	Late English Fluency	t=2.138	p=0.0465 *
Language Competition	t=2.839	p=0.01089 *			
English TOT Proportions			**Norwegian TOT Proportions**		
factor	*t-value*	*proportion value*	*factor*	*t-value*	*proportion value*
Mixed Language Exposure	t=2.106	p=0.0495 *	English Proficiency	t=2.220	p=0.039527 *
English Vocabulary Test	t=-2.048	p=0.0555 .	Norwegian Proficiency	t=-4.746	p=0.000161 ***
English Proficiency	t=2.061	p=0.0541 .	Language Competition	t=2.214	p=0.039981 *
			Mixed Language Exposure	t=2.287	p=0.034518 *

Table 7. *Dependent variables. ***= degree of significant relations. .= borderline significance***

Also, two factors were significantly related, to the Norwegian unknowns: Norwegian proficiency related negatively, and late English fluency related positively to the Norwegian unknowns. This means that the participants with lower Norwegian proficiency and who reached English fluency at a later point would know fewer words in the Norwegian TOT Experiment.

4. Discussion

Is this study we attempted to find which aspects of the bilingual profile relate to Norwegian-English bilinguals' issues with word finding. To do this, we performed two within participant experiments with 29 Norwegian-English bilinguals trying to induce tip-of-the-tongue experiences using definitions of low frequent words in each of the two languages. The participants were also subjected to vocabulary tests in both languages to get objective measures of proficiency. Additionally they answered a comprehensive self-rated bilingual language profile questionnaire measuring key aspects of their profile.

4.1 Significant findings in the TOT scores and factor correlations

No significant effects were found on the simple count of TOT states for Norwegian-English bilinguals. Therefore I cannot discuss the results based on the simple counts of TOTs. We did, on the other hand, find significant effects for TOT proportions, which show the amount of TOT states the participants experienced based on their total capacity of experiencing TOTs (words they know). The results show a significantly higher amount of TOT proportions in English than in Norwegian among our bilinguals.

Additionally, we found that the participants knew significantly more English common noun cognates$_1$ than proper noun cognates$_3$. For Norwegian, they knew significantly more common noun non-cognates$_2$ than both common noun cognates$_1$ and proper noun cognates$_3$, and significantly more proper noun non-cognates$_4$ than common noun cognates$_1$ and proper noun cognates$_3$.

For the words the participants did not know, they knew significantly fewer proper noun cognates$_3$ than common noun cognates$_1$, common noun non-cognates$_2$, and proper noun non-cognates$_4$ in English. For Norwegian, they knew significantly fewer common noun cognates$_1$

and proper noun cognates$_3$ than common noun non-cognates$_2$, and significantly fewer common noun cognates$_1$ and proper noun cognates$_3$ than proper noun non-cognates$_4$.

The regression analyses with the vocabulary scores and factors as predictors showed that for English TOT proportions, the more the bilinguals experienced mixed exposure of Norwegian and English (competition input), the higher proportion of English TOTs they got. Also, one borderline predictor showed that a smaller English vocabulary in our participants yielded a higher proportion of TOTs in English. Another borderline predictor showed that bilinguals who had a higher proficiency in English experienced a higher proportion of TOTs in English. In other words, higher TOT proportions in English were significantly related to what seems like competition from the two languages, and near significantly related to vocabulary size and proficiency in English.

There were four significant predictors for the Norwegian TOT proportions. First, the analyses showed that high English proficiency yielded a higher proportion of Norwegian TOTs in bilinguals. Also, low Norwegian proficiency, experiencing more language competition or being more exposed to Norwegian and English (competition input) yielded a higher proportion of Norwegian TOTs. The Norwegian TOT proportions in our study were therefore seemingly related to proficiency and language competition. Other findings in the regression analyses showed that having a smaller English vocabulary, acquiring fluency in English late or experiencing more language competition relates to bilinguals having a smaller vocabulary in English. In addition, analyses showed that a lower Norwegian proficiency and a later acquired fluency in English are related to bilinguals having a smaller vocabulary in Norwegian.

4.2 Discussion of TOT scores and factor correlations

4.2.1 TOT scores

The higher TOT proportions in English seem to be consistent with the weaker links predictions because our participants reported using Norwegian more frequently than English. They also stated Norwegian as their preferred language, being more exposed to Norwegian than English, and starting to hear Norwegian from birth (0) as opposed to English at a mean of 6.5 years. All these factors could indicate a higher frequency of Norwegian use, and

should therefore, also result in more TOTs in English than Norwegian. Higher TOT proportions in English than Norwegian is also consistent with the competition for selection hypothesis' prediction that you will get fewer TOTs in the language where you have the highest proficiency because you are then more trained to suppress the competing non-target language. The participants reported a higher proficiency in Norwegian than in English, which then coincides with them experiencing a higher proportion of TOTs in English than Norwegian. So taken together, the total TOT proportion scores seem to provide a combined support for both the weaker links- and competition account.

The weaker-links hypothesis predicted a cognate facilitation effect where cognate words would yield fewer TOTs, because of the Costa et al. (2000) prediction that cognates have only one phonological representation in both languages. The results in this study seem to contradict this prediction because the TOT proportions on cognates and non-cognates were fairly similar; it even looks like the participants experienced higher TOT proportions with cognates compared to non-cognates (even though this difference was not rendered significant). So, they did not experience lower TOT proportions with cognates, but our results did not significantly show whether they experienced higher TOT proportions with cognates either. Therefore, it seems like there was no cognate facilitation effect, which then, as said, contradicts the prediction from the weaker links hypothesis. The only place where one could maybe sense a cognate facilitation effect is between the English proper noun cognates and -non-cognates. But there may be another reason why proper noun non-cognate TOT proportions were this different compared to proper noun cognates. Finding proper noun non-cognate words in Norwegian and English was very challenging and demanding due to the similarity of the two languages (i.e. many cognates). To come up with enough non-cognate proper nouns in English and Norwegian, we had to look for target words in specific children's TV shows and in the Harry Potter-, and Lord of the Rings universe. Many of these shows, movies and books have non-cognate translations of their proper nouns, both in their titles and in the names of the various characters. In Norway, people have seen a lot of these shows an movies, and might for instance in the beginning have read the books or seen the dubbed movies in Norwegian. When getting older, they might have read or seen them again, but now in English. Therefore, the grounds for knowing the proper non-cognate words may be specifically linked to factors such as age of acquisition, language environment etc. and therefore may be based on different grounds for knowledge than the words in the other three conditions (i.e. the lack of available proper noun non-cognate words limits the possibility for

matching it properly with the other conditions). Summing up, all these challenging aspects of choosing the proper noun non-cognate stimuli might have put a restraint on their credibility. The high proportion of TOTs in non-cognate proper nouns could perhaps then be just an effect of too low frequent words that the participants thought that they had a TOT for the word in the target language, but in reality they did not.

The significant differences in unknown words across conditions and language tell us that in English, the proper noun cognate$_3$ target words were harder for our participants to find than all other three conditions. For Norwegian the common noun cognates$_1$ and proper noun cognates$_3$ were harder to find than proper noun non-cognates$_4$. This shows that in the English stimuli, the proper noun cognate$_3$ stimuli was much more difficult than the other three conditions, and in Norwegian the common noun cognate$_1$ and proper noun cognate$_3$ stimuli was more difficult than proper noun non-cognates$_4$. More even unknown results would have made the results more credible as the TOTs in the different conditions would then have occurred on more similar grounds than what they truly did in this study.

4.2.2 Factor correlations

That higher English proficiency and lower Norwegian proficiency related to higher TOT proportions in Norwegian, means that the participants in our study reporting a higher proficiency in English and a lower proficiency in Norwegian, experienced more TOTs in Norwegian. This would support the competition hypothesis' prediction, that a higher proficiency in a language reduced the need for the suppression of the other language due to better inhibitory control, and therefore might have lead to fewer TOTs in that language. The results just show this in a reversed manner. So, because proficiency in Norwegian was lower than in English, one had to suppress the English language while thinking for Norwegian, which then would lead to more experiences of TOTs in Norwegian. The need for suppression seemingly increased when speaking in Norwegian compared to English. Also, the participants who experienced a mixed and competitive input from both languages, in addition to more language competition, fell into more Norwegian TOTs. This may also support the competition hypothesis, seeing as both those factors deal with the competition of the two languages. The language competition factor includes a great mix of English and Norwegian variables (i.e. could lead to competition, hence the factor name) and amongst others the variables of language intrusions (see Table 5 in results section). The competition factor correlating significantly with higher TOT proportions in Norwegian could provide further

support for the competition account, seeing as experiencing more language intrusions could be interpreted as having less experience with controlling the other active non-target language in a conversation (Green & Abutalebi, 2013).

Our bilinguals' TOT proportions in English were higher for those who had experienced more mixture of exposure to both English and Norwegian. This may suggest that there is competition when mixed exposure to your two languages makes you experience a higher amount of TOTs out of your known vocabulary (i.e. support for competition for selection hypothesis). The English vocabulary test also reached a borderline significance where the English proportion of TOTs was higher for those who scored lower on the English vocabulary test (had smaller English vocabulary). Smaller vocabulary might be related to frequency of use, and therefore this may indicate support for the weaker links hypothesis. Another interesting borderline relation is that of the factor English Proficiency, meaning that those who rated themselves as having a higher English proficiency might also have experienced a higher proportion of TOTs in English. This would then contradict the predictions from the competition for selection hypothesis, as higher proficiency in English would have reduced the need for suppression of Norwegian, thus decreased the proportion of English TOTs. These last two discussed relations only reached a borderline significant effect, which means that one cannot make clear-cut arguments based on them.

4.3 Interesting patterns in the data

An interesting trend in the data is that the participants in two conditions, common noun non-cognates$_2$ and proper noun cognates$_4$, had the same or very similar amount of correct answers to phonology across languages. That our bilinguals have more or less the same access to phonology for common noun non-cognates$_2$ and proper noun cognates$_3$ in both languages, could, according to the weaker links hypothesis, could suggest that they use both languages equally frequent (the prediction that correct access to phonology in a language is related to frequency of use). On the other hand, for common noun cognates$_1$ and proper noun non-cognates$_4$, there are more correct answers to phonology in Norwegian than in English. Those results again may suggest that our bilinguals use the Norwegian language more frequently than English according to the weaker links hypothesis. Therefore, the results depicting our bilinguals' access to phonology could seem contradictory when discussing them in light of the predictions made by Gollan & Silverberg's (2001) weaker links hypothesis (because they

are similar for common noun non-cognates$_2$ and proper noun cognates$_3$, but different for common noun cognates$_1$ and proper noun non-cognates$_4$). The competition for selection account does not predict any degree of correct access to phonology as the hypothesis assumes that TOTs occur during lexical selection, therefore before phonological activation. None of the results from access to phonology have been validated for significance and must therefore be analyzed and investigated further for anyone to make any clear assumptions.

The similarity of TOT proportions for proper noun cognates$_3$ across Norwegian and English may indicate a support the weaker links prediction based on Costa et al.'s (2000) assumption that cognates share the same phonological representation across languages. The weaker links hypothesis makes this prediction because if cognates share phonological representation across languages, there will not be a difference based on frequency of use because the same representation is accessed regardless of the target language (Norwegian or English). At the same time, there is neither a noticeable similarity between the common noun cognates$_1$ across Norwegian and English nor a significant difference between them. Therefore the support for the weaker links hypothesis on this account is at best partial, and not fully arguable.

It is interesting to see that cognates and non-cognates within languages are similar for common nouns, but not for proper nouns in both Norwegian and English. So if I were to only look to the common noun TOT proportions, there would seem to be support for the competition account here predicting that the TOT proportions are not influenced by phonology. As for the proper nouns, although not proved to be significantly different, they may be different simply because of the before-mentioned difficulty with finding proper noun non-cognate stimuli.

It seems like there is evidence for the competition account with the prediction that you should experience fewer TOTs in your dominant language, because the number of TOTs should be connected to language dominance and other language dominance related factors. 27 out of 29 participants in the current study stated that their dominant language was Norwegian. Therefore, the result of higher proportions of TOTs in English (non-dominant language) seems consistent with this prediction.

4.4 Critique of the study and aspects that might have had a negative impact on results

Norwegian and English are two languages that are very similar, as I pointed out in the comparison section during the introduction. Because the languages are that similar, this could have led to a lot of mutual activation during our tip-of-the-tongue experiments. There are for instance so many cognates sharing phonological, semantic, and/or orthographical traits across both languages. The cognate issue is something that also made the process of creating stimuli for TOT experiments a challenging and time demanding one, trying to match the target words on frequency, letters, phonemes, and syllables as well as possible. The results from the TOT scores showing unknown and known words also show that the stimuli were not ideally matched, as some target words within certain conditions were significantly harder to come up with than others in the set of stimuli from both languages. The weakness of the similarity between the languages might have led to further competition that perhaps could have been avoided had we tested bilinguals with two more differing languages.

Additionally, we did not control for or manipulate translatability, which would have been a great way of securing that the stimuli probably would have been more known for the participants. That way, we could have gotten more genuine TOTs because there would have been a greater possibility of our participants knowing the target words. The set of definitions should also have been subjected to some sort of filtering or testing before running the experiments. That way, there would maybe have been less confusion around whether the definition for instance might have aimed for a common- or proper noun, which was the case during the testing of our subjects. The participants would have understood the definitions better in general as well.

The LEAP-Q also showed some weaknesses as the purpose of some of the questions we asked the participants about were hard to interpret. Having agreed on all questions and what they meant before we started testing subjects would have been an even better way to make sure the responses were as accurate as possible. The fact that the LEAP-Q in itself was based on self-ratings may also have impacted the results negatively, even though self-rated measures were proven to be sufficiently accurate by Marian et al. (2007). There is always a chance that some subjects are not as genuine when answering those kinds of questions, or

that for instance when rating proficiency, they do not have enough self-knowledge to rate themselves accordingly.

A clear weakness in this study is that the number of 30 participants is too low to be sure of the factors and the data in general. The fewer participants you have, the harder the factors may be to interpret, as the common ground for the variables is not as clear-cut, making it harder to see what makes the different variables correlate within a factor. This is what happened with the factor analyses in this study, where for some of the factors it was hard to see what they were really measuring. Moreover, the participant group did not vary enough on the more critical variables needed to make clearer assumptions as most of the bilinguals we tested shared both dominance and language use.

4.5 Suggestions for future research

Future research on the same topic should focus even more on matching the stimuli across conditions and also check the stimuli for translatability, and try to find a more diverse group of participants. That would make the results more credible than in the current study. It would also haven been interesting to look more into the access of phonology during TOT states, and to include a question, if the participant resolved a TOT state underway, of what made them resolve the TOT. For instance, using the current study as a base, adding a question like "If this TOT was resolved under way, which phonological information question helped you most in resolving the TOT?" Then the alternatives could have been "initial letter/sound", "final letter/sound" or "number of syllables". Adding that as a question in a future study would provide data on phonological/orthographical traits that may facilitate TOT resolution. A study with the same manipulations of stimuli as the current one, only with bilinguals where the other language apart from English is not as similar, would also be beneficial to do to check the impact language similarity may have on these type of studies.

4.6 Conclusion

The significant results in this study could seem to point towards most evidence for the competition for selection hypothesis. Even though, superficially, the higher proportion of TOTs in English than in Norwegian may seem to provide a combined support for both the weaker links hypothesis and the competition for selection hypothesis, the correlations of

factors seem to gear more towards support for the competition for selection account. The fact that it seemed like we could not find a cognate facilitation effect, and that mixed language exposure of English and Norwegian (could also be interpreted as competition input) significantly correlated with higher TOT proportions in both languages, may suggest that the TOT states were induced by the competition of two translation equivalents at the lexical level during the planning stages of language production. Another factor that for us seems to measure language competition in itself, with positively correlating variables of language intrusions, also significantly correlated with Norwegian TOT proportions. This seemingly provides further support for the competition for selection hypothesis. On the other hand, in addition to higher TOT proportions in English than in Norwegian, other results also seemed to provide support for the weaker links. Therefore I will not conclude as to which hypothesis holds the answer to the mechanism underlying the occurrences of tip-of-the-tongue states in bilinguals. I will simply state that more research is needed to make a more clear-cut assumption on the issue.

What I can say is that in the current study, the factors of the bilingual language profile that related most to TOT proportions in both languages were language competition both with interaction and input (mixed language exposure), and also proficiency and vocabulary knowledge. Due to the many challenges with our relatively low number of participants and the other weaknesses mentioned above, more research is needed on this topic to ensure credibility of how the bilingual disadvantage of tip-of-the-tongue states in word finding relates to the bilingual language profile.

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6. Appendices

6.1 Adapted Leap-Q

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 perhaps 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 glasses or contact lenses?		
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 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*	

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 percent of 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 percent of total time.

(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 fluent?

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)		
Reading		
Writing		
Grammar		
Vocabulary		
Spelling		

Q5 Please list what percent of 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 percent of total time.

(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 fluent?

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	

4. DIALECT AND ACCENT

Please answer these questions below about your Norwegian dialect and your accent when speaking English.
Please fill in your responses in the appropriate yellow boxes, and ask the experimenter if you have any questions.

Q1 Which dialect of Norwegian do you speak?

Q2 How important is speaking your own dialect for you on a scale of 0-10 (whereby 0 = not at all, 5 = moderately important, 10 = extremely important)?

Q3 To what extent would you say you modify your own dialect when speaking to a person with a different dialect on a scale of 0-10 (whereby 0 = not at all, 5 = moderately, 10 = totally)?

Q4 Have you lived in an environment where you have been exposed to other dialects than your own for a longer period of time (e.g. moving to a different city in Norway or living with someone who speaks another dialect)?

If yes, which dialect?

And for how long (in years)?

Q5 In your opinion how strongly regional is your spoken Norwegian on a scale of 0-10 (whereby 0 = not at all, 5 = moderately, 10 = very much)?

Q6 What kind of accent do you think your spoken English has (e.g., British / American / other / none in particular)?

Q7 In your view, how much of a Norwegian accent do you have when you speak English on a scale of 0-10? Whereby 0 = none, 1 = almost none, 2 = very light, 3 = light, 4 = some, 5 = moderate, 6 = considerable, 7 = heavy, 8 = very heavy, 9 = extremely heavy, 10 = pervasive.

Q8 To what extent do you think others identify you as a non-native speaker based on your ACCENT when speaking English on a scale of 0-10 (whereby 0 = never, 5 = half of the time 10 = always)?

Q9 How important is it for you to have a good accent when speaking English on a scale of 0-10 (whereby 0 = not at all, 5 = moderately important, 10 = extremely important)?

Q10 How much effort have you put into improving your accent when speaking English on a scale of 0-10 (whereby 0 = no effort at all, 5 = moderate effort, 10 = constant effort)?

Q11 How would you rate your ability to imitate foreign accents and dialects on a scale on a scale of 0-10 (whereby 0 = extremely poor, 5 = moderate, 10 = extremely good)?

Q12 Please rate the degree to which you agree with the following statements on a scale of 0-10 (whereby 0 = very strongly disagree, 10 = very strongly agree)?

Statement	**Rating**
It is important to me to speak grammatically correct English	
I pay attention to how people pronounce words and sounds	
I want to improve my pronunciation of English	
If it were possible I would like to pronounce English like a native speaker	
Pronunciation is not important to me because it does not affect how well I can communicate	

Q13 Are there any sounds in the English language you find difficult to pronounce?

If yes, which one(s)? (Write down the letter representing the sound or a word that contains the sound (capitalize the sound).

Q14 Have you noticed any English speech sounds that are difficult for other Norwegians when speaking English?

If yes, which one(s)? (Write down the letter representing the sound or a word that contains the sound (capitalize the sound).

Q15 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)?

Q16 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)?

Q17 Which written form of Norwegian have you predominantly been using?

END OF QUESTIONNAIRE - THANK YOU FOR YOUR TIME!

6.2 Stimuli for both experiments

Norwegian TOT stimuli					
Common noun cognates	**Definition**	**Target word**	**Foil 1**	**Foil 2**	**Foil 3**
1	Provisorisk naturtoalett brukt av militæret.	latrine	urinal	kantine	kaserne
2	Plagg som benyttes for å gi overkroppen en ønsket form av estetiske eller medisinske grunner.	korsett	neglisjé	støvlett	krage
3	Maskin som ved rotasjon skiller tunge stoffer fra lettere.	sentrifuge	trommel	segregering	sufragette
4	Generator som, typisk på sykler, omdanner mekanisk energi til elektrisk energi.	dynamo	motor	dogmatikk	termometer
5	En person, ting eller situasjon som utviser en tilsynelatende motstridende natur.	paradoks	dilemma	polaritet	meningsytring
6	Forkortelse som blir lest og uttalt som et vanlig ord.	akronym	anagram	monogram	konklusjon
7	Delen av ytterveggen på et hus som slutter seg til husets skrånende takflater; betegner også husets kortvegger.	gavl	møne	gulv	garasje
8	Regler for skikk og bruk i selskapslivet.	etikette	prosedyre	regelrett	norm
9	Ord som har navn etter en person, oppfinnelse eller enhet.	eponym	etymologi	antonym	kryssord
10	Problemer med tallregning.	dysleksi	analfabet	dysmenoré	valuta
11	Fredsmegler mellom to parter, en forsonende talsmann.	diplomat	taktiker	advokat	aktorat
12	En person som har det overordnede musikalske ansvaret i en menighet/kirke	kantor	dirigent	korridor	pastor
13	Tynt plastikkrør til å føre inn i urinrøret.	kateter	skalpell	kanyle	spekulum
14	En person som stopper ut dyr.	taksidermist	dermatolog	tapetserer	karikatur

15	Sykdomsutbrudd som strekker seg over hele verden eller store geografiske områder.	pandemi	bakterie	dermatitt	farsott
16	Krukke til å oppbevare aske fra avdøde mennesker.	urne	vase	kum	hendel
17	Oppdiktet fremtidig samfunn der alt er ubehagelig, kaldt og umenneskelig.	dystopi	diktatur	isotopi	profeti
18	Kalender med opplysninger om merkedager og helligdager og annet.	almanakk	dagbok	ammoniakk	primstav
19	Utendørs hagespill der en med trekøller slår kuler gjennom ståltrådbøyler.	krokket	golf	basket	boccia
20	Bruskskive som befinner seg mellom knoklene i kneleddet.	menisk	femur	meningitt	harnisk

Common noun non-cognates	**Definition**	**Target word**	**Foil 1**	**Foil 2**	**Foil 3**
1	Frontlokket på en bil.	panser	kalesje	plate	kaliper
2	Lagkonkurranse hvor hver deltager gjennomfører en del av den totale distansen.	stafett	maraton	ekspress	ilpost
3	Redskap som holder fiskesnøre.	snelle	stang	snekke	sjark
4	Væske som sprøytes inn i endetarmen for å fremkalle avføring.	klyster	stomi	cyste	gasett
5	Elektrisk uttak i veggen med hull der et støpsel kan plugges inn.	stikkontakt	fjernkontroll	stikling	reseptor
6	Blåsvarte bær med bitter smak, mest vanlig som hagebær.	solbær	krekling	blåbær	tranebær
7	Gul ugressblomst som kommer om våren, hvis væske setter flekker på klær.	løvetann	hestehov	løpstikke	engkarse
8	En rot man bruker som krydder i mat eller drikke. Finnes i frisk, tørket, malt og syltet variant.	ingefær	rosmarin	laurbær	estragon
9	Solskjerm over vindu, dør eller veranda.	markise	baldakin	remise	presenning

10	Innledning til en avisartikkel.	ingress	rapport	regress	interim
11	Virus som forårsaker betennelse i spyttkjertlene, slik at ansiktet hovner opp.	kusma	meslinger	astma	ødem
12	Sterkt truet kattedyr, størst utbredelse i Skandinavia og videre østover gjennom Russland til Sentral-Asia.	gaupe	røyskatt	jerv	mink
13	Innledende presentasjonssekvens til TV program eller film, gjerne med musikk.	vignett	epitaf	bankett	trailer
14	Overgangen mellom underliv og låret.	lyske	bekken	lymfe	nyre
15	Hinne på (særlig kokt) væske.	snerk	skorpe	skinn	flis
16	Stativ til lerret for malere.	staffeli	stillas	staffasje	armatur
17	Gammelt redskap til å spinne på.	rokk	tein	krok	vev
18	Læraktig syntetisk stoff, brukt f.eks. til vesker og møbler.	skai	duk	scuba	filt
19	Typisk materiale brukt til frakt av takeaway mat.	isopor	glava	isoterm	betong
20	Gammeldags ord for dagligvarebutikk.	kolonial	samvirkelag	filial	basar

Proper noun cognates	**Definition**	**Target word**	**Foil 1**	**Foil 2**	**Foil 3**
1	Hva het mannen i Bibelen som Jesus brakte til livet igjen?	Lasarus	Johannes	Salazar	Barabbas
2	Hva heter den britiske kolonien på sørspissen av Spania?	Gibraltar	Casablanca	Malta	Istanbul
3	Hva er navnet på den amerikanske romfergen som eksploderte rett etter oppskyting i 1986?	Challenger	Apollo	Columbia	Sputnik
4	Hva er etternavnet til Wendy i Peter Pan?	Darling	Bouquet	Spelling	Radcliffe
5	Hva er fornavnet til skuespilleren som spilte Kate i TVserien "Lost" og alven Tauriel i Hobbiten-filmene?	Evangeline	Melinda	Elizabeth	Sarah
6	Hva er etternavnet til skuespilleren som spilte hovedrollen i "Gjøkeredet"?	Nicholson	Harrison	Eccleston	Anderson
7	Hva heter den kjente filmtrilogien som omhandler livet til mafiaen?	Gudfaren	Sopranos	Nattsvermeren	Fellinis
8	Hva er det opprinnelige navnet til Gollum?	Smeagol	Bombur	Smilden	Fili
9	Hva het mannen som var amerikansk president under 2. verdenskrig, etter Roosevelt?	Truman	Reagan	Hoover	Nixon
10	Hva heter komponisten bak musikkstykket "De 4 årstider"?	Vivaldi	Beethoven	Garibaldi	Rasputin
11	Hva er etternavnet til den kjente britiske artisten Adele?	Adkins	Collins	Adams	Carter
12	Hva er etternavnet til den kvinnelige forfatteren av novellen "Karens jul"?	Skram	Collett	Sandell	Vesaas
13	Hva er etternavnet til forfatteren av "En tjenerinnes beretning"?	Atwood	Gillian	Aclott	Walker

14	Hva er etternavnet til mannen som spiller keyboard i A-ha?	Furuholmen	Ingebrigtsen	Furuseth	Hegerberg
15	Hva er etternavnet til forfatteren bak "Alice i Eventyrland"?	Carroll	Dickens	Carlyle	Christie
16	Hva er fornavnet til verdens raskeste mann?	Usain	Carl	Jessie	Tayeb
17	Hva er etternavnet til forfatteren av "Jungelboken"?	Kipling	Rushdie	King	Grisham
18	Hva er fornavnet til mannen som spiller Mr. Bean?	Rowan	Steven	Morgan	Rick
19	Hva heter øygruppen øst for Argentina som tilhører Storbritannia?	Falklandsøyene	Salomonøyene	Kanariøyene	Nimrodøyene
20	Hva het skipet som fraktet de første engelske bosetterne til Nord-Amerika i 1620?	Mayflower	Columbus	Mauretania	Titanic

Proper noun non-cognates	**Definition**	**Target word**	**Foil 1**	**Foil 2**	**Foil 3**
1	Hva heter husnissen til Malfangfamilien i Harry Potter?	Noldus	Gygrid	Noddy	Guffen
2	Hva heter eselvennen til Ole Brumm?	Tussi	Petter	Lassie	Robin
3	Hva heter tegneseriefiguren som blir sterk av spinat?	Skippern	Elmer	Skippy	Remus
4	Hva heter feen i filmen om Peter Pan?	Tingeling	Aurora	Tigelilje	Marina
5	På hvilken øy vest for Sør Amerika har Thor Heyerdahl satt sine føtter?	Påskeøya	Bermuda	Pinseøyene	Cuba
6	Hva heter vesnene i Ronja Røverdatter som bor i små huler?	Huldretussene	Hattifnattene	Huttetuene	Gorgene
7	Hva heter bestevennen til Mummitrollet som røyker pipe?	Snusmumrikken	Filifjonka	Snorkfrøken	Hemulen
8	Hva heter den blodige filmen fra 1970-tallet med sultne sjødyr?	Haisommer	Piraya	Vannhesten	Blekksprut

9	Hva er etternavnet til Bilbo i "Ringenes herre"?	Lommelun	Dumling	Langballe	Malfang
10	Hva heter tegneserien som handler om Baltus, hunden Sniff og vennene hans?	Knøttene	Smørbukk	Rocky	Wusslene
11	Hva er hjemlandet til Aleksander Rybak?	Hviterussland	Litauen	Usbekistan	Mongolia
12	Hva er navnet på Anne Cath. Vestlys velkjente pinnefigur?	Knerten	Morten	Kanutten	Bjarne
13	Hva heter trikkeføreren i Kardemomme by?	Syversen	Wiltersen	Simonsen	Johnsen
14	Hva heter skolehuset til Draco Malfang?	Smygard	Galtvang	Midgard	Heimdal
15	Hva heter stedet der hobbitene bor i Ringenes Herre?	Hobsyssel	Myrkskog	Harrenhal	Gudriksdal
16	Hva heter gården i romanen som den foreldreløse Anne flytter til?	Bjørkely	Tiriltoppen	Granli	Konnerud
17	Hva heter den oransje katten som elsker lasagne?	Pusur	Miss	Pondus	Lilo
18	Hva heter den gule hunden som gjemmer seg under papirklaffer i en serie barnebøker?	Tassen	Ludde	Timmy	Balto
19	Hva er Voldemorts opprinnelige etternavn?	Venster	DeMons	Benter	Sarumann
20	Hva er navnet til legen som helst unngår menneskelige pasienter?	Dyregod	Proktor	Jekyll	Watson

English TOT stimuli					
Common noun cognates	**Definition**	**Target word**	**Foil 1**	**Foil 2**	**Foil 3**
1	Hereditary social status or position conferred by a system based on class.	caste	estate	caliber	globe
2	Medieval forerunner of chemistry.	alchemy	thaumaturge	augury	astrology
3	A person unnecessarily anxious about their health.	hypochondriac	valetudinarian	hypothermia	vassal
4	A phrase or manner of expression natural or peculiar to a particular language.	idiom	vernacular	colloquium	asterisk

5	Game like hockey but with ball caught by, carried, and thrown from a net on a stick.	lacrosse	polo	shinty	hurling
6	Adherent of the view that whether God exists is unknown.	agnostic	atheist	prognostic	academic
7	Stoppered glass vessel, in which spirits are brought to the table.	decanter	tankard	dispenser	cherub
8	An irrational, overwhelming fear.	phobia	psychosis	physiognomy	phylum
9	The study of the developing foetus before birth.	embryology	cytology	etiology	genetics
10	To keep eggs warm until hatching.	incubation	gestation	enervation	development
11	A piece of jewelry thought to be a magical charm or protection against evil or disease.	amulet	ornament	ampoule	collar
12	Political segregation involving discrimination against people who are not Whites.	apartheid	disunion	apostate	recreant
13	Relating to or coming from stars.	astral	lustral	asporate	static
14	A system that supplies fields with water using channels or streams.	irrigation	reservoir	implication	synthesis
15	Someone who bears a child for another person.	surrogate	substitute	supplicant	deputy
16	A cruel and oppressive dictator.	tyrant	martinet	vagrant	bully
17	A person from a roaming, migratory culture.	nomad	pilgrim	nematode	savant
18	A bird sanctuary or building where birds are kept.	aviary	corral	aversion	lair
19	A pleasure-seeking persin devoted only to enjoyment.	hedonist	gourmand	Hellenist	customer
20	An opponent a person cannot overcome and the goddess of divine retribution.	nemesis	Medusa	siren	egress

Common noun non-cognates	**Definition**	**Target word**	**Foil 1**	**Foil 2**	**Foil 3**
1	A large escape of blood from vessels including internal as well as external bleeding.	haemorrhage	contusion	blockage	apoplexy
2	Able to read and write.	literate	professor	proletariat	adjunct

3	The complete remains of a dead animal, especially at a butcher's.	carcass	remains	corpse	skin
4	Someone who listens to other people's conversations.	eavesdropper	blabbermouth	auditor	sloth
5	A person or animal that eats both plants and flesh.	omnivore	herbivore	predator	voraciousness
6	The crime of making false statements under oath	perjury	ditortion	merger	attenuation
7	A small shining disk or spangle used for ornamentation on clothing.	sequin	tinsel	beacon	sparkler
8	The meat of a deer.	venison	sirloin	brisket	rump
9	A person who brings suit to a court of law.	plaintiff	contractor	accusative	litigator
10	A rolling staircase.	escalator	cascade	conveyor	vestibule
11	An acute shortage of food.	famine	paucity	gamin	drought
12	The broken remains of a building that has been destroyed.	rubble	detritus	rabble	scrub
13	An animal that feeds on dead matter.	scavenger	sycophant	scrounger	bloodsucker
14	A rush of animals running together in panic.	stampede	commotion	scattering	exodus
15	An irrational belief in omens or magic.	superstition	persuasion	supposition	aspersion
16	A sharp hooked claw especially on a bird of prey.	talon	grapnel	tarpaulin	barb
17	A crime that undermines the offender’s government.	treason	mutiny	regression	retrenchment
18	A prejudiced person who is intolerant of any opinions differing from his own.	bigot	stickler	rivet	kippa
19	A young bird with its first feathers or any new participant in some activity.	fledgling	cygnet	leveret	gelding
20	Someone who is punished for the errors of others.	scapegoat	hostage	turncoat	lamb

Proper noun cognates	**Definition**	**Target word**	**Foil 1**	**Foil 2**	**Foil 3**
1	What is the last name of the author of "Animal farm"?	Orwell	Austin	Rowling	Elliot
2	What is the original last name of the boxer who became known as Mohammed Ali?	Clay	Grey	Ried	Grant
3	What is the last name of the author of Little Women?	Alcott	Browning	Sewell	Bronte
4	What is the last name of the cosmonaut who was the first person to orbit the earth?	Gagarin	Ivanov	Patrovski-Ssaxe	Solokov
5	What is the last name of the British Queen's husband?	Mountbatten	Windsor	Coburg	Wales
6	What was Princess Dianna's maiden name?	Spencer	Ogilvy	Lawrence	Philips
7	What is the last name of the female star of "Pretty Woman"?	Roberts	Taylor	Aniston	Stone
8	What is the first name of Paul McCartney's first wife?	Linda	Susan	Grace	Sylvia
9	What is the last name of the actress who played Dorothy in "The Wizard of Oz"?	Garland	Crawford	Lansbury	Harlow
10	What is the last name of the director of the "Lord of the Rings" films?	Jackson	Lynch	Scorsese	Anderson
11	What is the last name of the director of the film "Moulin Rouge"?	Luhrmann	Kubrick	Burton	Nolan
12	What is the last name of the author of the "James Bond" novels?	Fleming	Chandler	Christie	Fanning
13	What is the last name of the author of "Dracula"?	Stoker	Swift	Wells	Hardy
14	What is the last name of the author of "Frankenstein"?	Shelley	Wilde	Kafka	Carroll
15	What is the last name of the black athlete who 4 gold medals at the 1936 Berlin Olympic Games?	Owens	Lewis	Long	Metcalf
16	What is the last name of the Scottish actor who payed the lead in "Trainspotting"?	McGregor	McAlistair	Macintosh	McKenzie
17	What is the first name of the actor who played the original Dr. Spock in Star Trek?	Leonard	William	Drew	Lesley

18	What is the name of the island state south of Australia?	Tasmania	Madagascar	Borneo	Sri Lanka
19	What is the name of the capital of Indonesia?	Jakarta	Bangkok	Hanoi	Phnom Penh
20	What is the name of the langage mostly spoken in Sri Lanka?	Tamil	Hindi	Bengali	Malayalam

Proper noun non-cognates	**Definition**	**Target word**	**Foil 1**	**Foil 2**	**Foil 3**
1	White and black beagle whose best friend is Charlie Brown.	Snoopy	Fido	Ruby	Copper
2	American animated children's TV series on Nickelodeon depicting a group of toddlers.	Rugrats	Teletubbies	Rascals	Flintstones
3	Garfield's canine friend.	Odie	Pongo	Brody	Pluto
4	American western TV drama that aired from 1955-75 with Burt Reynolds as one of the leads.	Gunsmoke	Westworld	Greyzone	Nashville
5	British children's TV series about creatures who live on a small moon-like planet who only speak in whistles.	Clangers	Muppets	Mangers	Fraggles
6	The blue creature in the British children's TV series "the Night Garden".	Igglepiggle	Scooby-Doo	Periwinkle	Tintin
7	A brown chimpanzee, whose best friend is "The Man with The Yellow Hat".	George	Charles	Gideon	Hugo
8	One of the twelve sign of the Zodiac, whose symbol is a pair of twins.	Gemini	Samurai	Sagittarius	Libra
9	A red-bearded overweight viking in a comic strip.	Hägar	Odin	Hardbard	Dagwood
10	Tall cartoon character whose best friend is Mickey Mouse.	Goofy	Bender	Daffy	Dennis
11	Children's horror book series and written by R.L.Stine.	Goosebumps	Busytown	Deadwood	Outsiders
12	Female Polynesian Disney character who sails out on a daring mission to save her people.	Moana	Ariel	Diana	Matilda

13	A blue haired boy in a children's tv series – who helps fix problems with his friends' vehicles.	Benjy	Pat	Henry	Alfred
14	Giant three-headed dog – used as a guardian for the Philosopher's Stone in Harry Potter.	Fluffy	Griphook	Buffy	Casper
15	American animated TV series following Hewey, Dewey, and Louie on various adventures.	Ducktales	Powerpuff	Talespin	Futurama
16	A children's TV program featuring three small clay monsters.	Plonsters	Boxtrolls	Monsters	Flanders
17	The third book in The Old Testament.	Leviticus	Ephesians	Ecclesiasticus	Lamentations
18	British police drama series set in the fictitious smalltown of Aidensfield, Yorkshire in the 1960's.	Heartbeat	Eastenders	Misfits	Episodes
19	Elvish realm in Tolkien's Middle Earth.	Rivendell	Asgard	Arendell	Brigadoon
20	Dumbledore’s loyal phoenix, who comes to Harry Potter's aid in the Chamber of Secrets.	Fawkes	Buckbeak	Felix	Flit

6.3 Words for vocabulary tests

ENGLISH VOCABULARY TEST

Test	Language	Item	Word	Length	WordFreq	DomPos_UK	DomPos_dic	Correct	FoilA	FoilB	FoilC	CorrectFreq	FoilAFreq	FoilBFreq	FoilCFreq	Source
syno	E	1	caprice	7	2,73	noun	n	whim	cattle	brute	lounge	3,16	4,25	3,33	4,19	SubtlexUK
syno	E	2	baffle	7	2,6	verb	v	confuse	hide	warp	bully	3,5	4,66	3,19	3,72	SubtlexUK
syno	E	3	ponderous	9	2,39	adjective	a	unwieldy	useless	supportive	thoughtful	2,56	4,1	3,87	3,52	SubtlexUK
syno	E	4	banter	8	3,66	noun	n/v	chatting	whispering	denial	beating	4,03	3,43	3,6	4,31	SubtlexUK
syno	E	5	garish	6	2,85	adjective	a	tasteless	spiky	green	bland	2,96	3,51	5,22	3,5	SubtlexUK
syno	E	6	sequin	6	2,36	noun	n	bead	stamp	sledge	order	2,93	4,2	3,3	5,15	SubtlexUK
syno	E	7	loquacious	10	1,87	adjective	a	talkative	broad	roomy	marshy	2,69	4,22	2,95	2,63	SubtlexUK
syno	E	8	covet	5	2,39	verb	v	desire	pad	cradle	cave	4,24	3,97	3,46	4,19	SubtlexUK
syno	E	9	acumen	6	2,65	noun	n	cleverness	blame	spicy	wealth	2,44	4,66	3,98	4,33	SubtlexUK
syno	E	10	drench	6	2,06	noun	n/v	soak	raise	erase	flatten	3,78	4,85	3,08	3,24	SubtlexUK
syno	E	11	abide	5	3,45	verb	v	endure	inhabit	crave	depart	3,5	2,99	3,13	3,27	SubtlexUK
syno	E	12	vocation	8	3,14	noun	n	occupation	holiday	pronunciation	vocabulary	3,86	4,94	3,09	3,43	SubtlexUK
syno	E	13	gulch	5	1,81	name	n	crevasse	swallow	shed	dislike	2,42	3,89	4,38	3,52	SubtlexUK
syno	E	14	cogitate	8	1,9	verb	v	ponder	achieve	succeed	enquire	3,06	4,66	4,15	2,75	SubtlexUK
syno	E	15	vexatious	9	2,02	adjective	a	effortful	engaging	horrifying	priceless	1,3	3,75	3,19	3,7	SubtlexUK
syno	E	16	peril	5	3,39	noun	n	danger	shiny	delight	shelter	4,75	4,15	4,04	4,13	SubtlexUK
syno	E	17	feral	5	3,13	adjective	a	savage	hungry	impartial	ugly	3,83	4,55	3,24	4,23	SubtlexUK
syno	E	18	ludicrous	9	4,41	adjective	a	ridiculous	developed	nasty	certain	4,57	4,51	4,45	4,99	SubtlexUK
syno	E	19	brisk	5	3,35	adjective	a	energetic	disposable	section	stern	3,58	3,31	4,53	3,57	SubtlexUK
syno	E	20	truculent	9	1,74	adjective	a	defiant	delicious	juicy	tardy	3,22	4,66	3,86	2,3	SubtlexUK

Test	Language	Item	Word	Length	WordFreq	DomPos_UK	DomPos_dic	Correct	FoilA	FoilB	FoilC	CorrectFreq	FoilAFreq	FoilBFreq	FoilCFreq	Source
anto	E	1	concerned	6	4,93	verb	a	uncaring	scarce	misleading	understanding	2,48	3,51	3,64	4,47	SubtlexUK
anto	E	2	timorous	8	1,81	adjective	a	fearless	forestry	funny	emotive	3,51	3,56	5,06	3,22	SubtlexUK
anto	E	3	disdain	9	2,73	noun	n	admire	unload	misfortune	huge	3,97	3,12	3,18	5,32	SubtlexUK
anto	E	4	acerbic	7	2,17	adjective	a	sweet	itchy	loud	beautiful	4,98	3,45	4,48	5,42	SubtlexUK
anto	E	5	nonplus	7			v	enlighten	subtract	gain	disadvantage	3,12	2,62	4,34	3,6	SubtlexUK
anto	E	6	surfeit	7	1,84	noun	n	lack	southern	excess	fake	4,62	4,5	4	4,51	SubtlexUK
anto	E	7	vicious	7	3,87	adjective	a	gentle	slippery	fierce	disobedient	4,23	3,84	3,97	2,34	SubtlexUK
anto	E	8	saunter	7	2,25	verb	v	rush	fry	punish	daydream	4,44	4,19	3,64	2,9	SubtlexUK
anto	E	9	slipshod	8	1,6	adjective	a	careful	difficult	clumsy	footwear	4,84	5,4	3,63	3,24	SubtlexUK
anto	E	10	umbrage	7	2,14	noun	a/n	delight	dungeon	demanding	appeal	4,04	3,14	4,09	4,59	SubtlexUK
anto	E	11	strenuous	9	2,92	adjective	a	effortless	arduous	smooth	tricky	3,13	3,06	4,36	4,51	SubtlexUK
anto	E	12	divulge	7	2,67	verb	v	conceal	purchase	disclose	smuggle	3,24	4,28	3,22	3,12	SubtlexUK
anto	E	13	loathe	6	3,16	verb	v	cherish	rejoice	kindle	undress	3,37	3,22	2,73	2,68	SubtlexUK
anto	E	14	querulous	9	1,3	adjective	a	agreeable	feathered	blatant	squeaky	3,03	3,14	3,19	3,42	SubtlexUK
anto	E	15	forgo	5	2,55	verb	v	acquire	precede	journey	disappear	3,46	2,53	4,91	4,21	SubtlexUK
anto	E	16	conquer	7	3,64	verb	v	surrender	demand	retain	release	3,76	4,56	3,9	4,6	SubtlexUK
anto	E	17	hovel	5	2,57	noun	n	palace	float	cloudy	stairwell	4,55	3,96	4,17	2,93	SubtlexUK
anto	E	18	adversity	9	3,24	noun	n	advantage	delay	grudge	persevere	4,67	4,11	3,19	2,85	SubtlexUK
anto	E	19	alacrity	8	2,08	noun	n	slowness	annoyance	fog	ingenuity	2,33	3,03	4,08	3,31	SubtlexUK
anto	E	20	penury	6	2,02	noun	n	wealth	dispatch	cunning	famine	4,33	3,34	3,82	3,62	SubtlexUK

NORWEGIAN VOCABULARY TEST

Test	Language	Item	Word	Length	WordFreq	DomPos_UK	DomPos_dic	Correct	FoilA	FoilB	FoilC	CorrectFreq	FoilAFreq	FoilBFreq	FoilCFreq	Source
syno	N	1	lektyre	7			n	lesestoff	leker	hytte	husdyr					NoWaC
syno	N	2	ufortrøden	10			a	uforstyrrelig	uforbederlig	ufokusert	fornøden					NoWaC
syno	N	3	noksagt	7			n	dumrian	ferdigstilt	selvdyrker	påstand					NoWaC
syno	N	4	lemfeldig	9			a	forsiktig	uberegnelig	langsom	frimodig					NoWaC
syno	N	5	febrilsk	8			a	hektisk	illevarslende	tilstrekkelig	varmblodig					NoWaC
syno	N	6	brudulje	8			n	slagsmål	ekteskap	floke	etterligning					NoWaC
syno	N	7	fjetre	6			v	lamme	røpe	legere	finne					NoWaC
syno	N	8	vankelmodig	11			a	ubestemt	nådeløs	mangelfull	hyklersk					NoWaC
syno	N	9	attrå	5			v	begjære	fornærme	avslå	trampe					NoWaC
syno	N	10	kryste	6			v	klemme	brodere	savne	forfølge					NoWaC
syno	N	11	amper	5			a	hissig	skyldig	travel	fyldig					NoWaC
syno	N	12	smektende	9			a	lengtende	spinkel	smakfull	buktende					NoWaC
syno	N	13	maroder	7			a	utmattet	blodtørstig	spenstig	hevngjerrig					NoWaC
syno	N	14	trettekjær	10			n	kranglete	grådig	kresen	svak					NoWaC
syno	N	15	fadese	6			n	tabbe	utside	krig	vegring					NoWaC
syno	N	16	mulkt	5			n	bot	dystert	sveiv	svalt					NoWaC
syno	N	17	atal	4			a	plagsom	sløv	dyktig	hvass					NoWaC
syno	N	18	vansmekte	9			v	lide	gnage	avsky	forgifte					NoWaC
syno	N	19	sondre	6			v	skille	undersøke	forske	vise					NoWaC
syno	N	20	omkalfatre	10			v	endevende	oppfatte	omkomme	omlegge					NoWaC

Test	Language	Item	Word	Length	WordFreq	DomPos_UK	DomPos_dic	Correct	FoilA	FoilB	FoilC	CorrectFreq	FoilAFreq	FoilBFreq	FoilCFreq	Source
anto	N	1	lapidarisk	10			a	pratesyk	usann	kortfattet	fremmed					NoWaC
anto	N	2	distré	6			a	oppmerksom	utakknemlig	motsatt	fordelt					NoWaC
anto	N	3	sjofel	6			a	hyggelig	annerledes	lumpen	skjærende					NoWaC
anto	N	4	vanvidd	7			n	fornuft	ordstrid	viktighet	velklang					NoWaC
anto	N	5	armod	5			n	rikdom	avsporing	elendighet	bopel					NoWaC
anto	N	6	overflod	8			n	fattigdom	omskifte	flom	vrede					NoWaC
anto	N	7	avertere	8			v	skjule	tirre	kunngjøre	forstyrre					NoWaC
anto	N	8	nennsom	7			a	voldsom	sparsom	virksom	strevsom					NoWaC
anto	N	9	ødsle	5			v	spare	hevde	nære	tvile					NoWaC
anto	N	10	bebreide	8			v	bersømme	beleire	betvile	betenke					NoWaC
anto	N	11	uaffisert	9			a	påvirket	redigert	offentlig	merkelig					NoWaC
anto	N	12	besynderlig	11			a	alminnelig	snevert	omfattende	anerkjent					NoWaC
anto	N	13	ublu	4			a	rimelig	skjør	freidig	skral					NoWaC
anto	N	14	hovmod	6			n	ydmykhet	angst	avskjed	tilregnelighet					NoWaC
anto	N	15	anfektelse	10			n	visshet	forhindring	åpenbaring	straff					NoWaC
anto	N	14	petimeter	9			n	slask	lekmann	tommestokk	skritt-teller					NoWaC
anto	N	17	avferdige	9			v	godta	avslutte	forhindre	testamentere					NoWaC
anto	N	18	bifalle	7			v	avvise	tilta	snuble	erobre					NoWaC
anto	N	19	fetere	6			v	overse	pine	ernære	flytte					NoWaC
anto	N	20	nidkjær	7			a	slurvete	trassig	selvopptatt	streng					NoWaC

6.4 Factors with original variable- and factor names

Factor RC1 **English Proficiency**	*Loading values*	**Factor RC3** **Norwegian Informal Learning**	*Loading values*	**Factor RC2** **Norwegian Proficiency**	*Loading values*	**Factor RC5** **Late English Fluency**	*Loading values*
ENG Reading	0.81	Q3d_Expos_SelfInstruct_Nor	0.84	Q5e_Prof_Writing_Nor	0.90	Q5f_FluentSpeaking_Age_Eng	0.82
ENG Vocabulary Proficiency	0.79	Q2g_Contrib_Music_Nor	0.83	Q4c_Prof_Reading_Nor	0.89	Q1a_Country_Nor	0.70
ENG Recent Reading Exposure	0.78	Q3f_Expos_Music_Nor	0.80	Q4g_Prof_Spelling_Nor	0.84	Q5e_StartHearing_Age_Eng	0.69
ENG Speaking Proficiency	0.76	Q2f_Contrib_TV_Nor	0.77	Q4f_Prof_Vocab_Nor	0.72	Q5h_FluentReading_Age_Eng	0.68
ENG Grammar Proficiency	0.71	Q3e_Expos_TV_Nor	0.71	Q4a_Prof_Speak_Nor	0.68	Q5g_StartReading_Age_Eng	0.57
ENG General Exposure	0.70	Q2e_Contrib_SelfInstruct_Nor	0.69	Q4e_Prof_Grammar_Nor	0.49	Q8_Accent_NonNative_Obvious	0.34
Q4b_Speaking_Eng	0.70	Q3c_Expos_Reading_Nor	0.60	Q4b_Prof_Pronoucing_Nor	0.43	Q7_Heavy_NorsktoEng_Accent	0.32
Q4k_Prof_Writing_Eng	0.67	Q2l_Contrib_SelfInstruct_Eng	0.41	Q1a_Country_Nor	0.42	Q12c_Improve_Pronounciation	0.30
Q3g_Expos_InteractFriend_Eng	0.61	Q2m_Contrib_TV_Eng	0.40	Q3_Dialect_Modify	0.41	Q12b_Attention_Pronounciation	-0.44
Q2j_Contrib_Reading_Eng	0.56	Q2n_Contrib_Music_Eng	0.40	Q4k_Prof_Writing_Eng	0.40	Q3h_Expos_InteractFamily_Eng	-0.54
Q6b_Choice_Eng	0.53	Q2d_Contrib_School_Nor	0.36	Q4l_Prof_Grammar_Eng	0.35	Q16a_Intentional_SubIn_Eng	-0.58
Q2h_Contrib_InteractFriend_Eng	0.51	Q5g_StartReading_Age_Eng	0.35	Q2n_Contrib_Music_Eng	-0.37	Q2i_Contrib_InteractFamily_Eng1	-0.67
Q12a_Grammar_Correct_Eng	0.49	Q2c_Contrib_Reading_Nor	0.34	Q5_Regional_Rating	-0.38	Q16b_Intentional_SubIn_Nor	-0.69
Q9_Import_Good_EngAccent	0.46	Q4b_Other_Dialect_Length	0.33	Q15a_Accident_Mix_Words_Freq	-0.45		
Q5b_FluentSpeaking_Age_Nor	0.46	Q2k_Contrib_School_Eng	0.32				
Q3l_Expos_Music_Eng	0.43	Q3j_Expos_SelfInstruct_Eng	0.32				
Q3j_Expos_SelfInstruct_Eng	0.42						
Q3k_Expos_TV_Eng	0.40						
Q5d_FluentReading_Age_Nor	0.33						
Q5_Regional_Rating	-0.34						
Q12d_Want_Like_Native_Eng	-0.40						
Q3a_Expos_InteractFriend_Nor	-0.44						
Q2k_Contrib_School_Eng	-0.50						
Q3c_Expos_Reading_Nor	-0.60						
Q7_Heavy_NorsktoEng_Accent	-0.75						
Q5a_Read_Nor	-0.82						
Proportion Variance	0.15	Proportion Variance	0.09	Proportion Variance	0.09	Proportion Variance	0.08
Cumulative Variance	0.15	Cumulative Variance	0.24	Cumulative Variance	0.32	Cumulative Variance	0.41
Factor RC4 **Improve English Pronunciation**	*Loading values*	**Factor RC6** **Language Competition**	*Loading values*	**Factor RC8** **Mixed Language Exposure**	*Loading values*	**Factor RC7** **Late Norwegian Fluency**	*Loading values*
Q12c_Improve_Pronounciation	0.75	Q15b_Accident_Nor_Intrude_Eng	0.65	Q2_Dialect_Important	0.75	Q5c_StartReading_Age_Nor	0.82
Q7f_Ident_Cult_Nor	0.68	Q5g_StartReading_Age_Eng	0.58	Q8_Accent_NonNative_Obvious	0.59	Q5d_FluentReading_Age_Nor	0.68
Q9_Import_Good_EngAccent	0.69	Q15a_Accident_Mix_Words_Freq	0.51	Q3a_Expos_InteractFriend_Nor	0.45	Q4a_Prof_Speak_Nor	0.49
Q10_Effort_Improv_EngAccent	0.57	Q3_Dialect_Modify	0.45	Q2d_Contrib_School_Nor	0.44	Age	0.48
Q12d_Want_Like_Native_Eng	0.50	Q5h_FluentReading_Age_Eng	0.40	Q3k_Expos_TV_Eng	0.39	Q4b_Prof_Pronouncing_Nor	0.46
Q4b_Prof_Pronoucing_Nor	0.45	Q12d_Want_Like_Native_Eng	0.39	Q12b_Attention_Pronounciation	0.38	Q5e_StartHearing_Age_Eng	0.36
Q12a_Grammar_Correct_Eng	0.33	Q2b_Contrib_InteractFamily_Nor	0.39	Q12a_Grammar_Correct_Eng	0.35	Q5b_FluentSpeaking_Age_Nor	0.31
Q3k_Expos_TV_Eng	0.32	Q3l_Expos_Music_Eng	0.33	Q2k_Contrib_School_Eng	0.33	Q3f_Expos_Music_Nor	-0.30
Q2m_Contrib_TV_Eng	0.30	Q2h_Contrib_InteractFriend_Eng	0.31	Q3e_Expos_TV_Nor	0.32	Q12b_Attention_Pronounciation	-0.31
Q12b_Attention_Pronounciation	0.33	Q5_Regional_Rating	-0.43	Q2c_Contrib_Reading_Nor	0.31	Q2j_Contrib_Reading_Eng	-0.32
Q2c_Contrib_Reading_Nor	-0.35	Q4b_Speaking_Eng	-0.43	Q2b_Contrib_InteractFamily_Nor	-0.40	Q4e_Prof_Grammar_Nor	-0.33
Q2h_Contrib_InteractFriend_Eng	-0.43	Q3j_Expos_SelfInstruct_Eng	-0.54	Q6b_Choice_Eng	-0.46	Q3_Dialect_Modify	-0.41
Q4b_Other_Dialect_Length	-0.44	Q2l_Contrib_SelfInstruct_Eng	-0.57	Q4b_Speaking_Eng	-0.48	Q2c_Contrib_Reading_Nor	-0.44
Age	-0.59	Q5b_FluentSpeaking_Age_Nor	-0.57	Q2a_Contrib_InteractFriend_Nor	-0.52	Q4b_Other_Dialect_Length	-0.63
Q12e_Pronounce_NOT_import	-0.72			Q3g_Expos_InteractFriend_Eng	-0.56		
Proportion Variance	0.07	Proportion Variance	0.07	Proportion Variance	0.07	Proportion Variance	0.07
Cumulative Variance	0.48	Cumulative Variance	0.55	Cumulative Variance	0.55	Cumulative Variance	0.55