# TWO TYPES OF BILINGUALS – TWO TYPES OF PRODUCTION CONTEXTS

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## Abstract

Language context affects different kinds of bilinguals differently at the preattentive level in speech perception. Bilinguals from birth (balanced bilinguals) perceive their languages in both language contexts similarly, which indicates that they have one unified phonological system. In contrast, bilinguals who have learned their second language in a classroom (dominant bilinguals) perceive speech according to separate, language specific systems and have separate phonological systems for the two languages. The present study focuses on speech production in similar kinds of bilinguals. We used three different language contexts, monolingual Finnish and Swedish and a bilingual context, in speech production tasks. Language context effects are seen in speech production of both bilingual groups. The difference in mother tongue identity is also shown as the dominant bilinguals differ from the balanced bilinguals in the production of Swedish vowels between monolingual and bilingual language contexts.

**Keywords:** *language context, speech production, bilingualism*

## 1. Introduction

Bilingual speech processing research has provided a vast set of varying results. The most obvious reason for the divergent and wide-ranging results is the definition of bilingualism. Defining bilingualism unequivocally and concisely has proven almost impossible. It may be defined according to the age of exposure (AOE), proficiency level or manner of acquisition. Albert and Obler (1978: 5–6) define bilinguals as *compound* if they have learned the second language before 6 years of age or if they have learned the second language at school or if both languages are regularly used within certain group of people. *Coordinate* bilinguals, on the other hand, are those who have learned the second language later or in a one-parent one-language manner or those who use different languages in different situations. Compound bilinguals have one shared system for both languages, whereas coordinate bilinguals have two separate systems for their languages. If the second language is processed through the first language and not as its own, the bilingual is called a *subordinate* bilingual. Furthermore, proficiency level introduces another division of bilinguals, *balanced* bilinguals who have high proficiency level in their languages and *dominant* bilinguals whose other language is more fluent that the other.

Foreign language learners, in particular advanced learners, are considered as dominant bilinguals. Regardless of the definition, bilinguals need to manage their languages in different language contexts and need to decide upon the prevailing language according to the context. Both learners of a second language and bilinguals from birth need to somehow control their two languages from mixing up. The control mechanism for choosing the appropriate language for speech production may be defined as an output switch which either permits or inhibits one of the languages. (Albert and Obler 1978: 5) It could be considered that the switch is more efficient in the balanced than in the dominant bilinguals since it is in constant use. Language may be inhibited or activated on word level or on language level, i.e., an equivalent word from the other language can be inhibited or the other language can be inhibited completely (Colzato et al. 2008). Inhibition mechanisms are not necessary in entirely bilingual language contexts contrary to situations where only one language is used and languages are controlled strictly and inhibition is important.

The holistic view of a bilingual with two coexistent languages as a "unique and specific speaker-hearer" (Grosjean 1989: 3), not a sum of two monolinguals, is closely connected to the language or speech mode thinking. The mode is considered as a continuum which consists of a monolingual mode and a bilingual mode as the endpoints with intermediary modes in between. The language mode is dependent on the environment of which the needs and interlocutors among other things vary. This view does not, however, differentiate balanced and dominant bilinguals. Grosjean (1989) also states that a bilingual's language use should not be studied through one language at a time but through the bilinguals' whole language repertoire.

Earlier studies have shown contradictory results concerning language context effects on speech perception at the preattentive level. In Winkler et al. 2003 there were no language context effects on native Hungarian immigrants, however, a few years later, Peltola and Aaltonen (2005) showed context effects on Finnish students of English. Winkler and colleagues' immigrant participants had lived approximately 11 years in Finland and they spoke fluent Finnish. The stimuli consisted of pseudowords /peti/ and /pæti/ in which the first vowels are separate phonemes in Finnish but not in Hungarian (at least not the dialect used in their study). The participants in Peltola and Aaltonen's study were native Finns studying English as their major at a university. The stimuli in that study were Finnish /i/ and /e/ and English /e/ and /ɪ/. The immigrants in the Winkler and colleagues' study (2003) seem to be balanced bilinguals since preattentive speech processing is not affected by the language context. On the other hand, the students in the Peltola and Aaltonen study (2005) can be considered as dominant bilinguals who are context sensitive and who show mother tongue dominance.

Another previous language context study (Peltola et al. 2012) looked at the effects of language context on the preattentive perception in balanced and dominant bilinguals. Balanced bilinguals had learned both their languages from birth, whereas dominant bilinguals had learned the second language later in life. The bilinguals were tested in two separate sessions in both languages (Finnish and Finland Swedish; hereafter, simply Swedish). For example, in the Finnish context only Finnish was used and the participants were told that they would hear Finnish vowels. The context was made as Finnish as possible. In the Swedish context, a different researcher spoke Swedish with the participants and they were told that they would hear Swedish vowels. The stimuli were, however, the same in both sessions, only the phonological status of the vowels was different depending on the language context. In the Finnish context, the stimuli represented two different categories (/y/ and /u/), whereas in the Swedish context the same stimuli were representatives of one category (/ʉ/). It was then found that balanced bilinguals are unable to switch one language off when perceiving the other suggesting that they have one intertwined phonological system. Dominant bilinguals, on the other hand, only use the context language phonological system while the other system is switched off and this implies that they have two separate phonological systems. Since the dominant bilinguals have to manage one phonological system at a time, their perceptual processing is also faster than in the balanced bilinguals who have both Finnish and Swedish categories to compare input with. In another similar study comparing balanced bilinguals and monolingual Finns, it was found that monolingual Finns' preattentive perception is faster than that of balanced bilinguals showing the same cost of a vast intertwined system (Tamminen et al. 2013).

Language context has been shown to have effects on speech production in dominant bilinguals, as Antoniou with his colleagues (2010) showed in their study on Greek-English bilinguals (born in Australia, exposed to Greek since birth, learned English before the age of six and were dominant in English). They recorded and analysed the participants' bilabial and coronal stops in different syllable positions. Bilabial and coronal stops were chosen as stimuli since the place of articulation is different in the Greek and English coronal stops, but not in the bilabials. These bilinguals were tested in two monolingual contexts, Greek and English, and

their production did not differ from monolingual Greek or English speakers, which implies that they were able to pronounce according to the context language and there was minimal interference between the languages.

As shown by Peltola et al. (2012), language context definitely has different effects on different kinds of bilinguals at the preattentive level of perception. In our current study we wanted to see whether different language contexts affect speech production in balanced and dominant bilinguals. For that purpose, we tested the bilinguals in three different language contexts: Finnish, Swedish and bilingual with the last adding to our selection of language contexts. The study was designed to see if balanced and dominant bilingual speech production is affected by different contexts. We used orthographically presented words containing /y/, /ʉ/ and /u/ as target vowels. Our research questions were: 1) Does the intertwined phonological system found at the preattentive perception level for the balanced bilinguals affect their speech production in different language contexts? Or do the separate systems found for the dominant bilinguals at the preattentive perception level show in speech production? 2) Are there differences between the monolingual contexts and does the bilingual context differ from the monolingual contexts? 3) Further, does the fact that only Finnish is a native language for the dominant bilinguals and both languages are native for the balanced bilinguals show in speech production?

There are three possible hypotheses for the question concerning the unified vs. two separate systems dichotomy affecting speech production and since speech production is conscious behaviour, the effects of the varying contexts may not be similar to the effects seen at the preattentive level of perception. Firstly, if the two languages are separate and do not affect each other in preattentive perception, they do not affect each other in conscious speech production either. In a monolingual situation the other language is passive and it most probably does not interfere with the other language. However, in a bilingual situation, mixing is probable since both languages are active, enhancing or inhibiting themselves. However, they do not prevent interference between the languages by inhibiting each other. Secondly, if there is one intertwined system which at the preattentive level cannot ignore one language, it could be hypothesised that speech production is controlled in a similar manner by one mechanism. Both languages would be active all the time and the languages would not interfere with each other in any context since the shared control mechanism is capable of inhibiting the other language if needed. In this case there should not be mixing of the two languages either in the monolingual contexts or in the bilingual context. Thirdly, in the case of the one unified system at the preattentive level, it could be hypothesised that speech production is controlled by language specific mechanisms. Again, both languages are active but with separate control mechanisms which are not capable of inhibiting each other and mixing of the languages may occur in any context. The first option most probably concerns the dominant bilinguals whereas one of the other two concerns the balanced bilinguals. Either the two languages of the balanced bilinguals are mixed in both monolingual situations and in the bilingual situation or not in any of the situations. In the case of the dominant bilinguals, the languages are not mixed in the monolingual situations but they probably get mixed in the bilingual situation.

The two types of bilinguals have different native language identities, since balanced bilinguals are presented with their native languages in all the contexts while only one context is entirely native for the dominant bilinguals. It is more than probable that the dominant native language shows some effects with relation to the other language. This native language effect may be seen as exaggeration of the contrast by using maximally differentiating formant values.

## 2. Methods

The groups consisted of five balanced bilinguals (mean age 23.2, range 18–34, 3 females) and 5 dominant bilinguals (mean age 22.2, range 21–25, 5 females). The balanced bilinguals

were from bilingual homes where they had acquired both languages from birth. These participants used both languages daily or almost daily. The dominant bilinguals were advanced students majoring in Swedish and had studied it as their major subject at a university at least two years.

All subjects participated in the study during three different sessions which were at least one week apart from each other. One session was carried out in Finnish – communication between researchers and participants was in Finnish only and the stimuli were Finnish words. Another session was in Swedish, again communication between researchers and participants was only in Swedish and the stimuli were Swedish words. The order of these two sessions was counterbalanced between the subjects in both groups. The last session was done in a bilingual language context where both Finnish and Swedish speaking researchers were present, all communication was carried out in mixed languages and participants received instructions in both languages. The stimuli were both Finnish and Swedish words; the same stimuli as in the previous sessions. Researchers only used one language, in other words, the Finnish speaking researcher only spoke Finnish in all circumstances when in contact with the participants and the Swedish speaking researcher always communicated in Swedish with the participants.

The closed round vowel area provides an interesting difference between Finnish and Swedish, since in Finnish the area is divided into two vowels (/y/ and /u/) and Swedish divides it into three categories (/y/, /ʉ/ and /u/). The most substantial acoustic difference between the closed round vowels is in the second formant (F2). According to two language learning models (Flege 1987; Best and Strange 1992), /ʉ/ is considered to cause learning problems for Finnish learners of Swedish. The stimuli in this study were Finnish and Swedish words which contained the target vowels /y/, /ʉ/ and /u/. The target vowels occurred between bilabial plosives and alveolar fricatives to minimize coarticulatory effects. The Finnish word stimuli were *'pyssy'* /pysːy/, *'pyysi'* /pyːsi/, *'pussi'* /pusːi/ and *'puuska'* /puːska/ and the Swedish words were *'pyssla'* /pysla/, *'pysa'* /pyːsːa/, *'buss'* /bʉs/, *'bus'* /bʉːs/, *'Bosse'* /busːe/ and *'boskap'* /buːskaːp/. Non-target words were used as distractors.

The stimuli were presented via PowerPoint presentation and the participants were instructed to read out loud the orthographically written stimuli which appeared on the computer screen every three seconds. The target and non-target words were all repeated ten times and they were presented in a random order. The Finnish list contained four target and eight non-target words, the Swedish list contained six target and twelve non-target words and the mixed list consisted of ten target (the same Finnish and Swedish words as in the monolingual contexts) and non-target words. Every session started with a short familiarization with four words. There were two pauses in the Finnish session and three pauses in the other two sessions and participants were instructed to continue when they felt ready. The Finnish, Swedish and bilingual sessions lasted six, nine and ten minutes minimum, respectively. Participants were instructed to keep approximately 20 cm distance to the microphone (Dynamic MT58) and not to repeat the words even to correct their pronunciation or a misread word. Audacity was used for recording the sessions for later acoustic analysis.

The target vowels from the speech data were acoustically analysed using Praat (Boersma 2001). The first two formants (F1 and F2) were analysed from a steady state point of the vowel. For all the ten repetitions of the different vowels, a mean value was calculated which was used in the further statistical analysis. Mispronounced and misread utterances were omitted from the analysis. A few utterances were also omitted due to noise interference from the equipment. Statistical analyses were performed using IBM SPSS 19 software. Four factors – Context (Finnish or Swedish context, Bilingual context), Vowel (/y/, /u/ or /y/, /ʉ/, /u/), Measure (F1, F2) and Group (Balanced bilinguals, Dominant bilinguals) – were entered in a Repeated Measures Analysis of Variance (ANOVA). Context differences were also analysed with pair-wise comparisons.

## 3. Results

### 3.1. Finnish vowels

For the Finnish vowels, an ANOVA showed that there was a significant interaction between Context (Finnish context, Bilingual context) and Measure (F1, F2) ($F(1,8)=5.998$, $p=0.040$), indicating that the formants were different in different contexts. There were no significant main effects or any other interactions.

The mean formant frequencies and standard deviations for the Finnish vowels in monolingual and bilingual contexts are shown in Table 1. Although there were no differences between the groups in the Finnish vowels, there was quite a large difference in the second formant of /y/ in the Finnish language context between the different bilingual groups, as can be seen from Table 1. The second formant was larger in balanced bilinguals' vowel production, suggesting it was more front than that of the dominant bilinguals'. The differences and the high standard deviations in the second formant of the Finnish /y/ probably explains the Context and Measure interaction as well.

*Table 1.* The mean formant frequencies of Finnish vowels produced in Finnish and Bilingual contexts by both groups. Standard deviations are included in parentheses.

| | Finnish /y/ | | | |
|---|---|---|---|---|
| | Finnish context | | Bilingual context | |
| | F1 | F2 | F1 | F2 |
| Dominant | 399 (26.2) | 1957 (118.7) | 411 (25.3) | 2050 (171.5) |
| Balanced | 364 (30.3) | 2090 (155.8) | 377 (27.1) | 2102 (197.7) |
| | Finnish /u/ | | | |
| | Finnish context | | Bilingual context | |
| | F1 | F2 | F1 | F2 |
| Dominant | 408 (37.1) | 817 (79.6) | 403 (27) | 814 (105.3) |
| Balanced | 404 (35.7) | 836 (78.3) | 403 (42.32) | 864 (101.4) |

### 3.2. Swedish vowels

The results for the Swedish vowels showed that there was a significant interaction between Context (Swedish context, Bilingual context), Vowel (/y/, /ʉ/, /u/) and Group (Balanced bilinguals, Dominant bilinguals) ($F(2,7)=12.030$, $p=0.005$) indicating that the Groups produced the vowels differently in different contexts. Another interaction was found between Context (Swedish context, Bilingual context), Vowel (/y/, /ʉ/, /u/), Measure (F1, F2) and Group (Balanced bilinguals, Dominant bilinguals) ($F(2,7)=21.988$, $p=0.001$), suggesting that the groups produced the formants differently in different vowels in different contexts. There were no significant main effects or any other interactions.

Mean formant values and standard deviations for the Swedish vowels in monolingual and bilingual contexts are shown in Table 2. The second formant in /ʉ/ was higher and the first formant in /u/ was lower in balanced bilinguals than in dominant bilinguals in the Swedish context, implying that the balanced bilinguals produced /ʉ/ more front and /u/ more close than

the dominant bilinguals. In the bilingual context, however, the second formants of /y/ and /ʉ/ were higher in balanced bilinguals (implying a more frontal production) and the first formant of /u/ was lower in balanced bilinguals (suggesting a more close production) than in the dominant bilinguals.

*Table 2.* The mean formant frequencies of Swedish vowels produced in Swedish and Bilingual contexts by both groups. Standard deviations are included in parentheses.

| | Swedish /y/ | | | |
|---|---|---|---|---|
| | Swedish context | | Bilingual context | |
| | F1 | F2 | F1 | F2 |
| Dominant | 403 (21.6) | 2100 (88.6) | 411 (22.4) | 2075 (127.2) |
| Balanced | 367 (28.7) | 2117 (236.3) | 369 (34.6) | 2195 (215.7) |
| | Swedish /ʉ/ | | | |
| | Swedish context | | Bilingual context | |
| | F1 | F2 | F1 | F2 |
| Dominant | 436 (39.2) | 1240 (214.9) | 422 (42.9) | 1304 (228.9) |
| Balanced | 393 (35.6) | 1473 (88.2) | 394 (28.7) | 1418 (93.2) |
| | Swedish /u/ | | | |
| | Swedish context | | Bilingual context | |
| | F1 | F2 | F1 | F2 |
| Dominant | 448 (50.7) | 935 (144.8) | 430 (58.4) | 954 (94.7) |
| Balanced | 391 (31.6) | 878 (53.5) | 386 (32.7) | 891 (72.1) |

### 3.3. Context comparison

The pair-wise comparisons between different language contexts separately within the groups show that balanced bilinguals produced the second formant of the Swedish /y/ ($t(4)=-2.772$, $p=0.50$) and /ʉ/ ($t(4)=15.825$, $p<0.001$) differently in Swedish and bilingual contexts. Table 2 shows that the second formant was larger in /y/ (implying a more frontal production) and smaller in /ʉ/ (implying more back production) in the bilingual context than in the monolingual context. In contrast, the dominant bilinguals produced the first formant of Swedish /y/ ($t(4)= -4.349$, $p=0.012$) and /ʉ/ ($t(4)=3.458$, $p=0.026$) differently in monolingual and bilingual contexts. The first formant was larger in /y/ (suggesting more open production) and smaller in /ʉ/ (suggesting more closed production) in the bilingual context than in the monolingual context (see also Table 2.).

### 3.4. Summary of the results

The balanced and dominant bilinguals produced the Finnish vowels in the same manner, but both groups differed in their Finnish vowel production between the monolingual and bilingual contexts. However, the groups produced the Swedish vowels differently in different contexts. Within the monolingual context the groups differed in their production in the Swedish /ʉ/ and

/u/ and in the bilingual context they produced all three vowels differently. The context comparison showed that both groups produced the Swedish vowels differently in the monolingual and in the bilingual contexts, and further, the balanced bilinguals made the difference with the second formant and the dominant bilinguals with the first formant.

## 4. Conclusions

As Peltola et al. (2012) showed, the balanced bilinguals have one intertwined phonological system for the two native languages at the preattentive perceptual level, whereas the dominants have separate systems for their two languages. The current study, with the added bilingual language context, was designed to see whether language context has a similar effect on balanced and dominant bilinguals' speech production. Our findings show that the balanced and dominant groups differed in vowel production as a function of language contexts. Both groups produced both /y/ and /ʉ/ differently in different language contexts, whereas /u/ was produced similarly in the two contexts. The dominant bilinguals made the variation in both /y/ and /ʉ/ through F1, while the balanced bilinguals made it through F2. This indicates disparity between balanced and dominant bilinguals in their sensitivity to language setting also in speech production.

An interesting outcome was that both bilingual groups produced the Swedish vowels differently in the monolingual and bilingual contexts. Further, the difference was shown in different acoustic parameters in the balanced than in the dominant bilingual group, in the second formant and in the first formant, respectively. Also, both groups made the difference between /y/ and /ʉ/ larger in the bilingual context than in the monolingual Swedish context. The fact that both groups showed larger difference within the two vowels in the bilingual context, is probably due to the context itself, i.e., the extra language encouraged them to differentiate the Swedish vowels more. The same was not seen in the Finnish vowels probably because the two vowels are more apart from each other to begin with. Difference in /y/ and /ʉ/ F2 seems more natural according to vowel descriptions of the closed area (e.g., Kuronen 2000), and hence the fact that the balanced group operated in F2 sounds only logical. The learning process may well be incomplete in the dominant bilinguals which could explain F1 being the varying acoustic parameter. This perhaps less natural or less native-like manner of differentiating between the vowels is still one way of producing a maximal difference.

Since language mode is dependent on the environment (Grosjean 1989), we generated the language environments to be as obvious as possible in our study. Both bilingual groups seemed to be in a monolingual mode in the Finnish and Swedish monolingual contexts and in a bilingual mode when the context provided was bilingual. They were able to keep the two languages apart from each other. Most probably the fact that Swedish language has a different role in the balanced and dominant bilinguals affected the results. Since Swedish is not the mother tongue for the dominant bilinguals, it most likely explains the difference between the groups within the Swedish vowels in the monolingual and bilingual contexts. In other words, the dominant bilinguals used a non-native manner, namely varying the first formant, in differentiating /y/ and /ʉ/ between the contexts.

Maximising the difference in the Swedish /y/ – /ʉ/ pair between the monolingual and bilingual contexts may be the result of a hyperspeech phenomenon (Lindblom 1991).[1] On the other hand, it does not seem to be the case that either of the groups use hyperspeech to differentiate between the two languages in the bilingual context since Finnish and Swedish /y/ and Finnish and Swedish /u/ do not differ from each other. Even though there were differences in the formants of the Finnish vowels between the contexts, there were no group differences. This may be due to the fact that Finnish is a mother tongue for both groups. However, both

[1] According to the H&H theory, speech production vary along a hyperspeech–hypospeech continuum. Speakers vary their speech to be as clear as possible (hyperspeech) or to be as economical as possible (hypospeech).

groups showed differences in Finnish productions in different contexts, which may also be due to hyperspeech effect.

The Greek-English bilinguals in Antoniou and colleagues' (2010) study were able to manage the languages according to the language contexts as was the case in our study also. However, their study only had two monolingual language contexts where the dominant bilinguals' speech production was tested and that result was unable to prove that bilinguals are able to keep the languages apart in a bilingual environment. Our results, on the other hand, showed that the Finnish and Swedish vowels were produced differently in the bilingual context. The bilingual context differentiated the bilinguals in the manner in which they produced the Swedish vowels.

In conclusion, it seems probable that the one unified phonological system for the balanced bilinguals is organised so that there is also one unified system for the control of speech production instead of language specific control mechanisms, since both Finnish and Swedish vowels differ across contexts. There should not be any within language differences across the different contexts if there were language specific control mechanisms. The dominant bilinguals have two separate phonological systems for their languages for perception of speech and although the speech production results seem to be similar to the balanced bilinguals, they most probably have two separate control mechanisms for speech production. They too differ in producing both Finnish and Swedish vowels across contexts, but the non-dominant vowels are controlled in a non-native-like manner which could be due to controlling the second language through a mechanism relying on the mother tongue. Yet, the mechanism, in trying to make a clear difference in the bilingual context, does not control the production according to mother tongue or the second language, but something totally different, namely by varying F1 instead of F2. There were no group effects among the Finnish vowels which is probably an indication of Finnish being the mother tongue for both types of bilinguals. Also, the continued use of the mother tongue alongside second language learning in the dominant bilinguals may hinder the learning of native-like productions (Flege and MacKay 2004). Furthermore, the fact that there were group differences in the Swedish vowels supports the mother tongue role of Finnish even further. The finding that the dominant bilinguals differ in their production of the Swedish vowels between the monolingual Swedish and bilingual contexts by the first formant instead of the second formant, as the balanced bilinguals, may also be an indicator of Swedish not being their mother tongue.

An earlier study on balanced and dominant bilinguals' preattentive perception showed, balanced bilinguals have one unified phonological system whereas dominant bilinguals have separate phonological systems for their languages (Peltola et al. 2012). In speech production, on the other hand, the groups differed in the way they produced Swedish vowels in the monolingual and bilingual contexts. Thus, the status of the two languages for the different bilinguals is also seen in speech production. The main point is that it seems that the dominant bilinguals have separate control mechanisms for their languages and the balanced bilinguals have one shared control mechanism for their languages. The perception study by Peltola et al. (2012) contained only monolingual contexts so the bilingual language context effects on preattentive speech perception may offer an interesting area of research on the basis of this study.

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