Contact without Contact: English Digital Language Input and Its Effects on L1 Icelandic

Sigríður Sigurjónsdóttir, Iris Nowenstein, Thorbjörg Thorvaldsdóttir, and Dagbjört Guðmundsdóttir

1. Introduction

Icelandic is one of the smallest independent languages in Europe. According to traditional measures of language vitality such as the EGIDS (Lewis & Simons 2010) and the UNESCO vitality scale (2013), Icelandic fulfills the highest criteria for a national language and thus appears to have a strong status. This categorization is based on the fact that Icelandic is the only official language of a nation-state (apart from Icelandic sign language), has an established literary tradition, and is almost the sole language in government, public administration, workplaces, education at lower levels, and most domains of society. Iceland additionally has a strong tradition for language planning, preservation, and prescriptivism (Ottósson 1990) and the country has long been largely monolingual, although in recent years immigration has increased and the tourism industry has grown exponentially (Hagstofan 2017).

However, language vitality scales typically do not consider the technological and sociological changes which in recent years have brought Icelandic into digital language contact with English. With this term, we refer to the situation in which speakers come in contact with another language in the digital domain as opposed to eye to eye contact in more traditional domains. Recipients of English digital contact in Iceland now increasingly include young children and teenagers, who are still in the acquisition stage and hence are more receptive to English exposure, e.g. through playing interactive computer games. Today, the globally dominant English is often perceived as a threat to Icelandic in public discourse (Kristinsson 2019).

A growing body of recent studies shows that children in traditionally non-English-speaking language communities acquire some of their English skills before the language is introduced in formal education, and continue learning extramurally through contextual learning (Lindgren & Muñoz 2012; Sylvén &

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Sundqvist 2012; Sundqvist & Wikström 2015; De Wilde, Brysbaert & Eyckmans 2019a, i.a.). Such contextual learning may in some cases be more efficient than school instruction (De Wilde, Brysbaert & Eyckmans 2019b), since English is the language of entertainment and technology, domains which might be highly relevant to children. Different types of activities seem to enhance this type of contextual L2-learning. Some activities, like gaming or watching subtitled television (De Wilde & Eyckmans 2017), pertain to what might be called digital language input (DLI). Although interactive and multimodal input, involving productive language, seems to be the most efficient type of digital input in contextual learning (De Wilde et al. 2019a, extending e.g. Hoff et al. 2014), it appears that contrary to what was previously thought (Krashen 1985), learning in the digital age can occur in situations of virtual contact through digital language input. Thus, contextual learning of English through digital means is a new and increasingly prevalent reality around the world.

Considering work on quantitative input effects and the possible distributive characteristics of bilingual knowledge (e.g. Pearson et al. 1997; Oller, Pearson & Cobo-Lewis 2007; Thordardottir 2011 and 2014; Paradis & Grüter 2014; Unsworth 2015 and 2016), should we expect English digital language input through contextual learning to impact the domestically dominant but globally small L1, Icelandic? The direct and indirect effects of an L2 on an L1 are well-known in various contexts (e.g. in work on L1 attrition). However, the research is usually conducted in a setting where the L1 is a minority language and not the dominant language of schooling or society more broadly (e.g. Montrul 2008; Sorace 2011; Schmid 2013).

In this paper, we address this understudied scenario and ask: Can a contextually learned and globally dominant L2 (English) affect a domestically dominant L1 (Icelandic) through digital language input? In particular, our research questions are:

(1) a. Does English digital language input entail a reduction of L1 input for children acquiring Icelandic in Iceland?
b. If it does, is the input reduction significant enough to predict individual differences in outcomes on vocabulary and grammar measures?

Due to space limitations, we focus on the results of our measurements of the Icelandic and English vocabulary of 3-12 year old Icelandic children. The data that we base our results on comes from the children's part of the research project *Modeling the Linguistic Consequences of Digital Language Contact* (*MoLiCoDiLaCo*, www.molicodilaco.hi.is) see footnote *.

The paper is organized as follows: Section 2 describes our participants, the methods used for data collection, and analysis of the data. In section 3, we outline the results from an online survey and in-depth testing sessions, focusing on English and Icelandic input and its relationship to the children's vocabulary. Finally, section 4 concludes the paper with a discussion of our main findings.

2. Methods

2.1. Twofold approach

In the *MoLiCoDiLaCo*-project, two main methods for data collection were used: an online survey and subsequent in-depth testing sessions. The children's part of the online survey was conducted from July 2017 – April 2018 among a stratified random sample of 1,500 Icelandic citizens aged 3-12, obtained from the National Registry of Iceland. The survey response rate was 50%, yielding 724 participants. Four versions of the online survey were administered, one tailored to each age group within the sample: 3-5-year, 6-7-year, 8-9-year, and 10-12-year-olds. Each survey included questions about the children's Icelandic and English input, their language use, and language attitudes. They additionally included a series of language tasks, testing receptive vocabulary and grammatical factors, both morphology and syntax. The surveys were parent-administered for 3-9-year-olds but partly independently completed by 10-12-year-olds.

The in-depth testing sessions took place from August 2018 – May 2019. A stratified random sample was drawn from the participants of the original online survey, based on input data results: small, average and large amounts of English input within each age group. 106 participants participated in the testing sessions. The participants were called in for interviews and further testing (three 1 hour sessions for the 3-9-year-olds and two 1.5 hour sessions for the 10-12-year-olds), allowing the administration of standardized language tests, more thorough experiments, and the gathering of highly detailed input information.

The number of participants in each age group in the online survey and the in-depth testing sessions is outlined in Table 1.

Table 1. Participants across age groups, online survey and in-depth sessions.

	Online survey (N = 724)	**In-depth sessions (N = 106)**
3-5	N = 228	N = 34
6-7	N = 122	N = 18
8-9	N = 144	N = 24
10-12	N = 230	N = 30

2.2. Measuring input

The input/output measurements reported on here are based on parental assessments. From the results of the online survey, coarse data was obtained on the children's language input/output based on three to five questions on hearing, reading, speaking, and writing for each language, e.g. *How frequently does the child hear English?* Information on the use of computers and smart devices was gathered as well, i.e. data on digital language input.

The results of the testing sessions gave a more fine-grained assessment of how much time the children spend on various activities on a typical day. Parents assessed the time their children spent on different activities and were asked to evaluate the ratio of different languages within each activity. From this data, the ten input indices in (2) were computed:

(2) Total (digital) receptive Icelandic input in minutes.
Total (digital) receptive English input in minutes.
Total (digital) productive Icelandic output in minutes.
Total (digital) productive English output in minutes.
Percentage of English in receptive input.
Percentage of English in productive output.

2.3. The linguistic variables

The linguistic variables tested in the online survey varied slightly depending on age. For the 3-9-year-olds, the variables were Icelandic and English word lists for vocabulary assessment and various repetition, completion and forced choice tasks for Icelandic grammar, e.g. syntactic complexity, case marking, plural, past tense, and word order. All of these tasks were parent-administered. For the 10-12-year-olds, who answered part of the online survey themselves, Icelandic and English word lists for vocabulary assessment and judgment tasks for Icelandic and English grammar (standard vs. variation or non-native) were used. The word lists in the surveys were designed based on Jóhannsdóttir and Rögnvaldsson's (2018) work on Icelandic children's acquisition of English vocabulary and Einarsdóttir, Pétursdóttir & Rúnarsdóttir's (2020) work on Icelandic vocabulary acquisition. Participants (older children and parents) were simply asked to mark which words, of a list of 30 (including five nonce words), they/their children understood and were able to use.

In the in-depth testing sessions, vocabulary was further assessed for 3-9-year-olds with Icelandic (Ragnarsdóttir 2018) and English (Dunn & Dunn 2007) versions of the PPVT-4. Icelandic grammar was tested with grammar production tasks targetting various variables, e.g. past tense, plural formation, the subjunctive mood and case marking. Additionally, language samples both in Icelandic and English were collected. As mentioned in section 1, we presently focus on input and vocabulary results.

2.4. Analysis

A linear regression model was fitted for each linguistic outcome variable, with background and input variables as predictors. For the data from the online survey, the linguistic outcome variables were normalized within each age group to enable an analysis across age. To focus on possible digital language input effects, the analysis was limited to children who are growing up (mostly) monolingual and developing typically when it comes to language abilities, according to the parents' estimation. The models include the following predictive variables: age, gender, parental education, residential area, smart device use (i.e. digital language input), receptive English, productive English, and the children's interest in English, as reported by their parents.

In the in-depth testing sessions, more fine-grained linguistic outcome variables were available (e.g. plural, past tense, use of the subjunctive mood, and language sample measures) and the predictive variables (different types of input measured in minutes and their ratio) were also more fine-grained. As reported in (2), 10 different input indices were compiled based on the data from the in-depth sessions (amount vs. proportions), so in order to prevent collinearity and to avoid overfitting the data, model comparison was used. Starting from a base model (including age, gender, and education), five different input models (also containing the background variables) were then fitted. As a final step, the model with the best fit as compared to the base model was selected. All analyses were carried out in R (R Core Team 2019).

3. Results

The organization of the section is as follows. In 3.1., we report on the modelling results for the participants' Icelandic and English vocabulary as measured in the online survey. In 3.2., results from the in-depth testing sessions are presented. We focus on the mapping of Icelandic and English input and the participants' receptive vocabulary, as well as the relationship between input and vocabulary.

3.1. Online survey

Starting with the analysis of the Icelandic vocabulary results, we find a low adjusted R^2 (Adjusted $R^2 = 0.02753$, $p < 0.001$, $N = 632$), with the model explaining only about 3% of the variance in the data. However, a significant positive effect is found for parental education, both secondary and university education, and a significant negative effect for smart device use (regardless of activity type or language) on vocabulary. The standardized effect sizes are shown in Figure 1, with the dark columns representing significant effects.

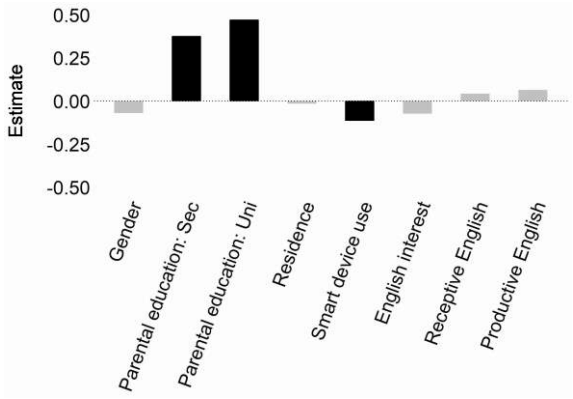

Figure 1: Icelandic vocabulary, standardized effect sizes.

As can be seen, the negative smart device use effect on vocabulary is small when compared to the effects of parental education.

Moving on to the results for English vocabulary in the online survey, the model explains about 26% of the variance in the data (Adjusted $R^2 = 0.2575$, $p < 0.001$, $N = 632$). As shown in Figure 2, we find a positive effect of smart device use – contrary to what we found for Icelandic vocabulary.

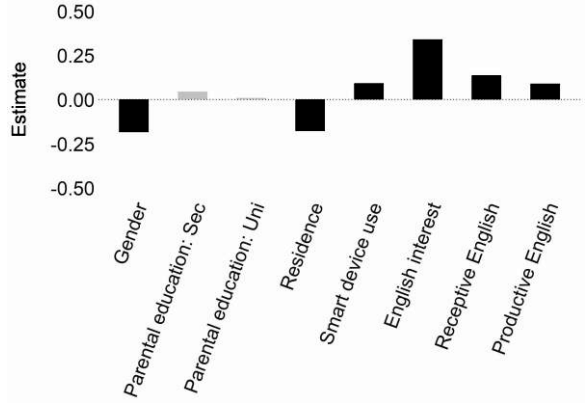

Figure 2: English vocabulary, standardized effect sizes.

We also find input effects: Receptive English shows a slightly bigger effect than productive English, but the largest positive effect is found with the measure of the children's interest in English as reported by their parents. Moreover, we find a negative gender effect, with girls having less English vocabulary than boys, and a negative residential effect, with children living outside the capital area of Reykjavík having less English vocabulary as well.

To summarize the vocabulary results from the online survey, we see that English input and interest affect English and not Icelandic vocabulary. On the

other hand, we find a small negative effect of smart device use, regardless of language, on Icelandic vocabulary. As has been mentioned, the input measures obtained in the online survey are coarse, but the in-depth sessions provided much more fine-grained input indices.

3.2. In-depth sessions
3.2.1. Input

We now turn to the results from the in-depth testing sessions, where 106 of the 724 3-12-year-old participants in the online survey came in for further testing. Before presenting results on the effects of the input on the vocabulary, we examine the input itself. The first question we address is how much English there is in Icelandic children's language environment according to parental report. In all the following scatterplots, every dot is a participant.

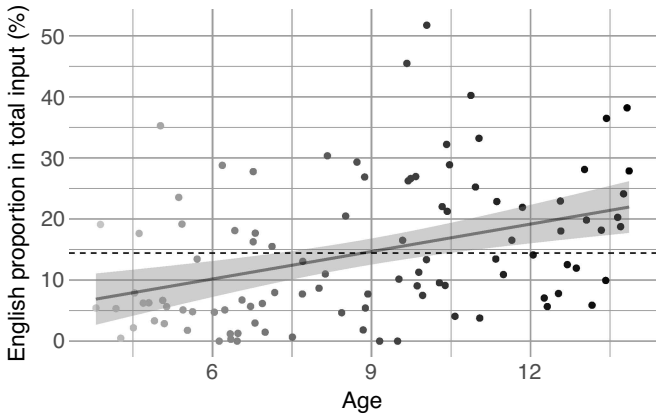

Figure 3: Mean proportion of English input.

Figure 3 shows that the mean proportion of English input, marked with the pointed line on the graph, is about 14% of a typical day, but the median is lower, or around 11%. The average amount of English use per day is 90 minutes (median value: 63 minutes). Both the proportion of English and the total amount of it grow as the children get older. If the time spent on English is divided between receptive and productive use (Figures 4 and 5), it is clear that the input is mostly receptive.

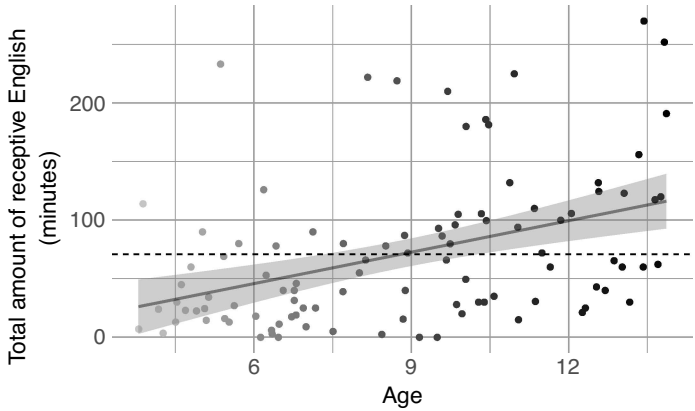

Figure 4: Total amount of receptive English input in minutes.

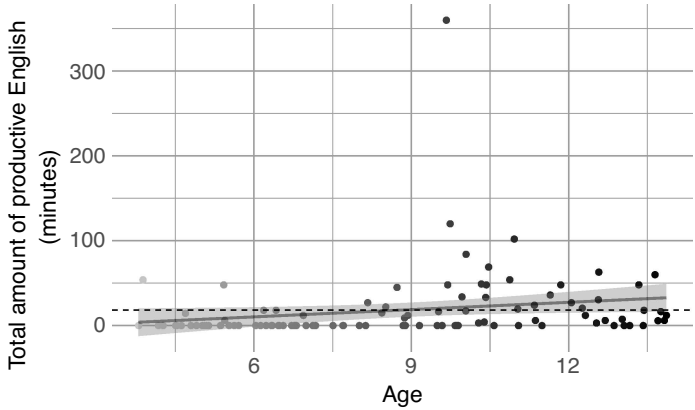

Figure 5: Total amount of productive English input in minutes.

A comparison of Figures 4 and 5 shows that the English input the children are getting is mostly receptive, and as Figure 4 shows, this receptive input increases as the children grow older.

Regarding this age trend, it is interesting to note that we do not get comparable results for the Icelandic input data that we also collected, as shown in Figure 6.

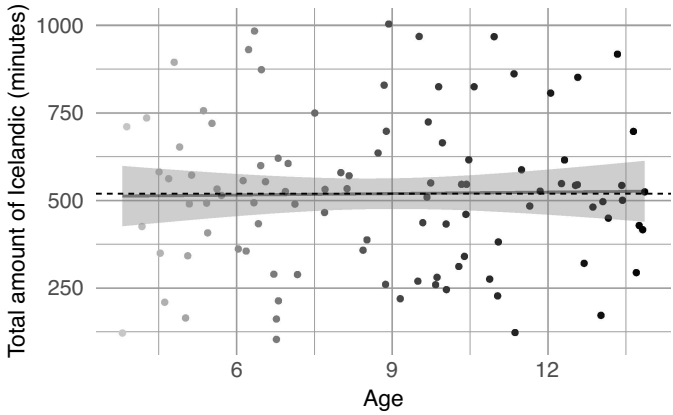

Figure 6: Total amount of Icelandic input in minutes.

Figure 6 shows that children across age get similar amounts of Icelandic input in minutes. The mean is 519 minutes or 8 hours and 40 minutes and the median is 525 minutes.

Following this, another question to address is whether the amount of time spent on English predicts the proportion of it in the children's total input, see Figure 7. This might seem straightforward but is not necessarily a given.

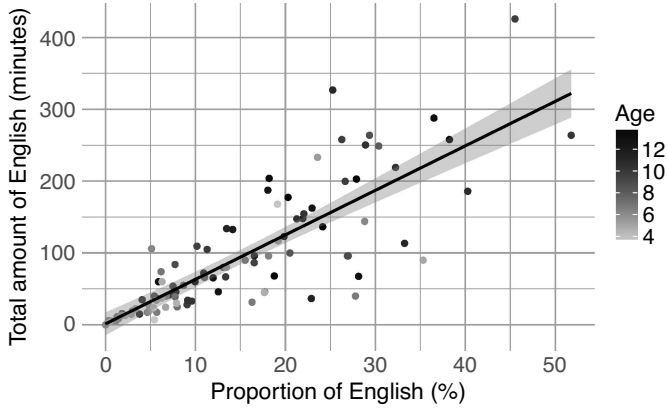

Figure 7: Amount of English (minutes) by proportion of English.

Figure 7 shows a clear relationship between the amount of time spent on English and the proportion of it in the input. However, we see that some participants show lower amounts of English in minutes but quite a high proportion of it still. Moreover, there are participants with high amounts of English who also are reported to get high amounts of Icelandic.

Following up on this, the question arises whether the time spent on English automatically reduces the time spent on Icelandic. Figure 8 shows that this does not seem to be the case. In fact, we see the opposite trend.

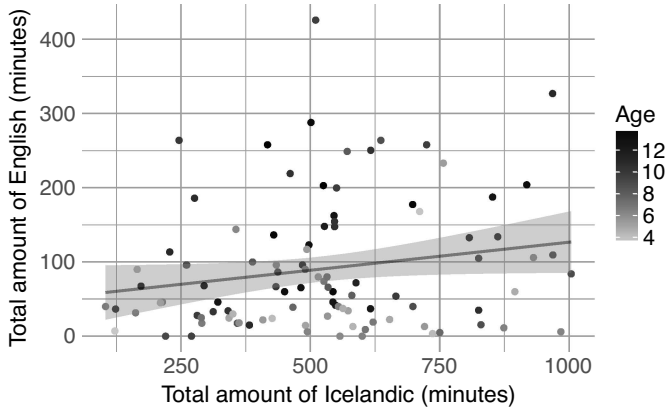

Figure 8: Amount of English (minutes) by amount of Icelandic (minutes).

Thus, Figure 8 shows that parents who tended to report that their child spent a lot of minutes on English also tended to report that they spent a lot of minutes on Icelandic. This might be an effect of the method used in the present study, but at least these results show that we should not always assume that time spent on one language is necessarily time lost in another language.

3.2.2. Input effects on receptive vocabulary

Now that we have described the distribution of the input, we turn to possible input effects on Icelandic and English receptive vocabulary as measured by the PPVT. In the Icelandic measure, we find significant positive effects for age and parental education, but no input effects. In the English measure, on the other hand, there is an age effect as well as a positive significant input effect. The model containing the variable for the proportion of English in the input was the best fit in this case, with a significant positive effect for the proportion of English. For every 10% of English in the total input, the standard English PPVT score goes up by 3.2-6. Figure 9 shows the relationship between the two variables. There we can see that this effect is not clear cut: for example, the children with the highest English PPVT scores are not necessarily the ones with the highest proportion of English in their input.

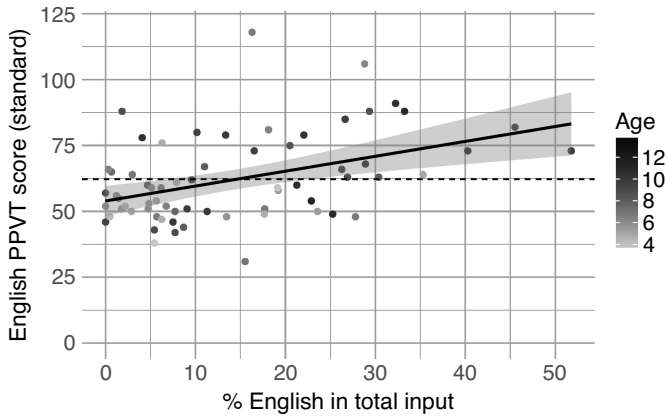

Figure 9: Standard English PPVT scores by proportion of English.

In this context it is also interesting to ask whether the English vocabulary reduces Icelandic vocabulary, considering ideas about the distributed characteristics of bilingual knowledge (e.g. Pearson et al. 1997; Oller, Pearson & Cobo-Lewis 2007; Thordardottir 2011; Paradis & Grüter 2014; Unsworth 2015 and 2016). The raw PPVT scores in each language (standardized scores are not available for Icelandic) are mapped in Figure 10, and interestingly, the English vocabulary shows a significant positive effect on the Icelandic vocabulary.

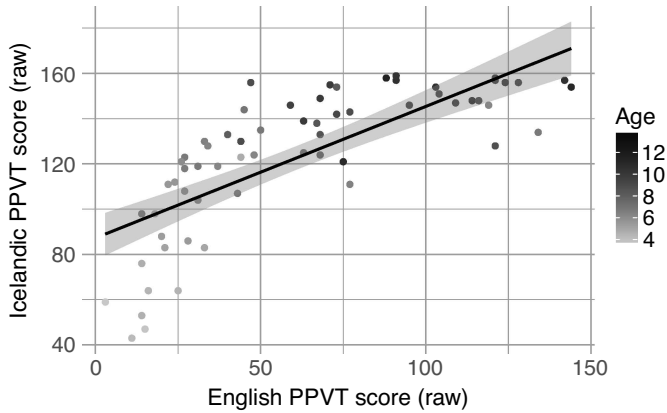

Figure 10: Icelandic and English PPVT raw scores.

This positive relationship between the English PPVT raw score and the Icelandic PPVT raw score is confirmed with a linear regression (95% CI 0.86-1.3, $p < 0.001$) including age, gender, and parental education ($F(5, 53) = 51.45$, $p < 0.001$). However, an interaction between age and the English PPVT raw score shows a significant negative effect (95% CI 0.09-0.14, $p < 0.001$), pointing towards a

possible distributive relationship between Icelandic and English receptive vocabulary as children grow older, where a higher English PPVT raw score indicates a lower Icelandic PPVT raw score.

4. Discussion

In the online survey, the only potential input effect on the Icelandic vocabulary is a relatively small negative effect of smart device usage. For the English vocabulary, the model is more successful as we see positive effects of smart device usage, receptive and productive English, and English interest. In the in-depth testing sessions, we find that although the amount of English predicts the proportion of the language in the input, it does not necessarily reduce the absolute amount of Icelandic input. Although the input measures were more fine-grained in the in-depth sessions, we do not find any English input effects on children's receptive Icelandic vocabulary. On the other hand, the proportion of English shows a positive relationship with the English PPVT scores. Thus, in general, we do not see pervasive effects of L2 English on L1 Icelandic measures of vocabulary. English input mainly affects English skills. We also see that early on, the English and Icelandic PPVT scores go hand in hand, with a negative effect only appearing when an interaction with age is added.

The results also indicate that English is still a relatively small part of Icelandic children's language environment (14%), although the range is wide: 0-52%. Even though this input is mostly receptive, we have seen that it predicts some of the Icelandic children's L2 English skills. This might fit a pattern of contextual learning where most children do not readily have access to input of better quality, unlike the children in e.g. Duncan & Paradis (2019). Such a scenario may be one of the differences between virtual language contact and traditional language contact, i.e., different types of input may be predictive. Even though interactive input probably is still better (e.g. Hoff et al. 2014), receptive input is still the primary source of linguistic data.

In general, our results show that there is no clear evidence of large-scale effects of this English presence on the L1. It is of course important to keep in mind that these are general results in only one of many linguistic variables tested, and further research within the *MoLiCoDiLaCo*-project should also look into individual profiles and smaller groups of children which might show different effect patterns. Another issue to keep in mind is that we focused on current input, and measures of cumulative input could yield different results.

To conclude, we want to emphasize that researchers can address public concern and inform policy-makers. Considering the results presented here, researchers could, for example, discuss the positive effects of increased English presence and aim to promote additive and sustainable multilingualism in Iceland. Additionally, it would be possible to point out that comparing multilingual children to previous monolingual generations is not necessarily effective. Given our results, we can also explain that there is no evidence, so far, for clear and widespread effects of English on Icelandic.

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