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ENGLISH L3 ACQUISITION IN HERITAGE CONTEXTS: MODELLING A PATH THROUGH THE BILINGUALISM CONTROVERSY

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ABSTRACT

The current study adds to research investigating the influence of bilingualism on third language (L3) acquisition, more specifically the assumption that the two previously acquired languages enhance the acquisition of an additional language. We here rely on data from 1,409 bilingual (Russian-/Turkish-German) and monolingual (German) students of grades seven and nine, sampled in schools across Germany. The relevant literature yields mixed and controversial results regarding bilingual advantages, yet it also suggests that L3 acquisition is a multidimensional process potentially affected by various linguistic and extra-linguistic factors. Thus, we examine the relationship between English proficiency (L2 or L3), reading comprehension in German and the heritage languages Turkish and Russian along with cognitive ability and socio-economic status by using several multi-group path analyses, a type of structural equation modelling. The proposed structural equation model of English proficiency can be successfully fitted for all participants investigated, i.e. for both the monolingual and bilingual learners, with the exception of the Turkish-German group when analyzed separately. Overall, the results do not suggest any obvious bilingual facilitation effects or general differences across the learner groups, yet minor differences between the monolingual and bilingual groups in various componential relationships are detected.

KEYWORDS: English proficiency; heritage bilingualism; L3 acquisition; multilingual advantages; structural equation modelling.

1. Introduction

Cognitive and behavioral reflexes of an individual's language experience have been a prominent research area for more than a hundred years. Whereas the early studies (Harris 1948; Jones and Stewart 1951; Saer 1923) were concerned with cognitive disadvantages as a consequence of bilingual upbringing, the seminal study by Peal and Lambert (1962) offered a more positive perspective on bilingualism and even discovered certain cognitive advantages associated with it. The interest in such cognitive differences related to bilingualism is unabated with partially conflicting results reported from different studies and even meta-analyses (De Bruin et al. 2015; Donnelly et al. 2015; Hilchey and Klein 2011; Lehtonen et al. 2018; Nichols et al. 2020; Paap et al. 2015). As results remain inconclusive and the notions of 'advantages' and 'disadvantages' are highly evaluative and probably also culture-dependent, we here prefer the more neutral verbalization in terms of 'bilingual effects' proposed in Leivada et al. (2021).

A number of issues have changed over the decades, with research having witnessed important developments regarding the cognitive areas under scrutiny as well as the tests employed. The earlier studies focused on non-verbal and verbal intelligence using progressive matrices as well as comprehension and/or production tests. Later research expanded to study the effect of bilingualism on executive control, educational attainment, metalinguistic awareness, learning of new scripts, and additional language acquisition. The present study is placed in the area mentioned last.

What has also changed is the conception of bilingualism. Generally, we can see a trajectory from a binary opposition of monolingual versus bilingual to a continuum (qua dominance), and more recently a spectrum of experiences (DeLuca et al. 2019). We here side with the conception of bilingualism in terms of a spectrum of experiences, as it allows us to incorporate sociolinguistic background information besides the more common acquisition parameters of age of onset, exposure, and proficiency. Moreover, viewing bilingualism as a spectrum tempers the expectation to find simple disadvantages or advantages. In addition, it requires us to be careful about cohort effects. Accordingly, we are here looking for effects of previous on subsequent language acquisition in different student groups.

Studying the acquisition of English as an additional language by learners with a bilingual background has revealed a number of potentially positive effects regarding general language proficiencies and metalinguistic awareness. Such positive effects surfaced most prominently with balanced bilinguals (Agustín-Llach 2019; Cenoz 2003, 2013; Cenoz and Valencia 1994; Lasagabaster 1998, 2001; Safont Jordà 2003; Sagasta Errasti 2003; Sanz 2000). The present study continues this line of research, but here targets bilingual heritage speakers of Russian and Turkish in Germany. This entails important distinctions, as the type of bilingualism of these speakers is radically different.

Immigrant bilinguals in their acquisition of English as an additional language have been studied quite extensively (especially in Germany), with partially conflicting results (Edele et al. 2018; Fleckenstein et al. 2018; Göbel et al. 2011; Hirosh and Degani 2018; Hopp et al. 2019; Klieme et al. 2006; Maluch et al. 2015; Maluch et al. 2016; Sanders and Meijers 1995; Schwartz et al. 2007; van Gelderen et al. 2003). There remain many problems, though, as the observable effects are influenced by type of bilingualism, the skills tested, sample size, selection of participants, cognitive abilities, socio-economic status, the background languages, age, the context of language use, literacy, and perhaps others. Any effects emerge in a multidimensional grid with large-scale mutual dependencies. One needs to be cautious regarding the outcomes.

2. Research questions

We here probe into the independence between languages based on specific proficiencies. This represents a special case of cross-linguistic influence in which knowledge of one language can positively (enhance) or negatively (inhibit) knowledge of another language. The present study works with three language groups, namely German monolinguals, Russian-German bilinguals, and Turkish-German bilinguals. They all learn English as a foreign or additional language in the German education system.

Following Cummins (1976, 1979, 1996), we hypothesize that previous language experience may enhance subsequent language acquisition processes (interdependence) as long as certain proficiency levels have been reached (thresholds). We are of course aware that Cummins developed these constructs for bilingual heritage constellations. The present study builds on this conceptual framework and extends it to the acquisition of additional languages, especially English as an L3. Accordingly, we pose the following three research questions:

Research question 1: How does the proposed model of English proficiency function across bilingual and monolingual groups?

Research question 2: How does the proposed model of English proficiency function within and across the three language groups?

Research question 3: How does the proposed model of English proficiency function across bilingual groups?

The research questions introduced above will be followed up by looking into specific language proficiencies like reading comprehension as well as the completion of C-tests. We do not make any claims about the underlying language competence of the subjects in a more narrow linguistic sense (see MacSwan 2000 for discussion).

3. Methodology

The present study is part of a comprehensive research project on multilingual development that scrutinizes the linguistic development of a national sample of German secondary school students (Mehrsprachigkeitsentwicklung im Zeitverlauf 'Multilingual development: a longitudinal perspective' (MEZ), University of Hamburg; www.mez.uni-hamburg.de). The project contrasts bilingual cohorts of Turkish-German and Russian-German students with monolingual German students. Participating schools were selected based on comparably high percentages of students with a Russian- or Turkish-German background and the offer of either or both Russian and French as foreign language subjects in addition to English (Brandt et al. 2017: 350). The longitudinal project features four waves of data collection carried out between 2016 and 2018. The present study concentrates on the first wave of data collection conducted between January and March 2016. In total, 72 schools from eight federal states in southern, western, and northern Germany participated in this first wave (Hellrung et al. 2017: 10).

3.1. Participants

The participants are German secondary school students attending the seventh (age 12–13) and ninth (age 14–15) grades. Initially, 1,875 students were approached, while 1,818 of these participated in the study. Later, 100 students were excluded from the study due to contradictory statements concerning their background languages, resulting in a total of 1,718 students (German monolingual: n=914; Russian-German: n=319; Turkish-German: n=485). After the data were screened for validity, reliability, and usability, it was observed that there were missing values completely at random for several variables. Initially, it was attempted to impute the missing values by using techniques such as regression imputation and multiple imputation. Nevertheless, considering the limited number of items on several measures to predict the missing values accurately, and the large sample size at hand, it was decided to exclude the students who did not complete all measures. In the structural equation modeling literature, a sample of at least 200 or 300 cases has been recommended to estimate models (Comrey and Lee 2013; Kline 2011; Tabachnick and Fidell 2013). Given that we had at least 230 students in each cohort, and the total number of students exceeded 1,000, the participants that did not provide complete answers were excluded. Thus, the final analyses were conducted on data obtained from 1,409 students (German monolingual: n=852; Russian-German: n=237; Turkish-German: n=320). The bilingual students were given a so-called locator test (Hellrung et al. 2017) to ensure that they had reached sufficient proficiency levels (listening comprehension) in their heritage language. All bilingual students are raised in Germany and attend German schools. This means that German counts as their majority language, while their heritage language is largely confined to the home context. All participants can be categorized as beginners/intermediate learners of English. The additional language English is the L2 for the monolingual participants and the L3 for the bilinguals (as they have already acquired two languages and English is their third language).

3.2. The instruments

We employed a set of instruments to collect the data, namely a reading fluency and comprehension test (LGVT – Lesegeschwindigkeits- und-Verständnistest) both in the heritage language and German, a C-test in English, and a cognitive ability test. In addition, we obtained information about the socio-economic status. Reading comprehension ability in the majority language German and the heritage languages (Russian/Turkish) are regarded as a proxy for language proficiency in the respective languages. Since we were specifically interested in understanding the relationship between a broad set of cognitive, linguistic, and contextual factors (e.g., English proficiency, reading comprehension in the majority and heritage language, cognitive ability, socio-economic status), we did not include additional variables (e.g., age, school type, affective or motivational variables) that were not directly linked to our research questions. The descriptive statistics (mean, median, and standard deviation) of the variables used are presented in Table 1 and the instruments as such are described in the following sections.

Table 1. Descriptive statistics of the variables.

Variable	Group	Mean	Median	SD
Cognitive ability (KFT)	GER	17.57	19.00	5.51
	RUS-GER	17.60	19.00	5.27
	TUR-GER	14.71	16.00	6.27
Socio-economic status (HISEI)	GER	55.19	56.00	20.19
	RUS-GER	44.83	39.04	20.07
	TUR-GER	40.17	31.71	18.90
Reading comprehension German	GER	31.43	31.00	9.98
	RUS-GER	28.76	29.00	9.78
	TUR-GER	26.43	27.00	10.55
Reading comprehension Russian	RUS-GER	5.73	3.00	9.90
Reading comprehension Turkish	TUR-GER	8.43	7.00	9.34
C-Test English	GER	53.74	56.00	18.46
	RUS-GER	51.56	51.00	18.41
	TUR-GER	50.56	51.00	17.92

Note: GER = German monolingual group (n=852), RUS-GER = Russian-German bilinguals (n=237), TUR-GER = Turkish-German bilinguals (n=320).

3.2.1. Proficiency in the majority language and the heritage languages

The reading fluency and comprehension test (Schneider et al. 2016) measures receptive abilities of the students in the majority language German and the heritage languages Russian or Turkish. The test, originally only available for German, was translated into and adapted for Russian and Turkish to have a comparable measure for both previously acquired languages. Each test includes a text with 47 gaps which had to be completed in a maximum of six minutes by using one of the three options provided for each gap. This task is the basis for assessing reading comprehension.[1] For each gap, a student receives two points for selecting the correct option, zero points if they leave the gap empty, and a negative point (−1) if they select the wrong option. The test scale ranges from −47 to +94 points.

3.2.2. English proficiency

We measure the students' English proficiency through a C-test, based on the C-tests used in the DESI-study (Klieme et al. 2006). The C-test includes four short texts on different topics and a total of 90 end-clipped words. A maximum of 20 minutes is allowed to complete the test. The students need to complete these end-clipped words and adjust the presented words grammatically. While a student receives one point for a correct answer, they receive zero points for partially or completely incorrect answers or for omitting the gap. The C-test scale ranges from 0 to 90.

3.2.3. Cognitive ability

We assess the students' general cognitive ability by using a subset of the standardized German cognitive ability test KFT 4–12+ R which measures visual-spatial (non-verbal) abilities and targets students from grades 4 to 12 (Heller and Perleth 2000). The subtest includes 25 test items, with differing test items for the two age cohorts to accommodate the age difference. The students receive one point for each correct answer and zero points for each incorrect answer, resulting in a scale of zero to 25 points.

3.2.4. Socio-economic status

The socio-economic status of the students' families is operationalized in form of the Highest International Socio-Economic Index (HISEI). This index was estimated by using the occupation of students' parents based on the Inter-

[1] This test also includes a measure to assess reading fluency via counting the words the students managed to read in a specific period of time. However, in the current study, this measure is not considered, as it does not add to the power of the models.

national Standard Classification of Occupations code, the ISCO-08-categorization (International Labor Office 2012) which was then transferred to the International Socio-Economic Index (ISEI) (Ganzeboom, De Graaf and Treiman 1992). The HISEI values vary between 16 and 90.

3.3. Data analysis

We employed a set of statistical techniques to analyze the data. Initially, the data were screened for reliability, validity, and missing cases. At this stage, we specifically used descriptive statistics, and inferential statistics such as Cronbach alpha coefficient using SPSS 25 (IBM Corp. 2017). We proceeded to the main analyses after ensuring that the data were complete and reliable.

To answer the research questions, we analyzed the data by using the structural equation modeling (SEM) approach. SEM enables researchers to model, estimate, and test underlying theories and scrutinize hypothesized cause and effect relationships as well as determine pivotal constructs by using empirical data. We tested our models and estimated the structural path coefficients by using R (Version 4.0.2; R Core Team, 2020), which is a language and environment for statistical computing. The data were analyzed using the structural equation function of the lavaan package (Version 0.6-1; Rosseel 2012). We evaluated the significance and relevance of the structural paths by scrutinizing the standardized path coefficients and the probability values. After estimating the structural paths, we conducted a follow-up analysis, a multi-group SEM analysis, to check if there are significant differences in group-specific parameter estimates across groups (i.e., German monolingual, Turkish-German bilingual, Russian-German bilingual).

The final analysis includes two structural equation models, i.e. the base model, and an expanded version of the base model including heritage language proficiency. We specified two models as detailed in the Appendix.

4. Results

The present study assumes that a set of linguistic, cognitive, and contextual variables account for and influence proficiency in English as an additional language. These variables are featured in the model of L3 proficiency (respectively L2 proficiency for the monolingual German participants) proposed in the present study (see Figure 1).

4.1. Research question 1: How does the proposed model of English proficiency function across bilingual and monolingual groups?

This research question seeks to understand how the proposed model (Figure 1) explains English proficiency and how the variables included in this model interact with each other. To this end, we initially tested the proposed model on all participants without forming groups. The model includes the interactions and relationships between the variables expressed as a set of hypotheses. We measured these hypothesized relationships and interactions by using SEM analyses. As a second step, we conducted a multi-group path analysis across two groups (i.e., monolingual students and bilingual students) to see if there are differences between the groups in terms of the hypothesized relationships.

The analyses were conducted to examine the properties of a structural model that represents the theory of interest along with a set of associated constructs (i.e., latent variables that are not observed or measured directly). The structural model includes a set of coefficients for hypothesized relationships obtained by estimating a series of regression coefficients.

To answer the first research question, we evaluated how well the model fits the data. We calculated several fit indices for the base model to determine whether it provides a statistically acceptable representation of the data (Table 2).

Table 2. Fit indices of the base model.

Fit index (cut-off criteria)	Obtained value
Chi-square ($p>0.05$)	16.125 (0.06)
RMSEA (<0.08)	0.024
CFI (>0.9)	0.999
SRMR (<0.08)	0.010
R^2 English proficiency	0.606

The fit indices presented in Table 2 indicate that the base model provides a good representation of the data based on the thresholds recommended by Kline (2011), and the estimates for the model can be interpreted. We checked the R^2 value, which ranges from 0 to 1, and stands for the variance explained in each

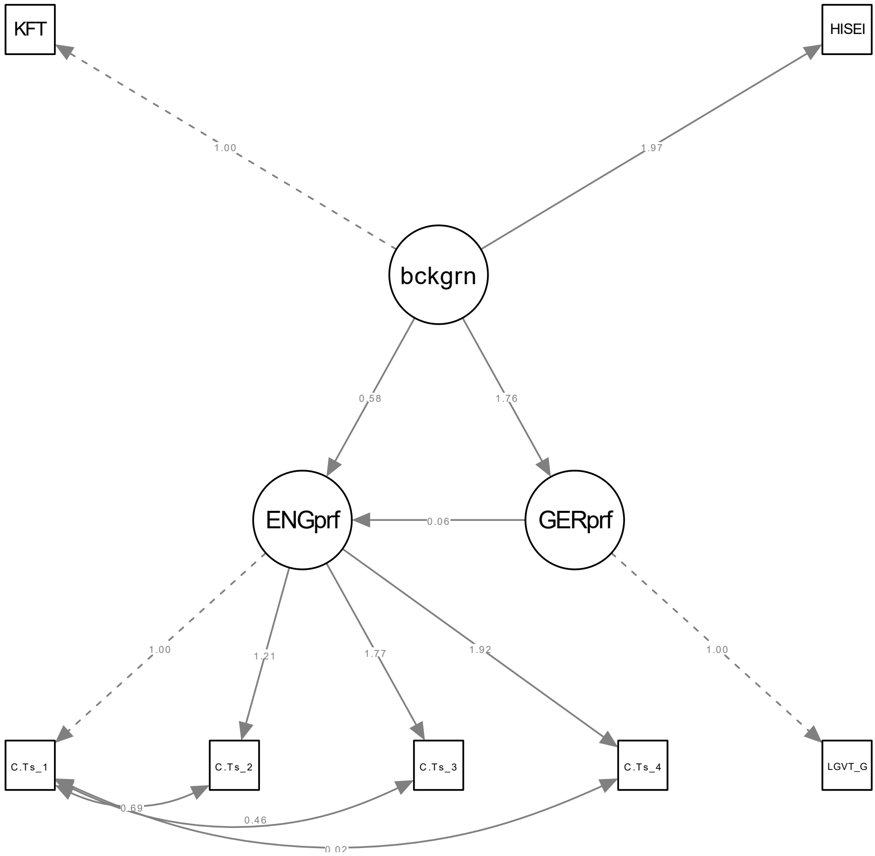

Figure 1. The proposed base model of English proficiency and (unstandardized) path estimates.
Note: KFT = cognitive ability, HISEI = socio-economic status, bckrgnd = background variables, ENGprf = English proficiency, GERprf = German proficiency, C.Ts_1/2/3/4 = English C-Tests, LGVT_G = German reading comprehension.

of the endogenous constructs. It can be regarded as an indicator of the model's explanatory power (Shmueli and Koppius 2011). We obtained an R^2 for English proficiency of 0.606, which can be considered substantial (Henseler, Ringle and Sinkovics 2009). Put differently, the variables we included in the model can explain around 60% of the variance in English proficiency. Based on these results, we conclude that the base model functioned at an acceptable level. Thus, the structural paths that denote the hypothesized relationships between the variables can be examined.

We estimated the path coefficients by using the sem-function in R. The significance and relevance of the structural paths were evaluated by examining the standardized path coefficients and the probability values (Table 3).

Table 3. Unstandardized and standardized path coefficients, and significance levels for the base model in Figure 1.

Parameter estimate	Unstandardized	Standardized
English proficiency → English C-Test 1	1.000	0.858^{***}
English proficiency → English C-Test 2	1.212	0.878^{***}
English proficiency → English C-Test 3	1.771	0.917^{***}
English proficiency → English C-Test 4	1.925	0.941^{***}
German proficiency → LGVT German	1.000	1.000^{***}
Background → cognition (KFT)	1.000	0.579^{***}
Background → socio-economic status (HISEI)	1.974	0.316^{***}
Background → English proficiency	0.576	0.639^{***}
German proficiency → English proficiency	0.062	0.210^{**}
Background → German proficiency	1.759	0.573^{***}

Note: LGVT German = reading comprehension in German; Significance levels: *** $p < 0.001$, ** $p < 0.05$.

The results presented in Table 3 demonstrate that all structural relationships specified in the base model are statistically significant and positive. The results indicate the significant role of the background variables i.e., cognitive ability and socio-economic status, for proficiency in German (0.573) and English proficiency. In particular, the impact of the background variables on English proficiency seems to be quite strong (0.639). Moreover, the results reveal that proficiency in the majority language German exerts a positive impact on English proficiency (0.210). After testing the base model in all groups as a whole, a multi-group analysis was conducted to determine if there are significant differences in group-specific parameter estimates across the two groups (monolingual versus bilingual). The estimates are examined for significance at the 5% probability of error level for group-specific path coefficients. Details are shown in Table 4.

Table 4. Standardized path coefficients, and significance levels
for the base model in Figure 1 for the monolingual versus bilingual groups.

Parameter Estimate	Standardized (mono)	Standardized (bili)
English proficiency → English C-Test 1	0.873^{***}	0.853^{***}
English proficiency → English C-Test 2	0.882^{***}	0.870^{***}
English proficiency → English C-Test 3	0.917^{***}	0.915^{***}
English proficiency → English C-Test 4	0.945^{***}	0.935^{***}
German proficiency → LGVT German	1.000^{***}	1.000^{***}
Background → cognition (KFT)	0.574^{***}	0.507^{***}
Background → socio-economic status (HISEI)	0.309^{***}	0.216^{***}
Background → English proficiency	0.695^{***}	$0.719^{n.s.}$
German proficiency → English proficiency	$0.181^{n.s.}$	$0.172^{n.s.}$
Background → German proficiency	0.561^{***}	0.561^{**}

Note: LGVT German = reading comprehension in German, mono = monolingual German group, bili = all bilingual participants, n.s. = not significant; Significance levels: *** $p < 0.001$, ** $p < 0.05$, $^{n.s.}$ $p > 0.05$.

While the R^2 value for the German monolingual group is 0.656, the R^2 for the bilingual group is 0.686. Overall, the results reveal that the two groups' estimates are quite comparable on most structural paths. In the monolingual group, German proficiency does not contribute to explaining English proficiency ($p = 0.083$). Likewise, the same is observed in the bilingual group ($p = 0.425$). For the bilingual group, the impact of background variables on English proficiency is insignificant ($p = 0.057$), while background variables influence English proficiency positively in the monolingual group. However, we would like to stress that some differences between the p-values are rather small and that the threshold of 5% has been set rather arbitrarily. In addition, the observed differences between the p-values may in fact not be statistically significant (see Gelman and Stern 2006). The impact of background variables on German proficiency is positive and significant in both groups.

4.2. Research question 2: How does the proposed model of English proficiency function within and across the three language groups?

The second research question seeks to understand the extent to which the previously introduced model (Figure 1) functions across the monolingual German and the two bilingual (Turkish-German/Russian-German) groups separately to detect any significant differences across the groups in terms of the hypothesized relationships. The procedures and estimations conducted to answer the first research question were repeated in the same order. Because we tested the base model presented in Figure 1 on the same data with different grouping arrangements (i.e., German monolingual vs. Russian-German vs. Turkish-German), we obtained the same model-to-data fit, and structural path coefficient values for the base model tested. To understand how the proposed model functions across the monolingual and the two bilingual groups separately and to capture existing differences, if any, we ran an additional multi-group analysis. Even though we obtained reliable results for the German-monolingual and Russian-German bilingual group, the model did not converge for the Turkish-German group, apparently due to issues related to multicollinearity. Hence, we only report the results for the Russian-German bilingual group in Table 5. For the German monolingual group, see Table 4 again.

Table 5. Standardized path coefficients, and significance levels for the base model in Figure 1 for the Russian-German group.

Parameter Estimate	Standardized
English proficiency → English C-Test 1	0.876^{***}
English proficiency → English C-Test 2	0.874^{***}
English proficiency → English C-Test 3	0.911^{***}
English proficiency → English C-Test 4	0.951^{***}
German proficiency → LGVT German	1.000^{***}
Background → cognition (KFT)	0.515^{***}
Background → socio-economic status (HISEI)	0.322^{***}
Background → English proficiency	$0.656^{n.s.}$
German proficiency → English proficiency	$0.248^{n.s.}$
Background → German proficiency	0.547^{**}

Note: LGVT German = reading comprehension in German, n.s. = not significant; Significance levels: *** $p < 0.001$, ** $p < 0.05$, $^{n.s.}$ $p > 0.05$.

The R^2 values for the German monolingual group and the Russian-German group are 0.656 and 0.669, respectively. As was the case in the first analysis, the results reveal that the two groups' estimates are quite comparable on most of the structural paths. However, while background variables exert a significant positive impact on English proficiency in the German group, the impact of background variables on L3 is insignificant in the Russian-German group ($p = 0.056$). Arguably, the significant path between background variables and English proficiency in Figure 1 could be due to the influence of the German subgroup. Moreover, the impact of German proficiency on English proficiency is insignificant across both groups (Russian-German: $p = 0.205$).

4.3. Research question 3: How does the proposed model of English proficiency function across bilingual groups?

While research questions 1 and 2 tested the functioning of the same base model by using different grouping arrangements, research question 3 seeks to understand how the base model functions within the bilingual groups (Turkish-German vs. Russian-German). We tested an expanded version of the base model (Figure 1) by including heritage language proficiency (Figure 2), since we are specifically interested in the contribution of the heritage language on English proficiency.

As was the case with the second research question, the model did not converge for the Turkish-German group (due to multicollinearity). Hence, we only report the results on the expanded model for the Russian-German group. Fit indices and R^2 values for the updated model are presented in Table 6.

Table 6. Fit indices of the expanded model (based on the Russian-German group).

Fit index (cut-off criteria)	Obtained value
Chi-square ($p>0.05$)	27.308 (0.274)
RMSEA (<0.08)	0.023
CFI (>0.9)	0.998
SRMR (<0.08)	0.016
R^2 English proficiency	0.686

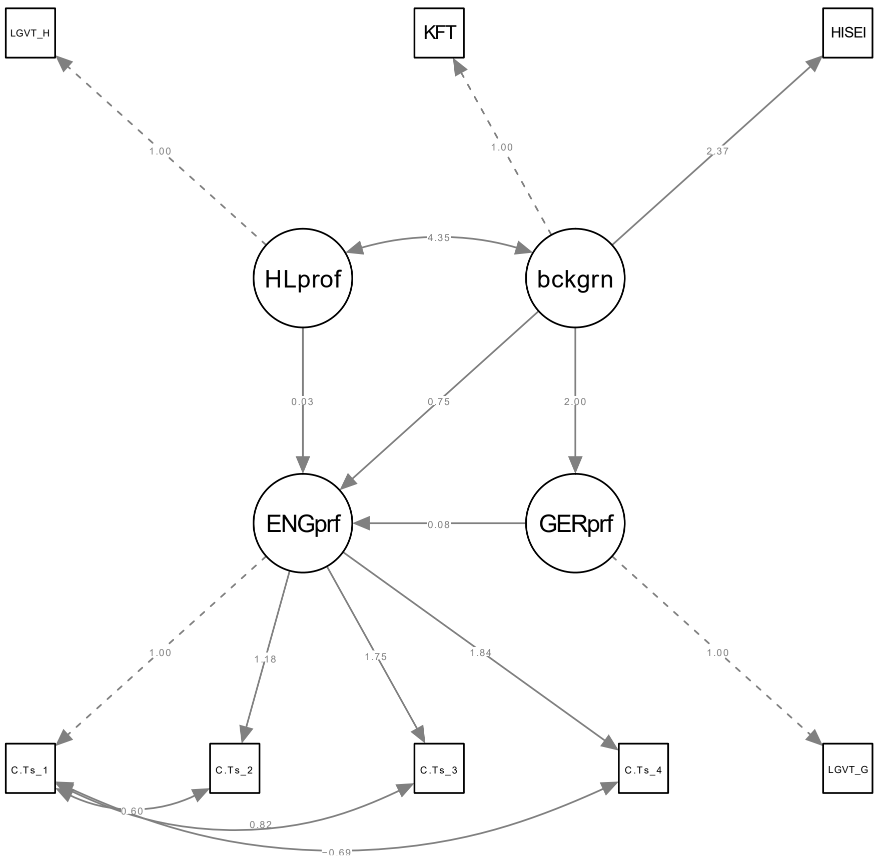

Figure 2. The expanded model of English proficiency for the Russian-German group and (unstandardized) path estimates.

Note: KFT = cognitive ability, HISEI = socio-economic ststus, bckrgnd = background variables, ENGprf = English proficiency, GERprf = German proficiency, C.Ts_1/2/3/4 = English C-Tests, LGVT_G = German reading comprehension, LGVT_H = heritage language reading comprehension.

The fit indices presented in Table 6 indicate that the expanded model provides a good representation of the data based on the criteria recommended by Kline (2011), and the estimates for the model can be interpreted. We obtain an R^2 of 0.686, which is quite substantial, as the variables included in the expanded model can explain around 70% of the variance in English proficiency in the Russian-German group. Based on these results, we conclude that the expanded model functions effectively, thus, the structural paths that denote the hypothesized relationships between the variables can be examined.

Table 7. Unstandardized and standardized path coefficients, and significance levels for the expanded model in Figure 2 for the Russian-German group.

Parameter Estimate	Unstandardized	Standardized
English proficiency → English C-Test 1	1.000	0.859^{***}
English proficiency → English C-Test 2	1.178	0.872^{***}
English proficiency → English C-Test 3	1.750	0.912^{***}
English proficiency → English C-Test 4	1.835	0.952^{***}
German proficiency → LGVT German	1.000	1.000^{***}
Heritage language (HL) proficiency → LGVT HL	1.000	1.000^{***}
Background → cognition (KFT)	1.000	0.511^{***}
Background → socio-economic status (HISEI)	2.374	0.319^{***}
Background → English proficiency	0.751	0.652^{**}
German proficiency → English proficiency	0.076	$0.241^{n.s.}$
Heritage language proficiency → English proficiency	0.027	$0.086^{n.s.}$
Background → German proficiency	2.005	0.552^{**}

Note: LGVT German/HL = reading comprehension in German/heritage language, n.s. = not significant; Significance levels: *** $p < 0.001$, ** $p < 0.05$, $^{n.s.}$ $p > 0.05$.

As before, we estimated the path coefficients by using the sem-function in R. The significance and relevance of the structural paths were evaluated by examining the standardized path coefficients and the respective probability values (see Table 7). The results demonstrate that 10 out of 12 structural relationships are statistically significant. As an exception, the impact of German proficiency on English proficiency is insignificant ($p = 0.195$). Likewise, the impact of the heritage language on English proficiency does not reach statistical significance either ($p = 0.180$). However, the results also indicate that the background variables exert a positive significant impact on both German as well as English proficiency in the Russian-German group.

5. Discussion

In this study, we propose a model of English ability (L3 for the bilingual and L2 for the monolingual participants) which is, as we argue, essentially defined by a number of linguistic, cognitive, and contextual variables. The aim is to model English proficiency, operationalized through the performance in four different C-tests, and to investigate how the proposed model responds to the entire student population as well as for each language group separately. With this approach, we can identify differences and similarities between monolingual German learners of English and their bilingual Russian-German and Turkish-German peers.

In principle, further variables may also impact the acquisition of the additional language English. Examples include gender, type of school, age, motivational and attitudinal variables, among others. However, we here deliberately opted for a candid model to approximate reality (even though we are aware that language acquisition is a multifactorial and complex process, influenced by numerous factors). Given that the R^2 value, i.e. the explained variance of the latent variable English proficiency, exceeds 60% for all groups, we can be certain that the two models presented in this study have considerable explanatory power. The following sections zoom into specific aspects that deserve a more detailed explanation. Crucially, depending on the perspective (i.e. the grouping of the participants), the results differ, at times quite drastically. We therefore emphasize that both results and discussion are exclusively valid for the specific cohorts investigated here in relation to the models tested. Thus, we cannot offer generalizations that generally hold for bilingual heritage speakers acquiring an additional language in an instructed setting. No study can do that.

5.1. The role of background variables in additional language acquisition

Background is operationalized as a latent variable, exclusively inferred from the cognitive ability score and the socio-economic status. In the entire sample, background adds significantly to explaining English proficiency (Figure 1, Table 3). This is in line with Berthele and Udry (2019), who also used a structural equation model approach and identified a positive link between cognition and foreign language ability. We here go one step further, arguing that both cognition as well as socio-economic status significantly add to explaining the variance observed in English proficiency. The meaningful role of the socio-economic background of the foreign language learners finds support in a number of studies, as it frequently has been shown that this variable impacts foreign language acquisition (Cenoz 2003, 2013; Montanari 2019), especially in immigrant contexts (Cenoz 2013). Again, for the entire sample, we can confirm this influence.

Crucially, the path coefficient between English proficiency and background variables is considerably stronger than that between German and English proficiency. This also finds support in Berthele and Urdy (2019), who even go so far as to argue against a multilingual boost but maintain that additional language acquisition success can be best predicted from cognitive ability rather than effects related to multilingualism or previous language acquisition.

Remarkably, however, once the model is applied to subgroups based on language membership, interesting contrasts emerge. Whereas the path coefficient between English proficiency and background remains positive and significant among the German monolinguals (as was for the entire cohort), statistical significance of the same path is neither reached in the group of the bilingual participants nor in the base model, when only the Russian-German bilinguals are considered. In the expanded model, i.e. where heritage language proficiency is part of the analysis, the path coefficient between English proficiency and background reaches significance for the Russian-German group again. Moreover, because the two models did not converge error free for the Turkish-German group, we disregarded them at this point. This clearly signals that the background of the three groups plays out differently. A closer look at these two variables in isolation (see also Table 1) reveals that the monolinguals have, on average, a higher socio-economic status than the bilinguals (see Lorenz, Rahbari, Schackow and Siemund 2020, for a more detailed presentation). Moreover, in the scatterplots correlating all variables included in the structural equation model, there is a weak but positive significant correlation between cognition and socio-economic status in both the German monolingual as well as the Russian-German group. In the Turkish-German group, this is not the case.

We understand these differences as explanations for the diverging output of the structural equation model for each cohort investigated here. In terms of background variables, there are significant differences across the monolingual students and their bilingual peers, which affects English proficiency.

5.2. Interdependence of languages

The linguistic variables included in the structural equation models are based on a reading comprehension test, administered in the majority language German and, if applicable, the heritage languages Russian or Turkish. In the C-test, which is used to operationalize English proficiency, both lexical as well as grammatical knowledge is tested, whereas in the reading task exclusively lexical and collocational knowledge is required. Ideally, the proficiency in the previously acquired languages German, Russian, and Turkish would have been tested with comparable C-tests in all three languages to ensure compliance and comparability with the skills tested in English (on reading comprehension see Trapman et al. 2017, van Gelderen et al. 2003; on C-tests see Chapelle 1994; see also Gogolin et al. 2017; but see Berthele and Udry 2019 who also used different tasks for the languages they compared). This, however, was impossible to administer in the course of this longitudinal study, which already consisted of a comprehensive test battery.

Building on Cummins (1979: 233), who argues for the connectedness of language skills across one's language repertoires (interdependence hypothesis), we investigate if we can attest this relationship between German and English, on the one hand, as well as the heritage language and English on the other. In contrast to subsequent publications (e.g., Cummins 2009: 267), we are here specifically interested in the interdependence of language abilities and not general cognitive abilities (see Berthele and Vanhove 2020: 551).

5.2.1. Interdependence of English and German

The results visualized in the base model (Figure 1) show quite clearly that there is a significant positive relationship between reading proficiency in German and additional language English proficiency. This suggests that reading comprehension in one language is indeed connected to the language skills measured with a C-test in another language. However, (i) this relationship is weaker than the one identified between English proficiency and background variables, and (ii) it is only significant when the entire sample is tested. Once individual groups are considered, statistical significance is not reached (as the p-values are above the threshold of 0.05; i.e. German monolinguals: $p = 0.083$; bilinguals: $p = 0.205$; Russian-German bilinguals: $p = 0.425$).

Although these results partly confirm Cummins' (1979) interdependence hypothesis, we hesitate to claim that we identified a clear and strong link between German and English proficiency in the current data. While we are convinced that the languages in the brain are interconnected, the measures used here suggest a path along general cognition rather than what Cummins terms common underlying proficiency (CUP; Cummins 2000).

5.2.2. Interdependence of English and heritage language

Furthermore, when heritage language proficiency is part of the model (Figure 2, Table 7), it does not reach statistical significance in the Russian-German group ($p = 0.180$). This non-significant relationship between the heritage language and English proficiency finds support in Cummins' (1979) threshold hypothesis (but see Berthele 2019 and Takakuwa 2005 for a critical assessment of the threshold hypothesis). Cummins (1979) argues that a certain level of (academic) proficiency is necessary in order to influence proficiency in another language positively. This may be an issue here, as the bilingual heritage speakers are considerably less proficient in their heritage language than in German, which is apparent from the lower mean scores in the reading comprehension test in Russian or Turkish (Table 1; see also Montrul 2016 and Polinsky 2018). The academic proficiency in the heritage language may not be developed enough to exert a positive influence on English proficiency. This is in line with a study based on similar groups of participants. Hopp (2019), who investigates cross-linguistic influence on L3 English in bilingual heritage speakers (Turkish-German), finds no influence from Turkish. Instead, he demonstrates equal performance in a sentence repetition task and an oral picture story retelling task of the bilinguals and monolinguals. Thus, the heritage language does not seem to have an effect on the performance in English, similar to what the present data suggest.

6. Conclusion

This study aimed to explain the relationship between the previously acquired languages of heritage bilinguals on the acquisition of English in comparison to learners with a monolingual background. Language acquisition is a multidimensional process influenced not only by linguistic but also extra-linguistic factors. Therefore, we propose a model which includes both linguistic as well as cognitive and social variables to explain the ability in the additional language English. We here compared monolingual German school-aged students with their Russian-German and Turkish-German peers. They all attend secondary schools in Germany and learn English as an additional language. The heritage speakers are unbalanced bilinguals with high proficiency in German and comparably low proficiency in their heritage language.

Based on two structural equation models, we could show that the ability in the additional language English is impacted by reading proficiency in the majority language German, cognitive ability, and socio-economic status in a statistically significant sense. Crucially, the background variables (cognitive ability and socio-economic status), introduced as latent measures, contribute most to the explanatory power of the model. Interestingly, these significant relationships vanish when the participants are subdivided into their respective language groups (i.e. German monolinguals, Russian-German, and Turkish-German bilinguals). We therefore conclude that any observable multilingual boost is highly group specific, and closely interacts with general cognitive ability.

APPENDIX

R syntax for the base model (Figure 1):

```
model.b <-
ENGprf =~ C.Ts_1 + C.Ts_2 + C.Ts_3 + C.Ts_4
GERprf =~ LGVT_G
bckgrn =~ KFT + HISEI
ENGprf ~ bckgrn + GERprf
GERprf ~ bckgrn
C.Ts_1 ~~ C.Ts_2 + C.Ts_3 + C.Ts_4
```

R syntax for the expanded model (Figure 2):

```
model.e <-
ENGprf =~ C.Ts_1 + C.Ts_2 + C.Ts_3 + C.Ts_4
GERprf =~ LGVT_G
HLprf =~ LGVT_H
bckgrn =~ KFT + HISEI
ENGprf ~ bckgrn + GERprf + HLprf
GERprf ~ bckgrn
C.Ts_1 ~~ C.Ts_2 + C.Ts_3 + C.Ts_4
```

ENGprf = latent variable English proficiency, C.Ts_1/2/3/4 = English C-tests, GERprf = latent variable German proficiency, HLprf = latent variable heritage language (Russian or Turkish) proficiency, LGVT_G = German reading comprehension score, LGVT_H = heritage language reading comprehension score, bckgrn = latent variable background, KFT = cognitive ability score, HISEI = socio-economic status.

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