Language acquisition and age at immigration: The difficult conditions for bilingualism[1]

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Summary

This contribution deals with the theoretical explanation and empirically observable impact of the age at immigration on the development of (competent) bilingualism. What is behind this, is the obvious, however also controversial, hypothesis that certain social conditions that foster the acquisition of one language impede the acquisition of another one. This may be due to the fact that the respective day-to-day language environments often differ in terms of space, time, and also socially. In addition, as concerns the age at immigration the – also controversial – hypothesis becomes important that there is a 'critical period' in language acquisition. In this contribution we develop a theoretical model of second and first language acquisition and analyse it empirically using data of the socio-economic panel. The two most important results are that, first, there are indeed certain conditions that mutually impede the acquisition of both languages and that this especially applies to the age at immigration as one of these conditions, and, second, that there is a clearly identifiable 'critical period' in second language acquisition (starting at about the age of 13). The development of (competent) bilingualism is thus impeded from two sides: A too low age at immigration obstructs first language acquisition, whereas a too high age obstructs second language acquisition. The practical conclusion for enhancing bilingualism is then to allow for *inter*ethnic contacts at an *early* stage in order to provide *simultaneous* exposure to different language environments during the period when learning aptitude is highest.

Keywords: language acquisition, bilingualism, age at immigration, critical period hypothesis

Bilingualism is often regarded as a particularly desirable form of the social integration of immigrants: The simultaneous mastery of the language spoken in the receiving country and of skills in a (different) mother tongue make up both a societal and individual capital of considerable value. This capital can serve, for example, as a communicative and cultural enrichment of the receiving country or it may be of great economic advantage to individual persons, particularly in times of globalisation and transnationalisation (cf., e.g., Portes and Rumbaut 2001: 243; Keim and Tracy 2006). Bilingualism requires, as a matter of course, the acquisition of two languages, what would be rather unproblematic if it occurred simultaneously in early childhood. In the normal case, however, individuals don't acquire both languages simultaneously and for immigrants (and their offspring) the problem is

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especially complicated: The acquisition of mother tongue skills is enhanced or even only possible when staying in inner ethnic environments, whereas the acquisition of the language of the receiving country is linked to interethnic contacts. The problem that arises is that both contexts are usually separated in terms of space and time as well as socially. This leads us to the assumption that the acquisition of bilingualism represents a kind of zero-sum problem, because certain "exclusive" social conditions, like ethnic segregation of the living environment, the ethnic composition of friendship networks, or the age at immigration, only allow to acquire one competence at that cost of the other one.

This contribution aims at analysing empirically whether this zero-sum problem for the acquisition of bilingualism indeed exists. In our analysis we focus, in particular, on *age at immigration*. There are two reasons for that: First, there is evidence that (second) language acquisition not only becomes more difficult with an increasing age at immigration, but even clearly declines once a certain "critical period" is reached after which it can hardly be compensated for any more. The second reason refers to a political practical background: Restrictions in terms of the age at immigration, e.g., in the course of family reunion, are among the most vehemently debated regulations of immigration policy, because it is assumed that the problems in (second) language acquisition arising from the age at immigration aren't that serious at all. This assumption is also based on the belief that the so-called critical-period-hypothesis (CPH) doesn't apply at all or if it applied it could well be balanced by, for example language courses for adults. We begin this contribution with the theoretical modelling of second and first language acquisition and then address the impact of certain conditions for language acquisition that can be expected on the basis of the theoretical model, followed by a discussion of the CPH. As far as the available data allow, we subsequently test the theoretical hypotheses with the Socio-Economic Panel (GSOEP), particularly focusing on the effects of age at immigration and on the CPH. We conclude this contribution with a summary of possible appropriate practical measures supporting those constellations that allow for a (competent) bilingualism to develop most easily or even without any problems at all.

I. Bilingualism and language acquisition

As may initially sound quite trivial, bilingualism means the mastery of two languages, i.e., of the first language or mother tongue L1 and of another language L2 (or as the case may be of

still other languages and the corresponding multilingualism) which are learned simultaneously or subsequently. Depending on the mastery of the respective language, different constellations can arise. If one dichotomizes the variables, the following typology will result.

Here: Figure 1

Bilingualism hence denotes the case of multiple inclusions in terms of language. Moreover, integrating it into the general classification of the dimension of (social) integration, bilingualism represents a part of the cultural dimension, i.e., the acquisition of skills in addition to, in particular, knowledge and habits (cf. Esser 2006: 24ff and on analogous and further differentiations that have been published in the field of linguistics Verhoeven 1987: chapters 2 and 3, as well as Tracy and Gawlitzek-Maiwald 2000: 496ff., for example).

The explanation of the emergence of bilingual competences represents a subtype of the explanation of language skills in general. *Two* clearly distinctive explanation problems arise here: One has to explain both the acquisition of skills in the *second* language L2 *and* the acquisition or retention of skills in the *first* language L1. In terms of the first language the question of whether to retain it or to give it up becomes important as well. This applies, in particular, to subsequent generations. These processes are also referred to as *language retention* or *language shift*. We will now develop a comprehensive model of the effective mechanisms underlying these processes that allows deducting special theoretical hypotheses on the impact of certain social conditions.

Acquiring language skills can be considered as a special form of *learning* (cf. Gazzaniga 1992: Introduction and chapters 2 to 4) or as a kind of *investment* that is made more or less consciously (cf., e.g., Chiswick 1998: 255ff.). Three basic conditions that underlie both processes can be specified: the *motivation* for language acquisition, the *opportunities* for it, and potential *costs*. In terms of the opportunities two distinct conditions become important: the level of *exposure* to a favorable learning environment and the *efficiency* degree of translating a certain exposure to a certain learning result (cf., e.g., Spolsky 1989 or Klein and Dimroth 2003 from a linguistic perspective; Chiswick 1998: 255ff. from an economic perspective; and Jasso and Rosenzweig 1990: 327f., 332ff., Stevens 1992: 172ff., van Tubergen 2004: 139ff. from a sociological perspective). The theoretical systematization of the

correlation between the three or four constructs is based on the assumption that both learning and an investment involve adding a new element to an already existing repertoire of skills. One can reconstruct this with a selection model that includes the choice between an alternative that is already given and hence certain and an alternative that depends on several conditions and hence uncertain. It is obvious to make this reconstruction within the scope of the well-known Expected Utility theory (EU-theory), which has been applied successfully to numerous similar problems (cf. Esser 2006: paragraph 3.1 on more details). Accordingly, learning or an investment will occur if the weight for their "expected utilities" (EU) exceeds the one for remaining in the status quo. Denoting the returns to the status quo as U(sq), those to a successful learning or investment as U(in), the probability of these returns to occur that varies with the available opportunities for a successful learning or investment as p(in), and potential costs as C(n) the two following equations for the two EU-weights result:

(1) $EU(sq) = U(sq)$.
(2) $EU(in) = p(in)U(in) + (1-p(in))U(sq) - C(in)$.

Assuming that $EU(in)>EU(sq)$, the following condition for the transition from a given status quo of equipment with human capital to a successful acquisition of a resource by learning or an investment applies:

(3) $p(in)\,(U(in)-U(sq)) - C(in) > 0$.

Accordingly, *motivation* consists of the difference U(in)-U(sq) and can thus change due to both variations in the status quo and in the returns to learning and investment. *Opportunities* p(in) involve the combination of *exposure* p(exp) on the one hand, and *efficiency* p(eff) on the other. One can then derive the following equation for the complete model:

(4) $(p(exp)p(eff))\,(U(in)-U(sq)) - C(in) > 0$.

In terms of *second language* acquisition *motivation* consists in the payoff that could be achieved by competencies in the L2 (U(L2)) less the payoff that is already given with competencies in L1 (U(L1)). The opportunities consist of the combination of an *exposure* to a favorable L2 environment (p(expL2)) and the *efficiency* (p(effL2)) of how this exposure can be utilized. In addition, *costs* (C(L2)) may arise. These include, for example, fees for language courses and efforts that possibly have to be made in learning a new language. According to

the general equation (4) stated above, the following condition for a successful *second* language acquisition results:

(5) $(p(expL2)p(effL2))\,(U(L2)-U(L1)) - C\,(L2) > 0.$

This model can also be applied to the learning of any further language L3, L4, […], Ln in addition to a second language. In this case the already acquired repertoire of languages serves as the status quo reference. For example, if one learnt a third language L3, the bilingual repertoire (L1, L2) would constitute the status quo reference.

First language (L1) acquisition then represents the special case in which the status quo reference is L0 and hence "speechlessness". Assuming that the payoff U(L0) is zero, the efficiency of learning in the early childhood approaches the maximum 1, and no costs at all arise, the following special case results:

(6) $p(expL1)\,U(L1) > 0.$

The pivotal difference between L2 acquisition and L1 acquisition then consists in the fact that *no* competing status quo can weaken the learning motive in terms of L1 acquisition. One doesn't have to motivate children to learn a language and, in addition, due to the high efficiency of learning in the early childhood one doesn't have to consider any deductions from the learning speed. Children "only" need the opportunity to learn a language.

Please note that L1 denotes here the language of the *country of origin* (or of the respective ethnic context), irrespective of whether this language is acquired as a "first" language or not. For those who were born in the receiving country or who immigrated at a very early age the language of the receiving country may, of course, well be their "first language". This applies above all to members of the second generation.

According to the model, first language acquisition will *always* occur provided that there are opportunities for linguistic feedback, particularly because there is virtually always a certain exposure, no reductions in efficiency on account of the learning age, and nearly no costs in terms of first language acquisition. This also applies to the early acquisition of more than two languages (cf. also paragraph VI).

Things are different with regard to L1 *retention* (or L1 shift): Retaining L1 skills, like any other skills, requires continuous practice and reinforcement within the corresponding environments. If the returns to using the mother tongue become smaller, the willingness to retain it will – ceteris paribus – also decrease. Like in the case of L1 acquisition but different from the L2 acquisition, the efficiency should play only a minor role. The reason for this is that L1 retention involves keeping an already acquired skill rather than learning a new one, what becomes more difficult with an increasing age. The opportunities to practice the L1 and so to retain the L1 are denoted as q(L1), the value of L1 proficiency and use as U(L1), and possible costs as C(L1).

We have to differentiate between L1 retention in the case of L1 monolingualism and L1 retention in the case of bilingualism. In terms of *L1 monolingualism* giving up the mother tongue ("language shift") results in linguistic marginality and the loss of any payoff. This is expressed by a reference value of zero and yields the following correlation between the weights for the selection of either retaining the mother tongue (L1r for language *r*etention) or giving it up (L1s for language *s*hift):

(7) $EU(L1r) = q(L1)\, U(L1) - C(L1).$
(8) $EU(L1s) = 0.$

Retention of monolingual skills in the mother tongue then occurs under the following condition:

(9) $q(L1)\, U(L1) - C\,(L1) > 0.$

Assuming that social disapproval in interethnic reference groups plays only a minor role and that no particular devaluation occurs by using the mother tongue, the model implies that retention of the monolingual mother tongue is above all a matter of a continuous exposure to an L1 environment. If this exposure exists, other circumstances like, for example, the utility value of the L1 in the new environment will be rather irrelevant. In terms of *bilingualism*, however, the motivation for retaining the L1 changes: Giving up the L1 results in the change from bilingualism to a "mere" monolingualism in L2. In addition, the motivation for retaining the L1 now doesn't depend on its value alone but on the *difference* between the incentive for it (U(L1)) and the value of the shift to mere monolingual assimilation (U(L2)). This yields the following condition:

(10) $q(L1)\,(U(L1)-U(L2)) - C(L1) > 0.$

From this follows, in particular, that if one has good skills in a second language that is highly valued in the receiving context he is more likely to give up the mother tongue than is the case if the mother tongue is scarcely understood there.

Already the definition of bilingualism as the proficiency in *two* languages suggests, that one can – again quite trivially – explain the absence of competent bilingualism in two ways: Either people fail to acquire the respective L2 skills, or they are proficient in an L2, but they

lack or loose the necessary skills in the mother tongue. The question then arises of whether there are any individual and social conditions which foster the simultaneous acquisition of a competent bilingualism or whether there are also conditions that promote the acquisition of one language at the cost of another one and so impede the acquisition of competent bilingualism.

II. Empirical conditions

Language acquisition always occurs in concrete social situations. In order to theoretically explain the related empirical patterns, we have to connect them with the theoretical constructs of the model of language acquisition and language retention (motivation, exposure, efficiency, costs) via so-called bridge hypotheses.

The various empirical analyses that address the individual and social conditions for language acquisition include numerous single conditions. Among them are the voluntariness of the immigration, the intention to stay in the country of immigration, the duration of stay, the age at immigration, the education acquired in both the country of origin and in the receiving country, the cultural capital related to the receiving country, the culturally determined intrinsic value of L2 for the immigrants, the communication values (the so-called Q-values) of L2 and L1, the exposure to L2 already in the country of origin, possible instruction in L2 in the country of origin, the linguistic distance between L2 and L1, the cultural and spatial distances between sending and receiving country, the labor market in the receiving country, the social and institutional value of L2, the institutional promotion of L1 proficiency, the value of an L2 as a collective good (e.g., as the lingua franca in case of highly heterogeneous first languages among immigrants), interethnic contacts and language courses in L2, the social distance towards the ethnic group, exposure to the L1 via (mass) media and transnational relations to the country of origin, ethnic concentrations, the proportion of bilingual speakers, the family language, spouses and friendship networks, (ethnic) family cohesion, and, finally, children who could serve as bridges to other language environments (cf. the complete lists in Esser 2006: 93f. on L2 acquisition and Esser 2006: 219 for L1 retention).

There is no single empirical analysis on language acquisition (particularly among immigrants) that considers all these conditions. The variables of the GSOEP we used for the empirical analysis (in paragraph V below) and the correspondingly related theoretical hypotheses on their respective impact are listed in Figure 2.

In addition to the age at immigration, the analysis includes the variables parents' education, generation status, duration of stay, one's own education, intention to stay, duration of visits to the country of origin (sending country: SC), ethnic segregation within the living environment, proportions of friends from the ethnic context (EC) and from the receiving context (RC), number of visits to natives (RC), and an acculturation index describing the further adjustment to the demands of the receiving country (cf. paragraph IV on details of the operationalization).

In Figure 2 they are roughly arranged in chronological order according to their occurrence in the migration biography and their inclusion in the empirical analysis. The first variable is the age at immigration as the condition of language acquisition that is central to our analysis.

In specifying the bridge hypotheses that connect the empirical conditions with the theoretical constructs we only use assumptions that are as simple and clear as possible.

Accordingly, two mechanisms underlie the effects of *age at immigration* that differ in terms of first and second language acquisition: The higher the age at immigration the longer the exposure to the L1 environment, but the lower the efficiency for second language acquisition which decreases with an increasing age at immigration.

In terms of the other conditions we assume that *parents' education* is in general advantageous to the efficiency of (language) learning due to, for example, the available cultural capital. Therefore, parents' education is conducive for the acquisition of both the second language and the first language (+/+). In addition, a higher education on side of the parents leads also to an increase in the motivation for language learning in general. Being a member of the *second generation* ("parents already immigrated") increases the L2 exposure and decreases the L1 exposure (cf. also paragraph IV below on this point and on the operationalization). The *duration of stay* enhances the chances for L2 exposure, but L1 retention becomes less likely due to weaker L1 exposure. The *own education* exerts its effects, on the one hand, through a higher motivation for L2 acquisition, because L2 language skills improve the usability of educational qualifications. On the other hand, it raises the efficiency of learning both languages. Another possibility is that the impact of one's own education can be attributed to the latent trait of (language) intelligence indicated by the education variable. The *intention to stay* influences the evaluations of L2 and L1 and so the respective motivations. In terms of the L1 this applies, however, only to the motivation to retain it. The *duration of visits to the country of origin*, ethnic *segregation* within the living environment, and exclusively *inner ethnic networks* reduce the chances for an exposure to L2 environments and raise those for an exposure to L1 environments. In contrast*, interethnic networks* have an opposite effect. The number of *visits to natives*, i.e., Germans, enhances the L2 exposure but doesn't have any particular impact on the L1. Finally, *acculturation* in terms of everyday habits is conducive to L2 acquisition, exerting its effects presumably through via all three mechanisms: motivation, exposure, and efficiency.

Here: Figure 2

The two columns on the right indicate the positive or negative signs resulting from the bridge hypotheses and the theoretical model in terms of the expected main effects of the respective conditions.

Against this background two particular facts are noteworthy here. Firstly, we expect only education (of the parents and/or one's own) to have the *same* supportive effect on the acquisition of *both* languages. Secondly, for all other variables (except for visits to Germans and the acculturation index) we have to theoretically presume *opposite* effects on first and second language acquisition as defined by the zero-sum hypothesis: Generation status, duration of stay, intention to stay, duration of visits to the country of origin, ethnic segregation within the living environment, networks and visits as well as other kinds of acculturation in general all support the acquisition of the one language and impede the acquisition of the other one. And this applies, in particular, to age at immigration.

III. Age at immigration and "critical period"

In terms of the age at immigration, the opposite directions of the effects on first and second language acquisition and the connected zero-sum problem are caused, in particular, by the decreasing efficiency in L2 acquisition. This problem would be (clearly) intensified if the decrease in efficiency of L2 acquisition wasn't linear but drastically impaired L2 acquisition from a certain "critical period" as the CHP states.

The CHP was originally formulated by Lenneberg (1967). According to him, there is a "critical" or "sensitive" period up to which individuals can acquire *any* level of language proficiency provided that the corresponding exposure (and motivation) is available. Things change when the critical period that starts approximately with puberty is reached. Then, language proficiency can, if at all, only be achieved at clearly lower levels or with noticeable higher efforts due to *neurophysiologic* reasons of a biological change in (language) learning ability *in general*. The empirical analysis by Johnson and Newport is the landmark contribution on the discussion surrounding the CPH (Johnson and Newport 1989; cf. also Newport): Up to an age of about six years the correlation between age at immigration and language skills in L2 was nearly a linear one and language proficiency of immigrants was similar to that of natives. Subsequently, language skills decreased more and more strongly up to an age of 15 years. At the same time, variances in the achieved proficiency clearly increased. Directly after an age at immigration of 15 years or higher there is again hardly any correlation to be observed anymore. Moreover, there were obviously only unsystematic individual differences, although a comparably high proficiency could also be achieved in single cases. The discussions surrounding the CPH and also this contribution are on three

alternatives of how one can interpret the results of a great many analyses (cf. the overviews in Long 1990; Birdsong 1999; Scovel 2000; or Birdsong 2006).

The *first* position represents the strongest version of the CHP according to the original formulation by Lenneberg. Proponents of this version presume an initially effortless and nearly automatic learning up to the limit of the "critical period". After this, the learning rate decreases (dramatically) and learning is no longer an automatic process, but includes other cognitive activities. Although this doesn't mean that considerable language proficiency cannot be achieved at all at a higher learning age, motivation and exposure have to be increasingly stronger in order to yield similar results. The *second* position also presumes a negative correlation between L2 acquisition and learning age. It differs, however, from the strong version of the CHP in that way that its proponents deny that the (biological) age and the correspondingly supposed neurophysiologic changes have a *causal* effect. In addition, they state that the "critical" period wasn't followed by an abrupt decline but rather by a gradual linear decrease. Proponents of the *third* position neither deny the negative correlation between learning age and language acquisition as well. In contrast to what the strong version of the CHP holds, they rather want to prove that perfect L2 proficiency can also be achieved at a high learning age (cf. Esser 2006: 256ff. for details).

In summary, we can note that in all discussions surrounding the CHP it has been never denied that the age at immigration had a *negative* effect on (second) language acquisition. Rather, the dispute is about whether the decrease in learning rate is empirically linear over the different periods or not and how to explain it theoretically. The overviews not unreasonably come to the conclusion that a moderate form of the strong version of the CHP is up to date and represents the opinion of the majority of researchers addressing this question (cf., e.g., Long 1990: 279f.; Scovel 2000: 216).

Figure 3 depicts three different versions of the course of (second) language acquisition in dependence on the age at immigration with equal declines in learning results (cf. a corresponding sketch in Birdsong 2006: 15).

Here: Figure 3

On the left one can find the version of a negative linear correlation without a "critical period". The graph in the middle depicts the simplest version of the CPH (CPH1) as proposed by Lenneberg: Learning results decrease first clearly and then constantly from a certain "critical period" on. The version on the right coincides with the results of the studies by Johnson and Newport (CPH2): There *is* a critical period, but the decline in the learning results soon

diminishes again. In paragraph V we test empirically which of these models is the most valid one.

IV. Data, variables, and analyses

Empirical studies on the social conditions of the emergence of bilingualism are very rare. The simple reason for this is that such studies required information on both second language acquisition *and* mother tongue proficiency and that most studies fail to collect the necessary data simultaneously (cf. the note in Bean and Stevens 2003: 164). One of the few datasets that actually allows conducting such studies is the German Socio-Economic Panel (GSOEP) which has the additional advantage of comprising numerous waves (cf. technical details on the design and structure of the GSOEP amongst others Schupp and Wagner 2002). For empirically analyzing the impact of age at immigration on immigrants' language acquisition and the emergence of bilingualism we collected all persons with foreign (i.e. non-German) citizenship and/or foreign country of origin from the dataset. We then selected the members of the "guest worker generations", ethnic German immigrants from different East European countries as well as all immigrants from non-German speaking West European countries from this subsample. The relatively few immigrants from North and South America and from Asian and African countries were excluded from the analysis, because we wanted to limit the latent heterogeneities that come along with the inclusion of too many different regions of origin. We then built a panel dataset for the selected groups across all 22 waves conducted between 1984 and 2005. In the end the dataset included a total of 58353 person years and 6761 individuals or cases (clusters; cf. below on the drop outs).

For the empirical analysis of linguistic integration the GSOEP provides subjective reports on first and second language proficiency in terms of speaking and writing (on a scale from 1 to 5) as variables for the measurement of language skills. Table 1 contains the respective empirical distributions.

Here: Table 1

On this basis we then constructed a (nominally scaled) variable for bilingualism (speaking and writing) involving the four types “linguistic marginality”, “L1 segmentation”, “L2 assimilation”, and “bilingualism” according to Figure 1 above. For that purpose we dichotomized both scales. In terms of the first language we differentiated between the highest level of skills (5) and all other levels (1-4), in terms of the second language between the two highest levels of skills (4, 5) and the rest (1-3). In Table 2 one can find the empirical distribution of the four types. To simplify matters, in the following empirical analyses on bilingualism we combined the two types “linguistic marginality” and “L1 segmentation” into one category “no L2”. We wish to note here that other dichotomizations and classifications didn’t change the substantial results.

Here: Table 2

It reveals that a high proportion of the respondents have at least “good” mother tongue skills. In addition, for immigrants included in the GSOEP the problem with bilingualism is rather the second language acquisition than lacking mother tongue proficiency. Quite unsurprising is the result that immigrants are less proficient in writing than in speaking. This is also reflected by the distribution of the four types of language skills: In terms of writing skills over 40 per cent of the respondents belong to the category “linguistic marginality” whereas only less than 15 per cent are bilinguals. By contrast, one can find a nearly uniform distribution across the four types in terms of verbal skills.

The results are based on subjective assessments of language skills by the respondents themselves. Such subjective assessments are standard measurements for language proficiency in larger (survey) studies and are also occasionally used in more linguistically oriented analyses (cf., e.g., Boos-Nünning and Gogolin 1988; Boos-Nünning and Karakaşoğlu (2005: 213ff.; Bialystok and Hakuta 1999: 173f.). In this context one can nearly always find the assertion that these subjective reports constitute a sufficiently valid proxy measurement of “objective” language proficiency (cf., e.g., Portes and Rumbaut 1996: 15; Bean and Stevens 2003: 163; Linton 2004: 291). Unfortunately, this assumption has hardly ever been tested systematically. This applies in particular to the assessments of mother tongue skills. There is only some evidence for second language proficiency (cf. details in Esser 2006: 526ff. with reference to the analyses in Esser 1985; Charette and Meng 1994; Dustmann and van Soest 2001). According to this evidence, subjective assessments and objective skills form different but closely related latent dimensions. Moreover, using subjective assessments as proxy measurements for language skills doesn’t yield false conclusions in the multivariate analysis of causal effects on language acquisition (and then of language acquisition on other

variables). The (few) studies containing objective measurements (as, e.g., the CILS study and the PISA study that include testing the reading performance in the second language), yield almost the same results as regards contents concerning the impact of certain social conditions on the pivotal variables. This particularly applies to the variable age at immigration which we focus on in this contribution (cf. the results in Esser 2006: 308ff.).

The *age at immigration* is measured in years, but for the purpose of the empirical analysis we constructed (equidistant) categories including the respective dummy variables (0-6, 7-13, 14-20, 21-27, 28-34 and 35 years of age at immigration and older). With that we wanted to test whether that the decline in second language acquisition indeed occurs abruptly when puberty is reached as stated by the critical period hypothesis or whether the decline is rather continuous and linear (cf. also paragraph V below). *Parents' education* is measured by three dummy variables indicating different levels of educational attainment (low, middle, high) for both parents. The *generation status* describes whether the parents (both or one parent) have already migrated or not and is measured by three dummy variables (both, one, none). The background for this is that we wanted to measure *exclusively* the migration experience within the family and hence a possible acculturative environmental effect. This clearly differs from current definitions of the generation status which include for the most part also certain upper limits of the age at immigration. However, because the (unspecific) effects of the parents' migration and acculturation experiences are theoretically independent of those of the age at immigration, one has also to measure them empirically independently of each other. This particularly applies to second language acquisition.

Age at immigration and generation status are typically strongly correlated, because many immigrant children of parents who had already migrated were either born in the receiving country or followed their parents very early. Yet the measured correlation between age at immigration and the independently defined generation status of 0.52 isn't that high to justify concerns about multicollinearity. Although estimations of the results excluding the generation status yielded higher values for the age at immigration, the structure of the results, particularly in respect of the CPH, didn't change.

Similar to the parents' education, one's *own education* is measured by three dummy variables, the *intention to stay* by one dummy variable (no/yes), the *duration of stay* and the *duration of visits to the country of origin* by the respective periods as indicated in the migration biography (in years or weeks and months), the *segregation* by a scale of subjective estimations of the proportion of foreigners in the living environment (low, middle, high), the proportion of *friends of the same ethnicity* and of *German friends* by estimating the composition of the network of the "three best friends", visiting Germans by a dummy variable (no/yes), and

acculturation by an index including preferences with regard to music and cooking (on a scale from 1 to 9 differentiating between preferences that are related completely to one's own ethnicity, mixed and completely related to the receiving country). For some of the categorizations via dummy variables we only include, for reasons of space, the coefficients for the highest category in the presentation of the results in the respective tables.

For the variables used in this study we found partly significant proportions of missing values. This can be mainly attributed to the fact that a couple of subgroups of immigrants and certain variables were not included in all 22 waves of the survey. For instance, some groups of immigrants, like the immigrants from East European countries, were systematically included in the GSOEP sample only in later waves and certain variables weren't considered from the very beginning, in each or in the same waves, and they also weren't measured retrospectively.

In order to reduce the missing values for those variables which hadn't been collected simultaneously with the language variables, we recoded them for the respective waves of language measurement presuming that the information collected in one certain wave can be used as proxy measurement for subsequent waves. We controlled possible effects of the missing values on the results of the multivariate analyses by constructing missing dummies for each variable with less than 36000 measured values (in terms of the person years). We then inserted the average value for the missing category of the variables in question into the respective variable and included this newly constructed variable along with the respective missing dummy in the regression equation. The variables in question were the intention to stay, the duration of visits to the country of origin, segregation, the proportion of friends of the same ethnicity and of German friends, visiting Germans, and acculturation. Controlling for the effect of the missing values by inserting a fixed value reduces the variance of the respective variable. As a result, we rather underestimate this effect (cf. Little and Rubin 2002). We *didn't* replace, however, the missing values of the language variables. This procedure yielded the person years and cases indicated in Table 1 for the analysis of first language proficiency (in terms of speaking: 46242 person years and 5576 cases, in terms of writing: 46213 person years and 5572 cases) and of second language proficiency (in terms of speaking: 46264 person years and5576 cases, in terms of writing: 46224 person years and 5573 cases). Other missing values in the individual analyses result from those variables for which no replacement was made. In addition, we always controlled for the various period effects (via year dummies) as well.

The following analysis aims at determining the special impact of the *age at immigration* on second and first language acquisition and on the emergence of competent bilingualism. For this purpose we compare the corresponding bivariat correlations of the age at immigration with those of a multivariate analysis including all other variables considered. We controlled for possible interdependences between the observations using the clustered Huber-White sandwich estimator (cf. Rogers 1993). The remaining effect of the age at immigration can

then be interpreted as a *causal* impact. Attention should be paid, however, to the fact that a substantial part of the control variables itself is probably correlated with language acquisition as well, i.e., endogenized. In the following analyses (as already in the overview in Figure 2 above) we, therefore, arranged the controlled variables accordingly: All the variables that are not endogenized with language are listed first followed by the conditions that are probably endogenized with language. We included the endogenized variables in the following analysis in order to control for the effects of the age at immigration, but we don't interpret them or only with reservation in terms of their causal connection with language acquisition. As additional control variables we included gender and the respective national or regional and ethnic origin, however without formulating any theoretical hypotheses about their possible effects on language acquisition. We wish to add that the different kinds of conducted analyses (for instance, including or excluding the missing values and periods or comparing single waves across different periods) didn't yield any differences in the substantial results. This particularly applies to the variable of age at immigration being at the focus of this contribution.

V. Results

The empirical analysis of the effects of the age at immigration on the acquisition of competent bilingualism involves four different steps. We first examine the conditions for acquiring the language of the receiving country as a *second language* followed by a closer examination of the *critical period hypothesis* in terms of second language acquisition. Then we analyze the conditions for *first language* acquisition and, finally, those for the emergence of *competent bilingualism*.

1. Second language

Both the bivariat analysis and the multivariate analysis controlling for all background variables reveal a strong negative effect of the age at immigration on second language acquisition (cf. Table 3). This is completely in line with the results of practically all empirical studies on second language acquisition that have been conducted so far. This negative effect is more pronounced in terms of writing skills that in terms of verbal language skills.

As regards the social conditions that aren't endogenized with language acquisition, i.e., parents' education, generation status, and duration of stay, we also find strong effects in the theoretically expected direction. The results for the social conditions being probably endogenized with language acquisition largely comply with the theoretically derived hypotheses as well. Particularly noteworthy are the significant (and theoretically expected) effects of the duration of stay and the (subjective) segregation, because previous analyses with the data of the GSOEP failed to reveal such effects (cf. Haug 2005: 276 on the duration of stay; Dustmann (1997) and Drever (2004) on the subjective segregation; cf. also Jirjahn and Tsertsvadze (2004) on segregation effects at the level of the German Bundesländer (states)). Why we now find such effects may be due to a more thorough use of the panel information, particularly in terms of the segregation effects, because only considering also a *longer* duration of stay and of (de-)segregation will allow the mechanism of exposure to become relevant. Results that don't correspond with the theoretical assumptions concern the intention to stay, the duration of visits in the country of origin (in terms of writing skills), and the ethnic networks: The intention to stay has *no* (positive) effect, the duration of visits to the country of origin *has* a (negative) impact on writing skills, and ethnic networks show *no* negative impact.

The most striking effects in terms of the demographic variables are the clear negative effect for women and the differences between immigrants from East European countries and "guest worker" immigrants. Here, immigrants from former Yugoslavia are the least disadvantaged in terms of second language proficiency, whereas the Italians, Spaniards, and especially the Turks are the most disadvantaged. In addition, none of these groups is more successful in second language acquisition than the West European (not German-speaking) immigrants of the reference category. Only immigrants from Russia or other East European countries are similarly successful in second language acquisition.

Here: Table 3

The overall results are completely in line with previous findings on second language acquisition. This particularly applies to the results on the age at immigration (cf. the overview in Esser 2006: paragraphs 3.2 and 3.3). We wish to point especially to the obviously great importance of acculturative processes and conditions in general: If parents have already migrated (i.e., the respondent belongs to the second generation) und if there is an acculturation with regard to everyday processes (here: preferences in terms of music and

cooking), second language proficiency will improve considerably. So, second language acquisition is apparently a part of a whole syndrome of access to and orientation towards the cultural demands of the receiving society which mutually support each other.

2. Critical period?

According to the *empirical* results, it can hardly be doubted that there is a clear negative effect of the age at immigration on second language acquisition. Its effect is even the strongest one that one single variable exerts on second language acquisition. However, the coefficients of the impact of the age at immigration clearly vary across the different age groups. Up to an age at immigration of 13 years there is only a weak (but already significant) decline in second language acquisition. Then we can observe a clear increase in the negative effect followed again by a gradual weakening (for both verbal and writing skills). Initially, this empirical finding rather supports the so-called critical period hypothesis (cf. paragraph III above).

Following the three hypothetical versions of the negative impact of the age at immigration on L2 acquisition described in Figure 3, Table 4 lists the results of different estimations under restrictions for the respective versions.

First, we examine two different reference models presuming a *linear* decline in language acquisition and thus *contradicting* the assumption of a "critical period". The analysis is initially done on the basis of single years of age and then on the basis of six age categories. In the third column one can find the results of the non-fixed estimation of the effects (according to the multivariate analysis in Table 3). This model serves as the basis for comparing the empirical course of language acquisition without any restrictions with the hypothetically fixed models. The other four columns contain the results for various fixations presuming a "critical period" (at an age of immigration of 14 years). Column "CP1" corresponds to the model CP1 in Figure 3 assuming that the critical period is followed by a further unchanged linear increase in the negative effect. The remaining three columns correspond to three versions of model CP2. In contrast to models CP2b and CP2c, model CP2a is based on the assumption that the critical period is not followed by a further increase in the negative effect. Model CP2b states that language acquisition is only gradually declining after the critical period, whereas model CP2c presumes a similar decline as the one occurring *up to* the critical period (and thus corresponds to the graphical sketch for CPH2 in Figure 3). The measures AIC and BIC reflect the fit of the various models with the empirical data. Smaller values indicate a better fit of the model thereby taking the parsimony of the model into account (cf. Raftery 1995). What we search for is the model (fixed to the different hypothetical courses) with the best fit, particularly in comparison with the models assuming a fixed linear course of the process and those assuming a critical period. The models with the best fit are highlighted in bold in Table 4.

Here: Table 4

The basic model (estimated without any restrictions) suggests a course according to the CPH models. As compared to this model the two models presuming a linear negative effect of the age at immigration fit very poorly as do the models CP1 and CP2a presuming a critical period followed by a constant linear decline or an abrupt decline to zero. In contrast, the two models CP2b and CP2c fit clearly better. Model CP2c fits best in terms of *verbal skills*. It includes a critical period followed by a weaker linear decline similar to that occurring before the critical period. In terms of *writing skills*, however, the model CP2c presuming a gradual decline in learning success after the critical period is reached fits best. What is noteworthy here is that the fit of these models is virtually as good as or even partly (marginally) better than the one of the basic model lacking any fixation of the course. The reason for this is probably that the measures of fit used in this analysis consider the parsimony of the models as well.

So, the substantial result of our analysis is that there *is indeed* a "critical period" for a clear decline in second language learning success both in terms of verbal and writing skills, which, however, levels off again after the critical period is reached. This result clearly contradicts occasional presumptions and empirical evidence in favor of the absence of a critical period and an ultimately linear negative effect of the age at immigration (cf., e.g., more recently Chiswick and Miller 2007). Our results (again) support early findings on the CPH described in the classical contributions by Johnson and Newport 1989 and Newport 1990 (cf. also Esser 2006: 254f.). However, the results by no means imply that perfect second language skills can never be achieved at a higher age at immigration. But this doesn't apply to all of the learners and perfect language skills can, above all, no longer be achieved "unconditionally", depending only on the exposure, as is the case for first language acquisition (cf. below) and early second language acquisition (cf. also paragraph VI). It remains open here, of course, which specific mechanism finally accounts for the critical period effect. Because, however, the correlation continues to exist under control of various empirical conditions, the effect cannot by explained by changing *social* conditions alone referring, for example, to lower motivations, lower exposure, or increasing costs involved in an increasing learning age. Therefore, the most plausible hypothesis for us is that the critical period effect has indeed something to do with a decreasing individual learning *ability* at an increasing learning age and, thus, with the learning *efficiency* – the reason for this must, however, also remain open here.

3. First language

Table 5 contains the results on first language proficiency. The theoretical model presumed a positive effect of the age at immigration (via the mechanism of exposure) and the empirical results clearly reveal this effect: The higher the age at immigration, the better the first language skills (in both speaking and writing). In addition, we also find a kind of critical period for first language acquisition that is significant and positive learning effects only occur after a certain period of exposure. This threshold apparently emerges after an age of 13 years is reached. After that the effects remain constant or get a little weaker again.

In terms of the social conditions being not endogenized with language acquisition (parents' education, generation status, duration of stay) the theoretically expected effects clearly reveal empirically for parents' education and generation status: L1 proficiency increases with a higher parents' education and L1 skills decrease among members of the second generation (again both in speaking and writing). Most of the empirical results are in line with the theoretical hypotheses, including, in particular, the positive effect of one's own education on L1, but we also find results contradicting our predictions. For example, segregation and ethnic networks show no (positive) effect on L1 proficiency (in speaking and writing). The duration of visits to the country of origin shows no positive and acculturation no negative effect on L1 writing skills, suggesting that L1 proficiency in writing is less dependent on specific contexts than verbal skills. What we particularly didn't expect is the clear positive effect of visits to Germans. In case such visits take place, L1 skills are *better* (rather than neutral as we expected). One possible explanation might be that such visits are more likely to occur in a "multicultural" environment, perhaps because natives find contacts with bilingual immigrants more interesting than contacts with those who hardly differ from themselves anymore. We cannot further specify here the unobserved heterogeneity behind the result, particularly due to the lack of necessary information on the German contact partners.

Demographic variables don't vary notably in terms of L1 acquisition. The only exception relates to the effect of gender on L1 writing skills: Female immigrants are clearly less proficient in writing than their male counterparts.

Here: Table 5

Summarizing the results on L1 acquisition, one can find primarily positive effects of education (that of the parents and one's own) in addition to the positive effect of the age at immigration. Other effects are rather weak. However, *this* is just one of the results of the theoretical analysis: L1 acquisition should depend clearly less on individual and social conditions than L2 acquisition and is mainly subject to the exposure (in early childhood) which preferably shouldn't be interrupted by a too early migration.

4. Bilingualism

Analyzing the social conditions of bilingualism involves the different transitions between the four types of language proficiency (according to Figure 1 and Table 2). We will investigate whether and how certain combinations of individual and social conditions support or impede the emergence of bilingualism and we will do this again with a special focus on the age at immigration. In order to illustrate the problem, Table 6 contains the bivariat distributions of the four types of language proficiency in dependence on the age at immigration (for both verbal and writing skills).

Here: Table 6

One can immediately discern the theoretically expected inverse correlation: An *increasing* age at immigration results in an *increase* in L1 segmentation (and linguistic marginality) and in a *decrease* in the tendency to acquire the L2 in the form of L2 assimilation (vice versa). In addition, one can again find an abrupt increase in the correlations for both tendencies after an age at immigration of 13 years: L1 segmentation and linguistic marginality strongly increase after this "critical period", whereas one can observe a clear decline in L2 assimilation. Bilingualism is evidently a combined effect of mutually exclusive opportunities. Its emergence, thus, depends on relatively rare good opportunities: The age at immigration is sufficiently high to allow for acquiring the necessary L1 skills, but it is still low enough to

acquire the necessary L2 skills as well. Correspondingly, the proportion of bilinguals varies clearly less with the age at immigration as compared to the other types of language proficiency: In terms of speaking, it only drops at an age at immigration of more than 27 years from about 30 % to just under 20 % and in terms of writing from just under 20 % to 10 %. The obvious reason for this is that L2 acquisition hardly occurs once this age is reached.

The question which then arises is: How does the age at immigration precisely influence the emergence of bilingualism after controlling for other conditions? We address this question by comparing the different types of language proficiency according to Figure 1. To simplify the analysis, we summarized linguistic marginality and L1 segmentation into one single category. One can interpret this category as non-proficiency in L2 ("no L2"). Three different comparisons can be made: that between L1 segmentation/marginality and L2 assimilation (L1→L2), that between L1 segmentation/marginality and bilingualism (L1→Bil), and, finally, that between L2 assimilation and bilingualism (L2→Bil). The results for verbal proficiency are listed in Table 7. We abstain, for lack of space, from presenting also the results for writing skills, because they are nearly the same as those for verbal skills, although the observed effects are weaker. We also want to add here that other dichotomizations of the language types and examining the transitions between all four types didn't yield different central results in terms of content.

Here: Table 7

The analysis of the *first* comparison (L1→L2) identifies the conditions for the emergence of second language proficiency as mere second language "assimilation" (as compared to the two types of "linguistic marginality" and "L1 segmentation"; cf. the first two columns in Table 7). Second language "assimilation" represents the special case of L2 acquisition while having no proficiency in the mother tongue. The most important result refers to the *age at immigration*: It not only retains its strong bivariat effects, but they even become stronger in the multivariate analysis. In addition, there is a clear critical period effect. Quite unsurprisingly, the results in terms of the other variables correspond basically to those in terms of L2 acquisition in general, i.e., not distinguishing between monolingual or bilingual L2 acquisition (cf. Table 3 above). Parents' education, generation status, and duration of stay have the theoretically expected strong effects on L2 assimilation. The other influences are similarly clear and in line

with the theoretical expectations: One's own education, the intention to stay, visits to Germans, and acculturation have positive effects, the duration of visits to the country of origin and segregation show a negative impact, and the ethnic composition of friendship networks appears irrelevant. In terms of the demographic variables, there are no gender effects, and immigrants from East European countries and those from former Yugoslavia don't differ from the reference group of West Europeans. The immigrant groups with the lowest linguistic assimilation are the Spaniards and the Portuguese.

In the *second* comparison, i.e., that between L1 segmentation/marginality and bilingualism (L1→Bil), the same conditions which also determine L1 acquisition/retention as an essential part of bilingualism should become noticeable. However, things are different, at least at first sight: The observed pattern of the correlations almost completely corresponds with that of L2 assimilation. This most clearly applies to the age at immigration as well. Just like in the comparison between L1 segmentation/marginality and L2 assimilation, we observe here a strong negative impact which is getting stronger in the multivariate analysis and which displays a course according to the critical period hypothesis. However, the impact is weaker as compared to L2 assimilation. Also in terms of the other variables we find nearly the same pattern as for L2 assimilation: The influences of parents' education, generation status, duration of stay, one's own education, visits to Germans, and acculturation on bilingualism all go into the *same* direction as their impact on L2 assimilation. Our results, thus, clearly suggest that the emergence of *bilingualism* is *above all* a question of *L2* acquisition (at least for the immigrants included in our analysis). However, the conditions being important for L1 acquisition actually become noticeable: Parents' education and one's own education as well as interethnic visits now become *more* effective, because they support the acquisition of *both* L1 *and* L2 proficiency (cf. the results in Tables 3 and 5). Apart from that, the effects of the conditions being conducive to L2 acquisition become rather weaker (as we have already observed for the age at immigration) in terms of bilingualism: Both the intention to stay and segregation no longer exert any impact and the effects of generation status and acculturation have clearly decreased. This may be interpreted as evidence for further opposite effects in terms of L2 and L1 acquisition: Being a member of the second generation, high intentions to stay, de-segregation, and acculturation rather result in immediate linguistic assimilation, because these conditions being favorable for L2 acquisition hardly allow acquiring the necessary L1 skills or even result in a complete L1 loss. With regard to the demographic variables there are again no gender effects. Bilingualism most frequently occurs among West

European immigrants and only immigrants from Russia/East European countries show a similar degree of bilingualism. Immigrants from Spain/Portugal, Italy, and Turkey have the lowest bilingual skills.

For the *third* comparison – that between L2 assimilation and bilingualism (L2→Bil) – we start from the (fictitious) assumption that L2 assimilation already exists and examine the conditions which *then* entail bilingualism, i.e., *additional* proficiency in L1. It concerns a statistical Gedankenexperiment for identifying the conditions for bilingualism – independently of the effects on L2 acquisition (as in the case of the second transition above). As applies to L1 acquisition in general, the age at immigration now has clear positive effects, which become rather stronger in the multivariate analysis: For one who is already proficient in L2 anyway, the chances for bilingualism are clearly better when immigration occurs at a higher age as compared to a lower one. This result further supports the idea of contrary courses of the processes behind the age at immigration: increasing exposure to L1 and decreasing efficiency of L2 acquisition resulting in bilingualism. For the other variables we again find a pattern that is quite similar to the one of L1 acquisition in general: A higher education (of the parents and one's own) increases the chances for bilingualism, even under the condition that one has already L2 skills, because it supports the acquisition of *both* languages. An effect opposing L2 assimilation, like that of the age at immigration, reveals for the generation status, the intention to stay, the duration of visits to the country of origin, and for acculturation. They all constitute conditions that are conducive to L1 acquisition and so to bilingualism – *provided* that L2 proficiency already exists. However, acquiring L2 proficiency demands *contrary* conditions. The duration of stay, segregation, networks, and – different from L1 acquisition in general – visits to Germans exert no particular effects. Gender has again no impact and there are only minor differences between the various ethnic groups. A little surprisingly, Italians and Turks (in addition to immigrants from East European countries) are those immigrants with the least bilingual skills, obviously because they have already a lower proficiency in their respective mother tongue.

VI. Summary

Acquiring competent bilingualism is not an easy thing to do, especially not for immigrants: In addition to the mother tongue, one has to learn a second language and this must happen mostly besides other activities. What is more, the social conditions supporting the acquisition

of bilingualism do not necessarily exist or support each other, at least with regard to the normal everyday life of most immigrant families. For some of the conditions one has to theoretically expect opposite effects: What promotes the acquisition or retention of one's mother tongue often impedes second language acquisition (and vice versa). The most significant example for such a condition is the age at immigration. Figure 4 illustrates these opposite effects on the basis of the multivariate results presented in Tables 3 and 4 for both verbal and writing skills (as reference category serves the category of an age at immigration from 0 to 6 years).

Here: Figure 4

One cannot only discern the opposite direction of the effects here, but also clearly the existence of a critical period after approximately an age of 13: Only from this age on L1 proficiency clearly increases and the chances for L2 proficiency even more clearly decrease. This particularly applies to writing skills.

Based on the results in Table 7 (columns L1→L2 and L2→Bil), Figure 5 contains an additional summary of individual and social conditions for bilingualism that are either mutually supportive, neutral (i.e., effective only for one of the two proficiencies), or effective in opposite directions.

Here Figure 5

From the observed correlations a complicated optimization problem arises for the emergence of bilingualism among immigrants, particularly with regard to the age at immigration (and to the other conditions being effective in opposite directions): On the one hand, immigrants have to be exposed to the L1 environment for a sufficiently long time. Therefore, they should not immigrate or leave the ethnic context too early, in order to achieve a certain L1 proficiency. On the other hand, they should not get in touch with the L2 environment too late, because they cannot adequately learn the L2 due to the decreasing efficiency even if exposure to the L2 is perfect. The decreasing efficiency is further intensified by the "critical period" at an age of about 14 years. This problem alone and quite simply explains why there is a clear tendency towards L2 *assimilation* among subsequent generations, who normally immigrated earlier,

and why bilingualism (with the language of the country of origin as L1) disappears little by little across the generations (cf., e.g., Alba et al. 2002, Alba 2004; or Rumbaut 2005 on the "New Second Generation" within the USA).

The question then arises: What can be done to overcome this problem, particularly if one considers bilingualism as a both socially and individually valuable resource? An obvious solution may be to start L2 acquisition (including a remaining or also supportive L1 embedding) at such an early stage that L2 exposure and L1 acquisition take place simultaneously in the early phase of maximal learning efficiency. Examples for such rare constellations are children of diplomats or children growing up in bilingual families. More recent linguistic psychological research provides clear evidence that such an early second language acquisition is indeed and obviously quite effortlessly possible (cf., e.g., Thoma and Tracy 2006; Keim and Tracy 2006). The *theoretical* models of first and second language acquisition as well as the *empirical* results on the individual and social conditions for competent bilingualism by all means provide unequivocal arguments that this is possible and especially effective: At an early age of about up to six years nearly everything is possible, and the zero-sum problem that comes along with the age at immigration only arises due to a too late contact with the second language and the necessary interethnic encounters. Because interethnic encounters and exposures are for many reasons rather rare in the everyday life of most (immigrant) families and because even in case they really exist they aren't necessarily maintained spontaneously, this would make up a field of *practical* intervention. Moreover, such a practical intervention should be particularly effective in preschools as we can safely assume that such an intervention effects integration more strongly than most of the other measures that have been attempted and suggested so far, like bilingual instruction in schools or language courses for adults. Unlike studies on the effects of learning age, studies on the effects of these measures at best provide evidence that they do no harm.

Like in many other fields of the research on migration and integration, there are only a few results on this topic that are actually *scientifically* confirmed and reliable. One reason for this is that the necessary lager studies that include all important "levels" of individual and social conditions and that allow analyzing long-term processes as well do not yet exist. Also the data of the GSOEP which contains rather small subsamples and includes only partially important individual and social conditions are insufficient. In addition, there is an urgent need for an (quasi) experimental and systematical examination of the causal effects of certain

organizational measures, like the impact of interethnic compositions in (pre-) schools or of specific language promotion measures, as well as for the development of valid instruments to measure “objective” language skills that can also be used in larger studies. Particularly in the interest of a sustained promotion of language acquisition, bilingualism, and the whole process of the social integration of immigrants and their children it is absolutely necessary that much more will be done in this area than has been done so far.

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Figure 1: Bilingualism as a special type of linguistic integration

Proficiency First Language (L1)	Proficiency Second Language (L2)	
	High	Low
High	Bilingualism	L1 Segmentation
Low	L2 Assimilation	Linguistic marginality

Figure 2: Variables used in the empirical analysis and their hypothetical impact on language acquisition and retention (L1 and L2)

	Motivation		Exposure		Efficiency			L2	L1
	U(L2)	U(L1)	for L2	for L1	for L2	for L1			
Age at immigration				+	–			–	+
Parents' education	+	+			+	+		+	+
2nd generation			+	–				+	–
Duration of stay			+	–				+	–
Own education	+				+	+		+	+
Intention to stay	+	–						+	–
Duration visits SC			–	+				–	+
Segregation			–	+				–	+
Network EC			–	+				–	+
Network RC			+	–				+	–
Visits to RC			+					+	0
Acculturation	+		+		+			+	0

Figure 3: Three ideal types of the correlation between age at immigration and (second) language acquisition

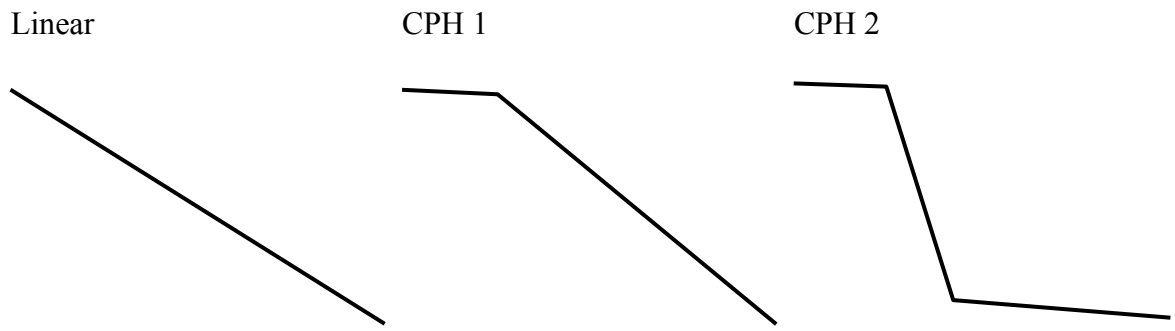
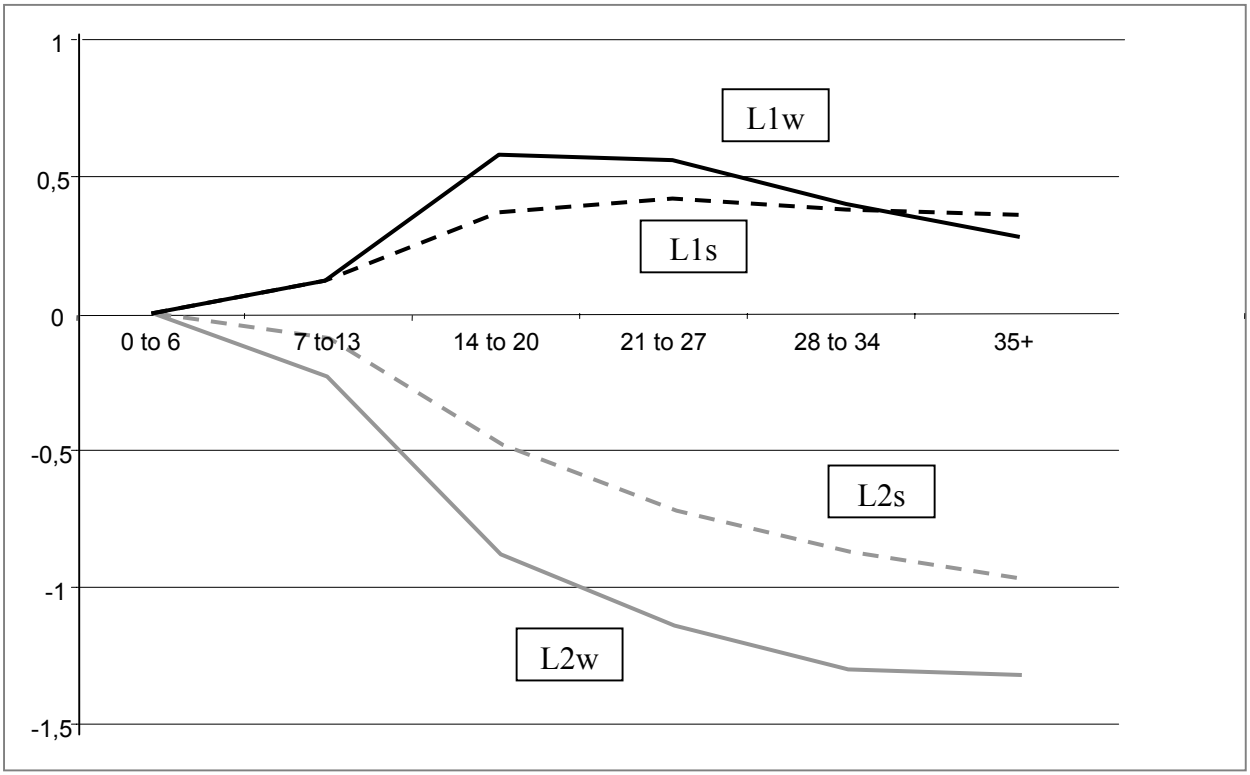


Figure 3: The opposite directions of the effects of age at immigration on first and second language acquisition (OLS coefficients after multivariate control)



s “speaking”; w “writing”

Figure 5: Supportive, neutral, and opposite conditions for the emergence of bilingualism

Supportive effects*	Neutral/one-sided effects	Opposite effects*
Parents' education (w) Own education	*Duration of stay* Segregation Network RC Network EC Visits to Germans	*Age at immigration* *Generation* Intention to stay Duration of visits to SC Acculturation

Italics: Conditions not endogenized with language acquisition
* Effects significant for *both* transitions (L1→L2, L2→Bil)
(w) Only significant for "writing"

Table 1: Empirical distributions of first and second language skills

	First language		Second language	
	Speaking	Writing	Speaking	Writing
1 no skills at all	0.58	4.17	2.65	20.94
2 rather low	1.48	5.13	14.61	22.48
3 not too bad	6.10	12.03	29.92	23.35
4 good	39.96	38.15	34.15	20.68
5 very good	51.88	40.52	18.67	12.55
Person years	46242	46213	46264	46224
Cases	5576	5572	5576	5573

Table 2: Empirical distributions of the four types of language proficiency (Proportion speaking/proportion writing across all person years)

Proficiency First language (L1)	Proficiency Second language (L2)	
	High (very good, good)	Low (rest)
High (very good)	Bilingualism 28.6/14.5	L1 Segmentation 23.2/26.0
Low (rest)	L2 Assimilation 24.1/18.7	Linguistic marginality 28.6/40.8

Table 3: Age at immigration and L2 acquisition

OLS coefficients	L2: speaking		L2: writing			
	bv	mv	bv	mv	Hypothesis/ Result	
Age at immigration 0-6	---	---	---	---		
Age at immigration 7-13	-0.07	-0.09*	-0.05	-0.23***		
Age at immigration 14-20	-0.71***	-0.48***	-1.06***	-0.88***		
Age at immigration 21-27	-0.85***	-0.72***	-1.27***	-1.14***		
Age at immigration 28-34	-1.08***	-0.87***	-1.53***	-1.30***		
Age at immigration 35+	-1.21***	-0.97***	-1.52***	-1.32***	–	–
Parents' education (highest)		0.15***		0.33***	+	+
2nd gen. (both parents immigrated)		0.30***		0.42***	+	+
Duration of stay		0.02***		0.01***	+	+
Own education (highest)		0.36***		0.62***	+	+
Intention to stay		*0.04*		*-0.01*	+	0
Duration of visits SC		*-0.01*		-0.03*	–	0/–
Segregation		-0.07***		-0.08***	–	–
Network EC		*-0.01*		*-0.02*	–	0
Network RC		0.09***		0.08**	+	+
Visits to Germans		0.39***		0.36***	+	+
Acculturation		0.08***		0.11***	+	+
Gender (female)		-0.11***		-0.07**		
Country of origin						
(Western) Europe		---		---		
Russia/Eastern Europe		-0.15		-0.06		
Poland/Slovakia/Czech Republic		-0.31***		-0.30**		
(former) Yugoslavia		-0.40***		-0.46***		
Greece		-0.63***		-0.60***		
Spain/Portugal		-0.77***		-1.03***		
Italy		-0.72***		-0.93***		
Turkey		-0.79***		-0.78***		
Person years	46264	43164	46224	43125		
Cluster (cases)	5576	5146	5573	5142		
R^2	0.197	0.427	0.251	0.493		

* p<0.05; ** p<0.01; *** p<0.001; italics: Deviation from the theoretical model

Table 4: Age at immigration and "critical period" for L2 acquisition (multivariately controlled)

L2: Speaking	Year linear	Category linear	Basic model		CP1	CP2a	CP2b	CP2c
ImAge 0-6		---	---		---	---	---	---
ImAge 7-13		-0.20	-0.09		-0.09	-0.08	-0.09	-0.12
ImAge 14-20		-0.39	-0.48		-0.29	-0.46	-0.48	-0.50
ImAge 21-27		-0.59	-0.72		-0.49	-0.80	-0.72	-0.75
ImAge 28-34		-0.79	-0.87		-0.69	-0.80	-0.91	-0.87
ImAge 35+		-0.98	-0.97		-0.89	-0.80	-0.91	-0.99
ImAge (year)	-0.02							
AIC	102117.8	101454.8	101181.5		101509.3	101560.8	101223.0	**101168.0**
BIC	101658.1	100995.1	**100687.2**		101049.7	101083.8	100737.4	***100691.0***

L2: Writing	Year linear	Category linear	Basic model		CP1	CP2a	CP2b	CP2c
ImAge 0-6		---	---		---	---	---	---
ImAge 7-13		-0.24	-0.23		-0.23	-0.23	-0.23	-0.11
ImAge 14-20		-0.49	-0.88		-0.46	-0.87	-0.88	-0.81
ImAge 21-27		-0.73	-1.14		-0.70	-1.21	-1.14	-1.07
ImAge 28-34		-0.98	-1.30		-0.93	-1.21	-1.31	-1.18
ImAge 35+		-1.22	-1.32		-1.16	-1.21	-1.31	-1.30
ImAge (year)	-0.03							
AIC	118369.9	117451.4	116438.3		117462.9	116615.7	**116428.4**	116487.5
BIC	117910.3	116991.8	115944.0		115943.2	116138.8	**115942.8**	116010.5

Bold: best fit of all models
Bold and italics: best fit of all CP-models

Table 5: Age at immigration and L1 acquisition

OLS coefficients	L1: speaking		L1: writing		Hypothesis/ Result	
	bv	mv	bv	mv		
Age at immigration 0-6	---	---	---	---		
Age at immigration 7-13	0.03	0.12**	0.00	0.12		
Age at immigration 14-20	0.36***	0.37***	0.54***	0.58***		
Age at immigration 21-27	0.44***	0.42***	0.58***	0.56***		
Age at immigration 28-34	0.38***	0.38***	0.34***	0.40***		
Age at immigration 35+	0.30***	0.36***	0.12***	0.28***	+	+
Parents' education (highest)		0.11***		0.12**	+	+
2nd gen. (both parents immigrated)		-0.31***		-0.25*	–	–
Duration of stay		-0.01**		-0.01***	–	–
Own education (highest)		0.16***		0.50*	+	+
Intention to stay		-0.07***		-0.09**	–	–
Duration of visits SC		0.02**		*0.01*	+	+/0
Segregation		*0.01*		*0.01*	+	0
Network EC		*0.01*		*0.01*	+	0
Network RC		*-0.02*		*0.00*	–	0
Visits to Germans		0.08***		0.23***	0	+
Acculturation		-0.02**		*0.01*	0	–/0
Gender (female)		-0.03		-0.11***		
Country of Origin						
(Western) Europe		---		---		
Russia/Eastern Europe		-0.11		-0.18		
Poland/Slovakia/Czech Republic		-0.06		-0.23*		
(former) Yugoslavia		-0.09		0.10		
Greece		-0.10		-0.05		
Spain/Portugal		0.13		0.08		
Italy		-0.02		-0.17		
Turkey		-0.03		-0.13		
Person years	46242	43137	46224	43112		
Cluster (cases)	5576	5144	5572	5141		
R^2	0.055	0.097	0.053	0.143		

* p<0.05; ** p<0.01; *** p<0.001; italics: Deviation from the theoretical model

Table 6: Bilingualism and age at immigration

	Age at immigration						
Speaking	0-6	7-13	14-20	21-27	28-34	35+	Total
Linguistic marginality	11.1	12.5	23.6	25.4	33.4	33.1	24.0
L1 Segmentation	6.2	5.7	22.5	29.7	32.9	32.1	23.2
L2 Assimilation	51.2	49.5	21.1	14.0	10.6	16.4	24.2
Bilingualism	31.5	32.3	32.8	30.9	23.1	18.4	28.6
Person years	6116	5139	9699	11817	7292	6172	46235
Cases	760	681	1082	1284	850	917	5574
Writing	0-6	7-13	14-20	21-27	28-34	35+	gesamt
Linguistic marginality	22.7	25.5	41.2	43.8	53.1	50.7	40.8
L1 Segmentation	8.8	7.6	30.4	35.5	31.1	27.1	26.0
L2 Assimilation	49.2	47.9	13.1	6.7	5.1	12.0	18.7
Bilingualism	19.3	19.0	15.3	14.0	10.7	10.1	14.5
Person years	6114	5132	9694	11806	7285	6163	46194
Cases	760	680	1082	1283	850	915	5570

Table 7: Age at immigration and bilingualism (speaking)

	L1 → L2		L1 → Bil		L2 → Bil	
Odds Ratios	bv	mv	bv	mv	bv	mv
Age at immigration 0-6	---	---	---	---	---	---
Age at immigration 7-13	0.94	0.63**	0.99	0.88**	1.05	1.40**
Age at immigration 14-20	0.16***	0.16***	0.39***	0.44***	2.52***	2.73***
Age at immigration 21-27	0.09***	0.07***	0.31***	0.24***	3.58***	3.42***
Age at immigration 28-34	0.05***	0.04***	0.19***	0.16***	3.54***	3.59***
Age at immigration 35+	0.08***	0.05***	0.14***	0.12***	1.88***	2.44***
Parents' education (highest)		1.26		1.92***		1.53***
2nd gen. (parents immigr.)		3.38***		2.11***		0.62***
Duration of stay		1.05***		1.04***		0.99
Own education (highest)		2.05***		2.44***		1.19*
Intention to stay		1.47***		1.06		0.72***
Duration of visits SC		0.90*		1.04		1.15***
Segregation		0.79***		0.83***		1.05
Network EC		0.95		1.03		1.09
Network RC		1.25**		1.31***		1.05
Visits to Germans		2.59***		2.45***		0.95
Acculturation		1.36***		1.20***		0.88***
Gender (female)		0.78**		0.79**		1.01
Country of origin						
(Western)Europe		---		---		---
Russia/Eastern Europe		0.64		0.37**		0.59*
PL/SL/CZ		0.45*		0.28***		0.62*
(former) Yugoslavia		0.30**		0.31**		1.05
Greece		0.15***		0.16***		1.04
Spain/Portugal		0.10***		0.10***		1.04
Italy		0.15***		0.11***		0.72
Turkey		0.15***		0.09***		0.63
Person years	46235	43137				
Cluster (cases)	5574	5144				
Pseudo-R^2	0.099	0.224				

* p<0.05; ** p<0.01; *** p<0.001