



## Markers of success: A study of twins' instructed second language acquisition



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### ABSTRACT

We examined the association between proficiency in instructed second language acquisition (ISLA) and previous bilingualism, starting age of ISLA, language anxiety and attitude. The analyses were conducted on 564 adolescent Australian twins. Additionally, by examining discrepancies within approximately 100 pairs of monozygotic twins, we sought to specifically identify the environmental effects related to attitude and anxiety on achievement (i.e. with genetic effects removed). We found a clear relationship between attitude towards language learning and proficiency in the second language. Furthermore, the analyses on the monozygotic twins point to the possibility that higher language anxiety is associated with higher proficiency. On the other hand, bilingualism and starting age of ISLA appear to be unrelated to proficiency in the language being learned.

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### 1. Introduction

It is obvious to researchers and practitioners in education that students' academic achievements at a particular grade level vary substantially; even within a relatively constant setting, such as children in the same class who share the same teacher and who study the same curriculum, some students progress quickly and some more slowly. If the educational landscape expands to include different classrooms, different schools, and different ways of teaching the curriculum, then the factors that can influence academic achievement multiply rapidly. Identifying which of these many factors, as well as that of the child's "native" ability, are the most influential is a challenging task for researchers, one that has important consequences for designing and delivering school curricula.

This paper considers some of the prominent factors hypothesized to be associated with learning a second language<sup>1</sup> (L2) in a classroom setting; namely previous bilingualism, starting age of acquisition, language anxiety, and learner motivation. Given previous findings of a relatively

high heritable component in the variability of students' attainment in the foreign language classroom (Coventry et al., 2012), further described below, the aim of this study was to explore factors associated with variability in attainment beyond innate ability.

Consideration of innate ability, which usually refers to a child's genetic endowment for a particular subject, places the issue of differential academic achievement within the broad "nature–nurture" debate: In essence, the question is: how much of the variability in a characteristic, such as school achievement, can be attributed to genetic differences among individuals and how much to environmental differences. As it turns out, for virtually all school subjects so far studied within a design sensitive to the relative influences of genes and environments, half or more of the differences among students are attributable to genetic differences (see Byrne et al., 2005, for literacy; Oliver et al., 2004, for mathematics; and Plomin, Kovas, & Haworth, 2007, for science). The finding of relatively substantial genetic influence on academic achievement, however, should not be a cause for alarm, as it sometimes is among educators (Grigorenko, 2007; Plomin & Walker, 2003). It is true that we cannot alter a child's genetic makeup, but well-designed and well-directed interventions can compensate children whose genetic endowments for a particular academic activity do not match others' (Byrne, Khlentzos, Olson, & Samuelsson, 2010). More importantly for present purposes, showing that genes matter *up to a point* implies that the environment matters beyond that point, and encourages the search for aspects of a child's experiences that play the biggest roles in academic development. And as it further turns out, the very methods that are used to identify degrees of genetic influence, often using the natural experiment afforded by monozygotic ("identical") and dizygotic

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<sup>1</sup> We use the term 'second language' (L2) in this paper to mean a language or languages that students are studying at school; which may in fact be a second or third or fourth language to them. We use this term in preference to 'foreign language', which has fallen into disuse because of its connotation of difference and disconnect, or 'additional language', which may in some contexts be reserved for immigrant learning of the dominant language of the community. In the Australian school system, these languages are referred to as LOTE (Languages Other Than English), but this term is not widely used internationally.

(“fraternal”) twins, can be turned to identify environmental factors. In particular, differences between monozygotic twins, as used here, can be especially revealing.

In the paper mentioned earlier (Coventry et al., 2012), we reported findings from behaviour-genetic analyses on the language learning achievements of monozygotic (MZ) and dizygotic (DZ) twins. The paper also outlines how twins are used to estimate the heritability of academic achievement and the relative contributions of environmental factors, and the reader is referred to that paper for in-depth explanations. Our results showed that, at least as demonstrated by teacher ratings, success at learning a second language in school is heritable, with about two-thirds of the variability among students attributable to genes. Shared environment, that is, environmental factors that twins within a family are likely to share, accounted for about one fifth of variability, while non-shared environment, that is, environmental factors unique to individual children within the same family and which includes measurement error, accounted for about one-quarter. These non-shared environment effects are simply the differences between identical twins, which we explore herein.

In this paper we adopt a mixed approach to focus on the environmental influences of several key factors on instructed second language acquisition (ISLA) among adolescent Australian twins where both twins are studying a second language at school. On the one hand, we ignore the fact that the respondents are twins, referred to hereafter as non-twin analyses, to explore associations between different factors. On the other hand, we also present one of the first applications of twin design to further explore the specific influence of contextual factors in second language achievement in the classroom by examining discrepancies between MZ twins for clues as to the types of environmental effects that predict achievement. MZ twins share 100% of their genes as well as sources of shared environmental influence on a trait (e.g., family attitudes and backgrounds, twins' shared friends), which means that any differences between the two twins in a pair, if not due to measurement error, should be due to differential non-genetic influences, that is, unique environment. Examples of this would be one twin but not the other suffering an illness, having separate peers, being instructed by separate teachers, and so on. Thus, examining which variables correlate with or characterize difference scores between MZ twins for a given trait could give an indication of which environmental factors influence that particular trait.

The question of which factors impact L2 acquisition – with a view to both explaining differences and improving outcomes in second and foreign language learning – is one that has received a great deal of attention in the instructed second language acquisition and pedagogical literature. Some inquiry methods focus on the instructional process itself: the teaching method, the role of the teacher and the merits of form-focused versus more naturalistic pedagogy (Norris & Ortega, 2000). In this study, however, we focused on the learner and how s/he interacts with opportunities for learning. Influences on the learner that have been studied include: the optimal starting age for second language learning (Birdsong, 2006); the role of motivation in achieving proficiency (Dörnyei, 1990; Dörnyei & Ushioda, 2009); the effects of various individual differences such as beliefs, affective factors, cognitive styles and learning strategies on outcomes (Dewaele & Furnham, 2000; Dörnyei, 2005; Verhoeven & Vermeer, 2002); and whether prior bilingualism assists the learning of a third or subsequent language (Cenoz, 2013). Our design allowed us to examine most of these. As mentioned above, we analysed the possible influences of previous bilingualism, starting age of L2 acquisition, language anxiety, and learner motivation. These factors were selected due to, on the one hand, their relevance in SLA research and, on the other, the feasibility of extracting reliable data from the sample under study. Although this list of possible influencing factors is not exhaustive, it is worth noting that we present here all the factors we did measure, therefore following the scientifically prudent course of reporting all associations measured even if they are not significant.

Below, we briefly review the literature pertaining to each of the four key issues in ISLA research that this paper focuses on: the effect of age on rate of learning, the effect of prior bilingualism, the effect of anxiety and the effect of attitude.

### 1.1. Age

Age is perhaps one of the most widely-researched aspects of Second Language Acquisition. Since Johnson and Newport's (1989) seminal paper extending the hypothesis of a critical period of language acquisition (Lenneberg, 1967) to the learning of a second language, much work has been done investigating the existence or otherwise of a critical or a sensitive period. This refers to the notion that there is a maturational threshold over which learners are markedly less likely to fully acquire certain aspects of a new language, most notably pronunciation, but also morphology and syntax when there are substantial differences between the learner's first and second languages. After a certain age, thus, learning another language is believed to be, if nothing else, much more effortful as well as more likely to result in limited success (DeKeyser, 2000; DeKeyser & Larson-Hall, 2005; Paradis, 2004; Ullman, 2001). However, the existence of gradual declines in ultimate attainment across the life span rather than a sharp drop after a certain age has led some authors to question the Critical Period Hypothesis, explaining differences between early and late learners instead as a function of opportunities to use the L2 (Birdsong, 2006; Birdsong & Molis, 2001; Singleton, 2005). Additionally, the existence of adult learners who achieve native-like proficiency (Ioup, Boustagui, El Tigi, & Moselle, 1994) and evidence of equivalent neurological markers underlying processing of linguistic aspects for first and second language speakers (Friederici, Steinhauer, & Pfeifer, 2002) also undermines the whole concept of a critical period. The lack of consensus extends beyond accepting whether there is a specific critical age to also query what that age may be, if there is one. In fact, there is evidence that different linguistic aspects may be associated with different critical ages (Flege, Munro, & MacKay, 1995; Hyltenstam & Abrahamsson, 2003; Kuhl, Tsao, & Liu, 2003; Sebastián-Gallés, Echevarría, & Bosch, 2005). For example, Kuhl et al. (2003) found very early effects, around the age of 1 year old, in the case of phonological acquisition. However, puberty is taken by many to be a useful cut-off point for most linguistic aspects, including syntax and morphology. This is because puberty is a time when the brain undergoes dramatic changes which are likely to have cognitive consequences, such as a decrease in the ability to adapt to specific features of a new language (Pulvermüller & Schumann, 1994; Ullman, 2004). In this (our) contribution to the issue, we followed this general trend in choosing puberty as marking the end of the critical period and adopted the age of 12, as a conservative estimate of puberty onset, to separate early starters from late starters (ages between 12 and 14 are common “late-starter” cut-offs in the literature, e.g., Antón-Méndez, 2010, 2012; Foucart & Frenck-Mestre, 2012; McDonald, 2006).

### 1.2. Bilingualism

Since 40 children in the database came from families where there were indications of family bilingualism, we were able to investigate whether prior bilingualism had any effect on success in ISLA. While some scholars take the position that the underlying processes are the same for learning second or subsequent languages (Mitchell & Myles, 2004; Sharwood-Smith, 1994), in recent years it has been widely recognized that third and subsequent language acquisition (TLA) is qualitatively different from SLA since the learner has two language systems to use as a basis for acquisition and, furthermore, prior learning experience is likely to play a role in the new learning task (De Angelis, 2007). The Dynamic Model of Multilingualism proposed by Herdina and Jessner (2002) suggests that not only does L1 influence L2, as is well-accepted in SLA, but that L2 influences L1, and the combined metacognition and increased language awareness accruing from knowledge of

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