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Effects of Foreign-Language Learning on the Mother Tongue

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Learning a second language (L2) inevitably reduces exposure to one's first language (L1). In immigrants' L2 learning, the attainment of high L2 proficiency often sacrifices the maintenance of high L1 proficiency. However, behavioral sciences have consistently reported that foreign language learning (L2 learning in the learner's home country) induces beneficial effects on one's L1. Here we review currently available evidence for this view, contrast two hypotheses that account for the available data, and introduce our ongoing project using the event-related brain potential (ERP) technique.

I. Background

Language learning is a slow process. Children have to be exposed to their mother tongue (or first language, L1) for tens of thousands of hours to acquire its basics (Clark, 2003). The acquisition of a second language (L2) also requires a long time. Long hours of L2 learning create a situation where exposure to the L1 is reduced, because one individual cannot be exposed to two languages simultaneously. In immigrants (e.g. Japanese people who moved to the U.S.), the attainment of high L2 proficiency often sacrifices the maintenance of high L1 proficiency; immigrants who attain high L2 proficiency are likely to lose high L1 proficiency, whereas those who attain only

low L2 proficiency tend to maintain high L1 proficiency. This tradeoff between L1 and L2 proficiency in immigrants is called the balance effect (Macnamara, 1966). However, there is consistent evidence from behavioral sciences that foreign language (FL) learning, that is, L2 learning in the learner's home country (e.g. English learning in Japan), actually induces beneficial effects on the L1.

II. Behavioral Evidence

Previous behavioral research as a whole suggests that FL learning induces beneficial effects on the L1. Supporting evidence exists at the level of high school (e.g., Cooper, 1987), junior high school (e.g., Kecskes & Papp, 2000), and even primary school (e.g., Taylor & Lafayette, 2010). There are also a few studies reporting null effects of FL learning, that is, cases where FL learning did not have any effects on the L1 (e.g., Schuster, 2005). To our knowledge, there is no empirical study which convincingly demonstrates harmful effects of FL learning on the L1. One limitation of the previous studies is that most evidence comes from English-speaking children's learning of another European language. Hence it remains unknown whether the beneficial effects of FL learning extend to cases where the FL and the L1 are linguistically unrelated. Another limitation is that the previous studies unanimously relied on offline behavioral data which look at the end results of language processing, rather than language processing per se. More specifically, many studies used conventional pencil-and-paper tests of language skills such as reading comprehension (e.g., Taylor & Lafayette, 2010) and metalinguistic awareness (e.g., Yelland et al. 1993). It is thus unclear whether FL learning has any effects on real-time processing of the L1.

III. Hypotheses

The currently available evidence for the beneficial effects of FL learning on the L1 is consistent with two hypotheses. The first one is that positive transfer occurs from the FL to the L1 mediated by the surface similarities between the two languages (Surface Transfer Hypothesis). Most of the currently

available data are based on native English speakers' learning of another European language. European languages share a common origin, and many words in different European languages used to be the same words (Crystal, 1997). Also, close contacts among European languages led to exchange of words and expressions. A primary example is the Norman Conquest, which brought numerous French words into English (Crystal, 2003). Systematic relations among European languages can also be observed in their syntax (Cinque & Kayne, 2005). Orthographically, all European languages use the alphabets. Based on superficial similarities at various levels, positive transfer from the FL to the L1 may occur. This hypothesis predicts that positive transfer will not occur for L1-FL pairs that do not share superficial similarities.

The other hypothesis states that the positive effects of FL learning on the L1 occur at more abstract, deeper levels, and not via superficial similarities (Deep Structure Hypothesis). Generative grammar theories claim that common structures underlie the syntax of all natural languages (Chomsky, 1981). Those common structures are highly abstract. Their presence is theoretically motivated and has not been assumed in all traditional descriptive grammars of particular languages. For example, the syntax of English and that of Japanese seem to share very little descriptively, but under the X-bar theory, these languages have completely the same hierarchical structure (Tsujimura, 1996). Hence Japanese speakers' learning of English may strengthen the psychological processing of abstract hierarchical structure common to all languages, even though English and Japanese do not have many surface similarities.

IV. Ongoing Project

Here we introduce our ongoing project using the event-related brain potential (ERP) technique. ERPs are brief segments of electroencephalograms time-locked to a certain event such as the presentation of linguistic stimuli (Rugg & Coles, 1995). They are online measures of neural activities that can illuminate mental processes occurring before conscious decisions and overt behavior. Since the seminal work of Kutas and Hillyard (1980), the ERP

technique has been fruitfully used to study online processing of language. For example, the theoretical distinction between syntax (grammar) and semantics (meaning) has been shown to have ERP correlates; sentences containing syntactic violations elicit a P600 component (Osterhout & Holcomb, 1993), whereas an N400 component appears for semantic violations (Kutas & Hillyard, 1980).

Using ERPs, our project compares Japanese adults who have either high or low proficiency in English. Apart from some loanwords from English, the Japanese language shares very little with English superficially. These languages are not related at all typologically, and do not share words of the same origin. They greatly differ in word order; Japanese is a so-called head-final language, whereas English is a head-first language (Tsujimura, 1996). Japanese is an agglutinative language, in which a series of morphemes can make up a predicate, whereas words are relatively independent in English. The inventory of phonemes also differs greatly between Japanese and English, presenting well-known difficulty in Japanese speakers' discrimination of some sound contrasts in English (e.g. L and R). Orthographically, English uses the alphabet system, whereas Japanese uses two types of original phonograms (Hiragana and Katakana) and ideograms of a Chinese origin (Kanji). In the absence of superficial similarities between Japanese and English, it is highly unlikely for Japanese speakers to gain positive transfer mediated via surface similarities, from English learning. Thus, the Surface Transfer Hypothesis predicts that Japanese speakers' learning of English will not have positive effects on their L1 Japanese.

In contrast, the Deep Structure Hypothesis predicts that positive effects will occur, because Japanese and English do share common underlying structure at abstract levels, despite superficial differences. We plan to elicit ERPs by syntactic violations contained in spoken Japanese sentences. The violations are due to word-category mismatches that disrupt hierarchical structure building. Syntactic violations of similar nature are known to yield a P600 component in European languages (Friederici et al. 1993), and the amplitude of the P600 is reported to be larger in native speakers with higher L1 proficiency than in those with lower L1 proficiency (Pakulak & Neville, 2010). In line with the Deep Structure Hypothesis, we predict that Japanese speak-

ers with high English proficiency who have experienced longer and more intensive English learning will show a larger P600 response to syntactic violations in Japanese and also higher metalinguistic awareness in behavioral tasks, than Japanese speakers with low English proficiency. In statistical analyses, the effects of socioeconomic status (SES) and general intelligence, if any, must be regressed out as covariates.

A second step of our project is to study Japanese children before and after the beginning of English learning. The study on adults introduced above may provide supportive evidence for the Deep Structure Hypothesis, but such evidence will be only of correlational nature. The causal relation between FL learning and heightened L1 ability can be inferred only by studying changes within the same individuals before and after FL learning. In Japan, FL learning becomes compulsory at junior high school. Hence the only potential subjects of this study will be primary-school children or even younger children. Two groups of children of similar socioeconomic and sociodemographic backgrounds will be followed up longitudinally. The experimental group will consist of children who plan to learn English. They will be examined before the onset of English learning and sometime later when a certain level of English proficiency has been attained. The control group will consist of age-matched children who have no plan to learn English until entrance to junior high school. They will also be examined twice, at approximately the same ages as the experimental group. We plan to acquire both behavioral and ERP measures from these children. The experimental paradigm of the adult study will be applied directly to the children. For this to be possible, linguistic materials that can be easily comprehended by primary-school children have been selected as experimental stimuli for the adult study.

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