Original Articles

Experience, aptitude and individual differences in native language ultimate attainment

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ABSTRACT

Several recent studies have demonstrated that some native speakers do not fully master some fairly basic grammatical constructions of their language, thus challenging the widely-held assumption that all native speakers converge on the same grammar. This study investigates the extent of individual differences in adult native speakers' knowledge of a range of constructions as well as vocabulary size and collocational knowledge, and explores the relationship between these three aspects of linguistic knowledge and four nonlinguistic predictors: nonverbal IQ, language aptitude, print exposure and education. Individual differences in grammatical attainment were comparable to those observed for vocabulary and collocations; furthermore, performance on tests assessing speakers' knowledge of these three aspects of language was correlated (rs from 0.38 to 0.57). Two of the nonlinguistic measures, print exposure and education, were found to contribute to variance in all three language tests, albeit to different extents. In addition, nonverbal IQ was found to be relevant for grammar and vocabulary, and language aptitude for grammar. These findings are broadly compatible with usage-based models of language and problematic for modular theories.

1. Introduction

It is a widely held assumption in linguistics – almost an article of faith – that all native speakers converge on (more or less) the same grammar (see, for example, Bley-Vroman, 2009: 179; Chomsky, 1965, p. 11, 1975, p. 11; Crain & Lillo-Martin, 1999, p. 9; Crain, Thornton, & Murasugi, 2009, p. 124; Herschensohn, 2009, p. 264; Lidz & Williams, 2009, p. 177; Montrul, 2008, p. 4; Nowak, Komarova, & Niyogi, 2001, p. 114; Seidenberg, 1997, p. 1600; Smith, 1999, p. 41). Along with poverty of the stimulus, this presumed fact is one of the most powerful arguments for an innate language faculty (cf. Chomsky, 1975, p. 11, 1999, p. 47; Crain et al., 2009, p. 124; Lidz & Williams, 2009, p. 177). There is growing evidence, however, that this assumption is unfounded: a number of studies have demonstrated considerable individual differences in adult native speakers' knowledge of various aspects of the grammar of their language, including complex syntactic structures involving subordination (Chipere, 2001; Chipere, 2003; Dąbrowska, 1997; Dąbrowska, 2013; Street 2010; Street 2017), some simpler constructions such as passives and quantified noun phrases (Dąbrowska & Street, 2006; Street, 2010; Street & Dąbrowska, 2010; Street & Dąbrowska, 2014), and some aspects of inflectional morphology (Dąbrowska, 2008; Indefrey & Goebel, 1993); for recent reviews, see Dąbrowska (2012, 2015), Hulstijn (2015), and Kidd, Donnelly, and Christiansen (2017). The existence of individual differences in native

speakers' grammatical competence has important implications for the language sciences in that it undermines the convergence argument for UG and provides indirect support for usage-based (UB) theories of language, which are fully compatible with such differences. Furthermore, the study of IDs in language acquisition and ultimate attainment offers opportunities for testing and refining UB models of acquisition, in that it allows us to examine the relationship between properties of the input and learner characteristics on the one hand, and linguistic outcomes on the other.

Many, although not all, of the individual differences in ultimate attainment observed in earlier studies are education-related. All of the studies that demonstrated the existence of education-related differences compared two groups of participants: a control group of high academic attainment (HAA) participants – often postgraduate students – and a low academic attainment group (LAA) – typically people who left school as soon as it was legally possible and who work in relatively low-skill jobs (cleaners, factory workers, supermarket shelf-stackers, etc.). Most of these studies found a characteristic pattern: while the HAA participants performed at or close to ceiling, the LAA group showed considerable variation, with some participants at ceiling, some at chance (or even below chance), and the majority somewhere in between. The studies employed a number of control conditions to ensure that the observed differences could not be explained by appealing to linguistically irrelevant factors such as attention, cooperativeness, or

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the ability to perform the experimental task: thus, the observed differences can be regarded as differences in competence rather than performance (for a discussion, see Dąbrowska, 2012a; Dąbrowska, 2012b). Furthermore, since the studies targeted constructions that do not differ across dialects, the low-performing participants' difficulties cannot be attributed to dialectal differences: for instance, there are no dialects in English in which *The boy was kissed by the girl* means 'The boy kissed the girl'.

The research described in this paper builds on this earlier work but goes beyond it in several ways. First, it strives to give a more rounded picture of adult native speakers' knowledge by targeting a much wider range of constructions than the earlier studies, and also measuring speakers' knowledge of vocabulary and collocations. Furthermore, rather than comparing two groups which are as different from each other as possible, it uses a sample which is representative of the UK population – participants with a range of educational and occupational backgrounds. This will make it possible to assess the extent of the incomplete acquisition identified in the earlier research.

The second goal of the study is to establish whether there is a relationship between different aspects of linguistic knowledge. It is well known that there are robust relationships between vocabulary size and grammar in language acquisition (Bates, Bretherton, & Snyder, 1988; Dionne, Dale, Boivin, & Plomin, 2003; Huttenlocher, 1998; Stolt, Haataja, Lapinleimu, & Lehtonen, 2009; Szagun, Steinbrink, Franik, & Stumper, 2006). It is unclear, however, whether this is merely a developmental phenomenon, or whether such correlations persist into adulthood. Cognitive and educational psychologists often refer to "verbal ability", noting that performance on various verbal tasks tends to be more strongly correlated than performance on verbal and nonverbal tasks; however, such studies typically use broad measures of language proficiency such as reading comprehension, essay writing (and sometimes listening comprehension and speech production) or tasks involving verbal analogies or anagrams, which tap intelligence rather than linguistic knowledge *per se;* apart from vocabulary, they typically do not measure specific aspects of linguistic knowledge, such as the ability to produce or comprehend a particular grammatical construction.

Thus, the relationship between different aspects of linguistic knowledge in adults remains something of a mystery. This is unfortunate, as such knowledge could make an important contribution to our understanding of how linguistic knowledge is organized, and, since different theories make different predictions about these relationships, help us distinguish between alternative accounts of the same phenomena. According to usage-based models (Barlow & Kemmer, 2000; Bybee, 2006; Bybee, 2010; Bybee, 2013; Goldberg, 2003; Goldberg, 2006; Langacker, 1988; Langacker, 2000), linguistic knowledge is represented by a network of constructions, i.e. form-meaning pairings varying in size (from single morphemes to sentence level constructions and beyond) and degree of specificity (from fully specified phonologically through partially abstract to fully abstract). Crucially, grammatical, lexical, and collocational knowledge are all represented in the same format and involve the same mental mechanisms (though possibly to varying extents). Hence, usage-based models assume a close relationship between these types of knowledge, and thus predict that measures of speakers' vocabulary size, grammatical ability, and knowledge of collocations should be correlated.

Modular models (e.g. Chomsky, 1981; Pinker, 1997; Pinker, 1999; Ullman, 2006), in contrast, assume that lexical and grammatical knowledge rely on different types of representations and belong to different "components"; hence, modular theories do not predict a correlation between these two aspects of speakers' knowledge, although they do not explicitly rule it out. On the other hand, those modular theories which also assume that the development of grammar is underpinned by an innate domain-specific mechanism do predict the absence of a correlation. This is because, if we assume that all speakers are equipped with the same language acquisition device and that the

acquisition of basic grammatical constructions is not sensitive to the learners' non-linguistic abilities or to properties of the input (as long as a minimal amount of input is available), variation in adult native speakers' knowledge of core grammar should be minimal, if it exists at all.

Linguistic theories also differ in the relationships they assume between speakers' knowledge of collocations and other aspects of linguistic knowledge. Since collocations are clearly learned from the input, nativist theories predict no relationship between collocational knowledge and core grammar, while allowing for a relationship between collocational knowledge and vocabulary, to the extent that the latter depends on the former, which is very plausible (see Dąbrowska, 2009 for evidence that this is the case). On the other hand, since grammar and collocations both arguably involve procedural memory, Ullman's Declarative-Procedural model (Ullman, 2001; Ullman, 2004; Ullman, 2006) would predict a relationship between these two aspects of linguistic knowledge and no link between these abilities and knowledge of word meanings (which relies on declarative memory).

The third goal of the present study is to explore some possible causes of individual differences in linguistic knowledge in adults. According to usage-based models, these should be related, on the one hand, to the quality and quantity of the input available to learners, and on the other, to individual differences in learning mechanisms supporting language. Thus, examining relationships between these factors and linguistic outcomes allows us to test predictions of usage-based models. The present study investigates the effects of two learner-internal factors, namely nonverbal IQ and language aptitude, and two factors related to the quality of the input: education and print exposure.

UB researchers often assert that language depends on "general cognition" but are rather vague when it comes to identifying the specific cognitive abilities that are supposed to be involved. One obvious candidate would be general intelligence, which is all the more interesting in that the development of language, and, in particular, grammatical knowledge, has often been claimed to be unrelated to intelligence (see, for example, Chomsky, 1965, pp. 57–58; Pinker, 1999; Reber, 2011, p. 30; Smith & Tsimpli 1995). Although robust correlations have been observed between grammatical abilities and IQ in development, these could be mediated by vocabulary: if higher IQ is associated with better word learning skills, but grammatical development cannot get off the ground until the learner has acquired a sizeable vocabulary, we can expect to find a significant relationship between IQ and grammar even if grammatical development does not depend on intelligence. However, such an explanation would be difficult to maintain if it turned out that the correlation between grammar and IQ is also found in adult speakers, who may be presumed to have long acquired the critical mass of vocabulary items necessary to trigger grammatical development.

The second learner-internal variable considered in this study is language analytic ability, that is to say, the capacity to (consciously) infer linguistic rules and generalizations. Language analytic ability is known to have an effect on second language learning, especially in classroom settings, and thus most tests of (foreign) language aptitude such as the Modern Language Aptitude Test (or MLAT: see Carroll & Sapon, 1959), the Pimsleur Language Aptitude Battery (PLAB; see Pimsleur, Reed, & Stansfield, 2004) or the LLAMA Language Aptitude Test (Meara, 2005) include a component designed to test it. On the other hand, it is generally assumed to be irrelevant for first language development, which is supposed to rely almost entirely on implicit learning mechanisms (Bley-Vroman, 1990; DeKeyser, 2000; DeKeyser, Alfi-Shabtay, & Ravid, 2010; Ellis, 2007; Reber, 2011).

There are some reasons to question this assumption. One is theoretical. Tests of language analytic ability such as the Language Analysis subtest of the PLAB, LLAMA F or the York Aptitude Test (Green, 1975) present participants with some vocabulary and sentences in an artificial language and ask them to use that information to infer the form of a novel sentence in the language (see Section 2.2.6 below for an