Infants are not initially sensitive to social intent: Development proceeds from social attention to social intent. Bloom contends that infants are sensitive to social intent in word learning from the outset. Evidence suggests otherwise. In one study, infants 10 to 24 months old heard novel words uttered in the presence of an unfamiliar interesting object and an unfamiliar boring one. Speakers used eye gaze and pointing to indicate the intended referent. All infants attended to the speaker’s gestures. Only 19- and 24-month-olds, however, used speaker intent to map the word onto the boring object (Hollich et al. 2000). Ten-month-olds did what Bloom argued “never happens” (p. 59). They mismapped — assuming that the label referred to the most interesting object regardless of the speaker’s intent (Hennon et al. 2001). Preliminary data suggests that children with autism respond more like 10-month-olds than like their older counterparts. These findings accord well with others in the literature. Before 18 months of age, infants do not use social intent in a word learning task (Baldwin & Tomasello 1998).

One way to reconcile these findings with Bloom’s is to suggest that when infants begin to learn words, people serve as salient perceptual objects that draw attention to, or highlight, word-to-world mappings. At around 18 months of age — around the time of the naming explosion — infants begin to note speaker intent and their word learning strategies shift. The Emergentist Coalition Model of word learning makes this prediction, offering a theoretical justification for the shift in word learning strategy (Hirsch-Pasek et al. 2000; Hollich et al. 2000). Under this scenario, children learn some words or “arbitrary signs” (p. 17) without social intent, but become more efficient word learners when social intent comes on-line for language learning. The challenge for those of us in the field becomes explaining how children who learn words like “Fido” transform into those who learn words like “Fred.”

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Vocabulary and general intelligence

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Abstract: Acquisition of word meanings, or vocabulary, reflects general mental ability (psychometric g) more than than do most abilities measured in test batteries. Among diverse subtests, vocabulary is especially high on indices of genetic influences. Bloom’s exposition of the psychological complexities of understanding words, involving the primacy of concepts, the theory of mind, and other processes, explains vocabulary’s predominant g saturation.

The main message of Bloom’s extraordinarily detailed and probing analysis, which I found completely convincing, is the primacy of conceptual thinking in the acquisition of vocabulary. The essential direction of causality is concept to word rather than word to concept, as is so commonly and mistakenly believed. The acquisition process is as different psychologically from the stimulus-response paradigm for paired-associate rote learning as one could imagine. Vocabulary is acquired when words fill conceptual “slots” that form in the course of mental development and seek to be filled. The wide range of individual differences in vocabulary reflects differences in the number “slots” much more than differences in the amount of exposure to words. The causes of the available number of “slots” are still largely unknown but are certainly related to chronological age and Spearman’s g factor. The proba-
bility that an individual will know the meaning of a given word is mainly a multiplicative function of that individual's level of g and the frequency of that word in the individual's past experience. I was first attracted to Bloom's book by my prior interest in vocabulary tests and in the fact that they are so strongly correlated with IQ, while individual differences in the paired-associates learning of words, nonsense syllables, or paralogues have such a relatively weak correlation with IQ and even with vocabulary. Although Bloom briefly alludes to this fact (p. 193 of HCLMW), I think much more should have been made of it, as it not only supports his thesis but extends it to psychometric findings and to the information processing theory of general intelligence. In combination with Bloom's conclusions, the psychometric and behavioral genetic facts about vocabulary should give pause to many psychologists and educators.

For a starter, consider the following observations. Recall that a factor in psychometrics is a source of variance (individual differences) common to a number of different tests; a test's g factor loading is its correlation with the one factor that is common to all of a number of diverse tests whose intercorrelations have been subjected to a factor analysis. In the national standardization sample of the Wechsler Intelligence Scales for Adults (WAIS), vocabulary has the largest g loading (.57) among the eleven diverse subtests. What may seem more surprising, however, is that when vocabulary is factor analyzed among only the six completely nonverbal subtests, its largest loading is only slightly lower (.82). Its loading among the verbal subtests is .92. Vocabulary therefore reflects g much more than it reflects verbal ability residualized from g.

Bloom emphasizes, rightly, that the "theory of mind" plays an important part in the child's acquisition of word meanings. This leads one to predict that, among nonverbal tests, vocabulary should have its highest correlation with Picture Arrangement (PA). Wechsler (1944, p. 88) described PA as a form of social intelligence, involving human, practical situations, and inferring what the cartoon characters in a disarranged series of pictures are trying to do. The correlation of PA with vocabulary is .65, a value that is entirely predicted from these two tests' g loadings. The same results are found at every age level in the Wechsler Intelligence Scale for Children (both in the American and Japanese versions) and in the British Intelligence Scales. A factor analysis of a much larger number of diverse subtests, performed to examine Carroll's (in press) 3-stratum model of the factor structure of cognitive abilities, allows a detailed analysis of Oral Vocabulary, showing its percentages of variance in each of the three strata of an orthogonalized hierarchical factor analysis: (1) Verbal Ability (V), (2) crystallized intelligence (Gc), and (3) general intelligence (g). The test's specificity and measurement error are the residual (Res), that is, components of variance not common to other tests in the battery. The averaged results of two batteries (of 29 and 16 subtests) are: g = 61%, Gc = 16%, V = 8%, R = 15%. A similar hierarchical analysis of another large battery containing many nonverbal tests (Gustafsson 1988) shows the factor composition of vocabulary as g = 55%, Gc = 34%, Res = 11%.

Although the acquisition of vocabulary naturally depends on exposure to words in some meaningful context, such exposure interacts strongly with innate biological factors, as indicated by the high degree of heritability of vocabulary tests. On a test of vocabulary, monozygotic (MZ) twins are more alike than dizygotic (DZ) twins (Newman et al. 1937). Vocabulary scores (with age partialed out) are correlated .86 for MZ twins and .56 for DZ twins; the broad heritability of vocabulary therefore, is estimated as $2(.86 - .56) = .60$. In this same data set, the heritability of Binet IQ is .50, of height, .57.

As a result of natural selection, advantageous traits typically show genetic dominance, a component of the trait's broad heritability. Dominance can be detected by the effect of inbreeding on the trait, a quantitative phenomenon known as inbreeding depression (ID), which is manifested in the offspring of parents who are closely related genetically, such as siblings or cousins (Jensen 1978, 1983). ID is measured as the percentage of depression of the trait among inbred offspring compared with the mean of an outbred group (i.e., offspring of genetically unrelated parents) that is matched (or statistically controlled) for parental socioeconomic and educational variables. The largest study of the effects of inbreeding (cousin matings) on children's mental test scores found that among the eleven subtests of the Wechsler Intelligence Scale for Children, vocabulary had the highest index of ID (11.45%) as compared with the average of ID of 6.38% for the other ten subtests (Schnell & Neel 1965). The inbreeding effect on the various subtests was correlated about + .50 with the subtests' g loadings (Jensen 1983).

Bloom's book describes, more thoroughly than any other analysis I have read, the purely psychological processes crucially involved in children's acquisition of word meanings. This fascinating array of behavioral phenomena and its social-environmental context accounts for why measures of vocabulary reflect so much of the brain's power that is represented psychometrically by the encompassing, and still causally unfathomed, g factor (Jensen 1998). The aim of reductively understanding the causal mechanisms of individual differences in vocabulary is essentially the same as that of discovering the physical basis of g, its predominant latent trait.

**Good intentions and bad words**

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Abstract: Bloom makes a strong case that word meaning acquisition does not require a dedicated word learning system. This conclusion, however, does not argue against a dedicated language acquisition system for syntax, morphology, and aspects of semantics. Critical questions are raised as to why word meaning should be so different from other aspects of language in the course of acquisition.

The failure of attempts to explain or model the acquisition of language in terms of an all-purpose general learning system has been taken as supporting arguments that humans have a domain specific language acquisition system, variously thought of as a mental organ (Chomsky 1965), a module (Fodor 1983) or a specialized instinct (Pinker 1994b). Children seem to be innately predisposed to prefer certain families of language structures over others, preferences that apparently cannot be explained by general principles of association, problem solving, or massive parallel processing. In addition, it has been difficult to expand the scope of this capacity beyond language to a somewhat larger domain such as hierarchically organized relations, temporal strings, or symbolic relations. Language in particular seems to be matched to specific mental faculties.

While this view remains convincing to many more than forty years after Chomsky proposed it, there is far less consensus on what aspects of language are innate determined and how that determination takes place. Paul Bloom's book offers an extraordinary re-examination of the claim that part of the language faculty involves a capacity to acquire the meanings of words. At first blush, it seems that learning words is surely near the center of the faculty. Children acquire words quickly and effortlessly; and they seem to rule out all sorts of alternative meanings that, on associative grounds, should be quite compelling. There seems to be a Word Acquisition Device (WAD), full of constraints that narrow down the extraordinary range of possible meanings that could be mapped onto words. Indeed, the impossibility of divining from scratch the meanings that another person attaches to their words is more striking on the surface than comparable arguments for syntax. The ease of laying out the indefinitely large set of logically possible alternative meanings for a word makes inescapable the conclusion that something must be profoundly limiting the child's conjectures (Quine 1960).

Bloom's book convincingly shows that there is no WAD as such. Fast mapping of words works for non-words equally well. There