Carleton UNIVERSITY **FASS Distinguished Visitor Lectures**

Normal variation in the behavior and neurology of language: Implications for genetic modularity of mind and brain

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Recent discussions of the evolution of language involve two alternate views: (a) autonomous syntax rests on a unique genetically determined structure; (b) what looks like "autonomous syntax" derives from other genetically determined brain systems, e.g., motor control, learning, communication, along with cultural elaboration and transmission. In this talk, I review behavioral and neurological differences for language and other cognitive behaviors in two large genetically differentiated normal groups: The differences suggest wide normal variation in neurological organization. This enriches the discussion of the foundations of universal human cognitive abilities such as language.

Sixty years ago, A. Luria reported that right handers with familial left handedness (FS+) recover from left-hemisphere aphasia relatively fast, and show crossed aphasia (from right hemisphere trauma) more often than people with only right-handed family members (FS-). Since then, our 4 decades of behavioral research have shown that FS+ people rely more on lexical access and less on syntactic patterns in language processing than FS- people. We now present a Bayesian model of the genetic load for left handedness based on 3,000 family handedness pedigrees, reporting on 30,000 individuals. The genetic load correlates strongly with the results of new behavioral and brain imaging studies. We report effects of familial sinistrality on lexical decision, sentence probe-word recognition, ungrammaticality detection, and odd-music-harmony detection. These findings have clinical and theoretical implications:

First, very few clinical or imaging studies of aphasia, and other language dysfunctions report familial handedness. The same is true for neurolinguistic investigations of normal brains. Yet our sustained behavioral research and new neurological investigations show that there are substantial neurological differences between FS+ and FS- people. Ignoring these differences, blurs our understanding of the relation between genetics, maturation, experience and brain organization for language.

Second, our research refines the differentiation of phenotypic laterality for the study of the genetics of left handedness, important to many clinical fields because of the association of left handedness with mild syndromes such as dyslexia and severe ones such as schizophrenia.

Finally, the population differences in the neurological organization of language suggest that there is not a unique genetically determined linguistic organization for language. On one view, the representation of linguistic structural architectures is labile, exploiting different brain structures differentially as a function of general differences in cerebral organization. On a second view, the variation in neurological representation reflects only non-structural aspects of language, e.g., its role in motor behavior, communication, learning and cultural interactions.

On both views, *the fundamental computational capacity for language would then rest either in a single universal small location or circuit, resistant to variation, or be represented in physiological mechanisms other than specific locations or connections.* Either outcome is consistent with exaptationist theories of language evolution.

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