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REVIEWS

MEGAN R. GUNNAR & MICHAEL MARATSOS (eds), *Modularity and constraints in language and cognition. The Minnesota Symposia on Child Psychology* Vol. 25. Hillsdale, NJ: Erlbaum, 1992. Pp. x + 242.

This volume arises out of a symposium held in 1990. It contains a preface, by Gunnar, and eight chapters. The first, by Maratsos, is a general introduction to 'Constraints, modules and domain specificity…' (p. 1). The last two, by Goodnow ('Beyond modules') and Siegler ('What do developmental psychologists really want?'), provide overviews arising from discussant contributions at the original symposium. The central five chapters address specific topic areas in current research: chapter 2, by Pettito, entitled 'Modularity and constraints in early lexical acquisition: evidence from children's early language and gesture' (p. 25); chapter 3, by Markman, on 'Constraints on word learning: speculations about their nature, origins and domain specificity' (p. 59); chapter 4, by Keil, on 'The origins of an autonomous biology' (p. 103); chapter 5, by Malatesta-Magai & Dorval on 'Language, affect, and social order' (p. 139); and chapter 6, by Bever, on 'The logical and extrinsic sources of modularity' (p. 179). Each chapter, save Goodnow's, has its own list of references, and there are separate consolidated author and subject indexes. In this review I shall concentrate on the middle chapters 2–6.

In chapter 2, Pettito's topic is the different types of gestures that are used by children exposed to spoken and signed languages. She considers issues in the attribution of lexical status to gestures of two types: those involving actions with objects in hand, and empty-handed symbolic gestures which are 'by far the most interesting type of gesture, and… the focus of this chapter' (p. 34). She criticizes the view that gesture and word have equal symbolic status, and that therefore the language abilities of the child are general-cognitive in basis rather than specifically linguistic. She presents the alternative view that words and *some* gestures are controlled by 'a distinct [linguistic] mental capacity, reflecting domain-specific knowledge…' (p. 35).

She presents findings from videotaped studies of a group of six children, three hearing (of hearing parents) and three profoundly deaf (of deaf parents using different sign languages), developing through the ages of 8–20 months. Results are that, for six defined types of manual activity, the frequency and distribution patterns are very similar between the hearing and deaf children, with actions with objects predominating, followed by empty-handed gestures, head-and-body gestures and with symbolic gestures being least frequent of all. However, for both groups, symbolic gestures were importantly different

from early lexical items: they were less frequent, emerged relatively late, did not increase in complexity over time, showed inconsistency of form, had restricted functions, exhibited context-dependence, only appeared *after* corresponding or related lexical items, did not respect kind boundaries, and did not enter into early gestural combinations.

Pettito concludes that these negative differences reflect the absence from symbolic gesture input of the specifically linguistic properties of 'sublexical, phonetic, and syllabic organisation as well as other phonotactic information (prosodic cues that bind segments into phrasal, clausal, and lexical bundles)…' (p. 54). She claims that such input properties are sought by 'innate predisposition' (p. 54), reflecting 'domain-specific knowledge … in the human language acquisition process' (p. 55).

Markman's topic in chapter 3 is also about children's vocabulary, but she focuses on the 'inductive feat accomplished by the two-year-olds of our species', and the hypothesis advanced to account for this, namely 'that children are predisposed to elevate some hypotheses about word meanings over others' (p. 59).

She proposes three constraints that reduce the hypothesis space that children have to work in, and addresses what she takes to be 'misconceptions about the nature of biological constraints'. She introduces the three constraints/assumptions through a selective review of the literature on young children's early vocabulary developments.

The whole-object assumption encourages the child's belief that when an adult points to an object and labels it, that label 'is likely to refer to the whole object and not to its parts, substance, or other properties' (p. 61).

Where the novel label is presented in the context of more than one object/label, others of which are known, *the taxonomic assumption* encourages the child to think of the novel label as being of like kind to known object-labels, rather than as marking some relation between them.

The mutual exclusivity assumption 'leads children to expect that each object will have only one label'; as such it 'helps children override the whole-object assumption, thereby enabling them to acquire terms other than object labels' (p. 63). Much of the research cited is directed at establishing how far down the age range certain assumptions can be attested: in summary, Markman notes evidence relating to the early- to mid-range of the second year, well before the landmark age of two years, for at least some uses of some of these assumptions.

Markman then considers how far each assumption might be regarded as domain-specific, prefacing her discussion by outlining some reasons for caution. She says of the mutual exclusivity assumption that it 'appears to be the most likely of the constraints to qualify as domain general' (p. 80). She discusses it in the context of other linguistic constraints, in the formation of

belief systems, and provides further possible parallels from classical conditioning and social psychology. She concludes that it 'could be one instantiation of a widespread attempt to find simple, regular, relations between elements in a domain. Mutual exclusivity [and other parallels to it] all cause animals and humans … to fail to learn something that could be useful. [It is] not flawless, but given limited resources may be highly adaptive' (p. 86).

In the final section, Markman considers the possible origins of the three assumptions. Her discussion emphasizes the dangers of simplistic approaches, whether they involve the dichotomy between innate versus learned abilities, confusion of universal with innate, or of learned with later age of onset; or 'presuppose that a given constraint is a single homogeneous ability' (p. 88). She concludes with a review of the ethology of learning approach, which 'treats learning itself as an adaptation, a product of evolution by natural selection'.

In chapter 4, Keil takes us away from the immediate domain of language, and what he sees as the quasi-perceptual nature of Fodorian modules, to explore 'the feasibility of constraints and modularized knowledge acquisition devices … at the ''highest'' and most central levels of cognition', and he takes as his topic the development of biological thought, 'for it is here that the most dramatic differences of opinion are still openly held' (p. 104).

He assembles findings from a number of ingenious studies that probed young children's understanding of biological versus non-biological entities, in terms of their *essential kind-properties*, the *inheritability* of these, and their *typical growth-patterns*. Other studies looked at biological vulnerability to disease, in terms of children's beliefs regarding what might be *contagious*, and the possible *agents of disease*. Finally, children were tested for their appreciation of a *teleological stance* with respect to biological versus non-biological kinds.

A flavour of the sorts of tasks used may be gained from the following selective characterization. The youngest children saw that an animal wearing another-animal-suit is still the same animal; but up to around four and a half years, they behaved as if leopards *can* become tigers by having their spots physically changed for stripes, just as stools can become tables by changing their physical attributes; beyond this age, however, biological kinds showed increasing resistance to such manipulation.

In judgement of which animal properties might be inherited, four-to-five-year-olds favoured those which were described to them as being functional to the animal; this type of response declined with age, and six-to-seven-year-olds started to show the adult-like choice of inborn properties.

Keil concludes that '… a great deal of conceptual change does occur with respect to biological thought from, say 3–10 years' (p. 134). He interprets this as supporting 'a view of constraints working at the most belief-laden

aspects of [cognition]…' (p. 135). The change does not seem to arise from: (1) 'completely domain-general learning procedures such as association, typicality tabulation, and induction'; nor from (2) 'an intuitive psychology or mechanics'; this leaves either (3) 'a fortunate match of one or more modes of construal that, although limited in scope of application, are not exclusively tailored for biology' or (4) 'a predetermined mode of construal or combination of modes that is specifically tailored for biological phenomena… Distinguishing between these [latter] two alternatives may be an exceedingly subtle problem, and may require a highly specific characterization of the biases at all points in development' (p. 135).

Chapter 5, by Malatesta-Magai and Dorval, 'addresses the question of modularity in human communication systems from the perspective of affect theory and sociolinguistics' (p. 139). They begin by introducing affect theory: 'Affect theory embraces a modular conceptualization of mental faculties in specifying semi-autonomous subsystems of personality including the cognitive, affective and motor … It also emphasizes the essential cooperation between separate subsystems that is achieved in the context of information processing and in responding to adaptational demands' (p. 141).

They go on to the biological bases for emotions and language: 'Most emotion theorists refer to a set of basic or fundamental emotions as being part of our biological heritage … The neurophysiological basis of emotion is limbic … The elaboration of emotional experience and response systems can be considered critical to the formation and maintenance of social bonds … language is also fundamentally social … [and] recent neuroanatomical and neurophysiological studies confirm … physical connectivity between the limbic and language modules. As such language and emotion, although not typically considered in relation with one another, must be regarded as intimately related and cooperating mental organs, both neuroanatomically, and, as we hope to illustrate, functionally' (p. 142).

They outline their approach as follows: '… a careful analysis of human speech discloses the fact that language is saturated with affect – the linguistic communicational system that in many ways is totally and artfully interwoven with the nonverbal communication system. When we speak, we not only reveal our thoughts, but also our momentary feelings as well as our affective biases… We also reveal basic dimensions of relatedness such as status, dominance, and affiliation' (p. 142).

On this basis, they claim that '… we have argued that affect and language, as socially constitutive activities, are not only modular subsystems of communication, but that they function essentially in a complementary and cooperative manner' (p. 142).

At this point, if the reader feels that a step has been missed, it could be either because the authors have not provided it, or because the reviewer has

failed to represent it. To avoid the latter possibility, I have let the authors speak for themselves as much as possible in the preceding extracts. Readers of the volume will be able to judge this chapter for themselves, both from these introductory sections, and from what follows. I suspect they will find, like me, that the chapter simply fails to get to grips with modularity (constraints are not mentioned, as far as I can see) in the required way.

In chapter 6, the volume returns to language in relation to cognition. Bever draws the distinction, as did Keil, between perceptual vs. belief-driven processes, and argues that where behaviour, as is the case with language, involves both types of processes '[c]laims that there are modules … are the most interesting because they are also the most controversial' (p. 181). In response to this challenge, Bever states his intention to offer 'an alternative framework for a research program on the interaction of mental systems underlying language behaviours, and some current results that support that program. I argue that language behaviour recruits a heterogeneous set of distinct capacities and neurological structures, each of which has intrinsic constraints on how it can interact with others. Furthermore, I raise the possibility that the differentiation of cognitive processes is general, cutting across types of behaviour. These facts and constraints can result in modular-like properties of certain aspects of language without being unambiguous evidence for an innate and architecturally distinct module for language, nor for modules within the language modality' (p. 180).

The first step in the argument goes as follows: regarding the apparent innate mental structures that two-to-three-months-old infants exhibit, it may be that: (i) there *are* innate mechanisms, but they are subcortical (either because the cortex itself cannot yet sustain them or because of lack of input for cortical mechanisms to get started); and hence (ii) they are not developmentally continuous with their mature counterparts; but (iii) they 'shape and partition the infant's experience into mentally natural kinds' (p. 186), partly via providing for appropriate adult input for … (iv) non-innate cortical mechanisms which subsequently develop.

The next steps are based on the following argument: if (i) 'cognitive processes are differentiated in part because of neurological differences'; and (ii) 'those differences are in part innate'; and (iii) 'the genetic code for such differences is complex, leading to relevant co-variation with other genotypes, and consequently phenotypes', then 'we may find that populations differentiated on the basis of biologically superficial phenotypic constraints may also have characteristic differences in cognitive processes' (p. 187) – a programme for research on linguistic/cognitive style differences within the normal population.

Distinct populations are investigated in terms of: 1 *left hemisphere computational power* – Bever reviews studies of humans (including musicians),

apes, rats and dolphins, and concludes that they 'suggest that the left-hemisphere superiority for language in humans may not be a reflection of a unique linguistic ability of the left hemisphere. Rather, the specific difference between the hemispheres reflects the logical distinction between relational and unary processing' (p. 193); 2 *the representation of associative knowledge in right-handers from left-handed families* (*LHF*) – Bever argues that the LHF differences show that 'the neurological foundations for a linguistic module are not monolithic' (p. 196); 3 *cognitive style differences between males and females on a language-learning task* – 'Males learned to [perform a] grammaticality task about 10% better in the two-way condition, while females showed exactly the opposite pattern' (p. 199). Bever points out that since gender is 'a biologically coded difference with ... immediate social consequences ... [we should be] cautious about claiming that the abduction difference is directly biologically caused' (p. 200). This leads us on to the next issue: 4 *cognitive style differences between females and males in learning to navigate a maze* – the similarity of distribution of one-way versus two-way learning styles over males and females in the language-learning and maze-learning studies suggests a 'relation between abduction and spatial mechanisms' (p. 204), and a link between linguistic and non-linguistic modes of cognition. Bever has comments to make on this, as well as some appropriately cautious considerations about the socio-political implications of findings relating to genetically-coded group differences among human subjects.

Bever concludes by noting that he has outlined a programme for research, rather than definitive conclusions. The goal of such a programme is 'to show which aspects of language can be explained from general principles and facts about behaviour and learning: Those that cannot be so explained become the basis for more specific hypotheses about what is truly uniquely innate to language' (p. 208).

From the foregoing summaries, it will be clear that this volume has rich information to supply, over a diverse range of studies, of humans and non-humans, children and adults, in different areas of language and cognition. Given the diversity, it is perhaps not too churlish to regret the lack of a chapter specifically on speech perception, especially considering the relation between the auditory and visual modalities, and the possibility that part of the responsiveness of the human visual system to face-processing relates to a specialized capacity for lip-reading (e.g. Summerfield, 1987).

Standing back from the detail, the reader may have questions such as the following in mind (my suggested answers in parentheses): Would the studies have been conceived without modularity? (yes); Does modularity pull these studies together? (yes); Is it possible to decide for or against modularity on the basis of these studies? (no); Are there worthwhile competing conceptual

frameworks to modularity? (yes); Is modularity a useful conceptual framework? (yes).

As a deck-clearing concept prior to engagement in research, modularity is useful; but it seems that it is not (yet) a framework within which research findings can be comprehensively accommodated/interpreted; moreover, it is not the only concept having these characteristics. More information on/understanding of the underpinning concepts of innate vs. learned, hard-wired vs. adaptive, early vs. late emergence, compatible vs. incompatible content, domain-specific versus general, etc. is required. The studies reviewed here (with the exception of chapter 5), whatever their stance regarding modularity, work together to that end.

REFERENCES

Summerfield, Q. A. (1987). Some preliminaries to a comprehensive account of audio-visual speech perception. In B. Dodd and R. Campbell (eds), *Hearing by eye : the psychology of lip-reading*. London: Erlbaum.

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