Introduction: nativism past and present

Tom Simpson, Peter Carruthers, Stephen Laurence and Stephen Stich

Nativist theorizing is now thriving. Present in the works of Plato, although much neglected since, nativism is once more at the forefront of contemporary developmental and cognitive theory. This resurgence owes much to the pioneering arguments of Noam Chomsky, which have stimulated a great deal of productive work in linguistics and cognitive psychology over the past half century. But nativist theorizing has also received a powerful impetus from work in genetics and evolutionary biology, as biological thinking has begun to permeate psychology and philosophy of mind. Consequently much of the research in the cognitive sciences over the past twenty years or more has been inspired by nativist theorizing. There have also been some revolutionary results.

This book is the first of three volumes that present some of these results and discuss their implications. These volumes will draw together research and arguments from philosophers, psychologists, linguists, anthropologists, primatologists and other cognitive scientists to provide an integrated and detailed picture of where nativist theory currently stands and of what its future holds. Not everything, nor everyone, can be included in these volumes of course, and there is much work outside of that presented here which is both inspired by and supportive of nativist theory. However, when taken together these volumes present a detailed and wide-ranging study of the current state and the possible future development of 21st century nativism. In so doing, they will also provide unparalleled insight into what we, as humans, are.

This first volume focuses on the fundamental architecture of the mind, and on some of its innate contents. The papers contained herein investigate such questions as: What capacities, processes, representations, biases, and connections are innate? How do these innate elements feed into a story about the development of our mature cognitive capacities? Which of these elements are shared with other members of the animal kingdom? What, in short, is the structure of the innate mind? A summary of these investigations, and of the answers that they provide, can be found in the final section of this Introduction. First, however, we will briefly review some of
the recent (and not so recent) debates in philosophy, psychology, anthropology, evolutionary theory and other cognitive sciences that provide a background for the topics with which this volume is concerned.

1 A brief history of nativism

Philosophical consideration of the innate structure of the mind has had a long and complex history, some of the origins of which lie in the works of Plato. In the *Phaedo* and the *Meno* Plato argued that, since we have knowledge and abilities for which experience is insufficient, then these things must have been present in us at birth. Plato further claimed that the process we call ‘learning by experience’ is in fact one by which we ‘recollect’ what we already know. Thus, for Plato, certain kinds of knowledge and ability are within us at our birth, and can thus be said to be ‘innate’.

Philosophers of the Enlightenment also examined the questions that Plato had addressed. This time, however, discussion concerned not only why certain things may be innate and what in particular these things may be, but also what we should take the very term ‘innate’ to mean. In his *Essay Concerning Human Understanding* John Locke argued that there can be ‘no innate principles in the mind’ because, amongst other things, no useful sense can be given to the notion of innateness itself. Locke argued that if innateness literally means ‘in the mind at birth’, then innate principles must play *from birth* the same kinds of role that such principles play in our minds later in life. But this, Locke claimed, is clearly not the case, since many supposedly innate principles play no role in the mental lives of infants and ‘idiots’. However, Locke continued, if the innateness of certain principles is to be read as the claim that such principles are somehow potentially or *dispositionally* in our minds at birth, then, when they do become present in our minds, we require some criterion by which we may distinguish those principles that are innate from those that are not. But, claimed Locke, such criteria cannot be found. Locke concluded that there is therefore no reasonable way in which the notion of innateness can be deployed, and thus no way to be a nativist about the origins of the principles in question.

Few have found this particular argument of Locke’s convincing. There are many physical features of our bodies that are plainly innate, of course, but that aren’t present at birth. Facial hair in men would be one example. There is no reason to think that innate features of our minds should be any different. An innate cognitive property or mechanism would thus be one that
emerges at some point in the course of normal development, but which isn’t a product of learning.

Everyone has always accepted, of course, that the basic structure of the mind must be innate in this sense. And everyone accepts that the basic principles of learning must be innate also. The dispute concerns the architecture of the mind itself, and what the learning principles are. Nativists are inclined to see the mind as the product of a large(r) number of innately specified, relatively complex, domain-specific structures and processes. Their empiricist counterparts incline toward the view that much less of the content of the mind exists prior to worldly experience, and that the processes that operate upon this experience are of a much more domain-general nature. In other words, empiricists favor an initial cognitive architecture that is largely content-free, and in which general purpose learning mechanisms operate on the input from the senses so as to build up the contents of the mind from the cognizer’s experience of the world. Nativists, in contrast, favor an architecture that is both more detailed and more content-laden, containing, for example, faculties or principles of inference that are specifically designed for the acquisition and performance of particular cognitive tasks.¹

We now come (via a somewhat lengthy stride) to the work of twentieth century theorists. Broadly speaking, contemporary nativists and empiricists differ over the existence, richness and complexity of the pre-specified contents, structures and processes of the mind. Of course, contemporary nativists and empiricists both agree that the facts of the matter lie somewhere in between the clearly untenable extremes of their positions (i.e. “Everything is innate” versus “Everything is learned”). For example, Noam Chomsky – perhaps the twentieth century’s most influential nativist theorist – observes that “the question is not whether innate structure is a prerequisite for learning, but rather what it is” (1980, p. 310), and W.V.O. Quine – no friend to nativism – points out that even the behaviorist “is knowingly and cheerfully up to his neck in innate mechanisms” (1969, pp 95-6). It is in the details that the important differences lie; and it is here, therefore, where the most significant results are to be found.

We now have, for the first time in this debate, a large body of data gained from decades of systematic, sustained, empirical research which bears on the questions in hand. However, whilst this research is solidly empirical in nature, the results that it has supplied have brought increasing discomfort to theorists of an empiricist persuasion. So let us now undertake a brief

¹ A clear and informative summary of the history of this debate can be found in Stich (1975).
tour of some of its more salient aspects.

2 The poverty of the stimulus

At the heart of the contemporary nativist/empiricist debate lie what are termed arguments from the poverty of the stimulus. These arguments are central to all of the chapters in this volume, and to much of the background work upon which they draw. Unfortunately, however, they don’t exist in the form of a standardized or universally agreed set of neatly circumscribed propositions (see, e.g., Cowie 1999; Laurence and Margolis 2001). Rather, they are a collection of related claims and arguments, all of which instantiate the same general idea: that the knowledge that cognizers acquire, to underpin certain cognitive abilities, is radically underdetermined by the input available to the cognizer in her developmental environment. In other words, arguments from the poverty of the stimulus claim, roughly, that the information available to a cognizer is too impoverished to provide her with the knowledge that the performance of certain cognitive abilities requires. Nativists conclude from such arguments that the required knowledge must thus originate elsewhere. That is, the knowledge must be innate. Empiricists, in contrast, conclude that the argument(s) must be unsound. They argue, for example, that there is more information in the environment than the nativist allows, or that the child is a better learner than the nativist supposes.

We will shortly consider arguments from the poverty of the stimulus in greater detail, but there is one more general issue which should be addressed first. For one might wonder why arguments from the poverty of the stimulus have resisted standardization, given the central role that they play in the contemporary nativist/empiricist debate. Indeed, one might think that such resistance somehow indicates a hidden but fundamental flaw in the arguments themselves, a flaw that should make theorists wary of employing them to the extent that they do.

There is a satisfactory response to these concerns, however. Resistance to standardization occurs primarily because the specifics of the cognitive abilities to which the arguments are applied have a significant effect on the way in which those arguments should be formulated. In other words, the reasons why the information in a cognizer’s environment underdetermines the

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2 In most of what follows the term ‘knowledge’ should be interpreted loosely, to mean whatever faculties, capacities, representations, beliefs, etc. are appropriate to the cognitive task at hand. It should not be interpreted in the strict sense of justified true beliefs, unless explicitly stated.
knowledge required for any particular cognitive ability depend to a large degree upon the domain-specific details of the ability in question. The knowledge required for, say, normal linguistic competence differs significantly from that required for an understanding of the mental states of others (our ‘Theory of Mind’) or the behavior of physical objects (our ‘naïve physics’). Arguments from the poverty of the stimulus reflect these domain-specific differences accordingly. Moreover, for each of these domains the details of the knowledge required can be rather complex – particularly for those of us who are not specialists in the domain in question – and this too makes succinct domain-general standardization difficult to achieve. In short, the resistance to standardization stems from the fact that arguments from the poverty of the stimulus can be broadly and powerfully applied across so many cognitive domains.

It is possible to say a good deal more about arguments from the poverty of the stimulus, however, even at a more domain-general level. In fact, it is possible to distinguish two broadly distinct kinds of argument (Botterill and Carruthers 1999; Samuels 2002). The first are those descended from the arguments presented initially by Plato, and more recently by Chomsky in the context of his work on linguistics and language development (e.g., Chomsky 1975, 1980a; Cowie 1999; Laurence and Margolis 2001; Pinker 1994, 2002). These arguments focus on an apparent ‘gap’ between the knowledge that is required for a given cognitive ability (e.g. our linguistic or geometric competence) and the information available in a cognizer’s developmental environment. In the case of linguistic acquisition the argument is roughly as follows.3

First, the grammatical knowledge that every child acquires is shown to exhibit certain specific properties. It is then argued that these properties could not have been acquired solely on the basis of information in the child’s developmental environment, if the child were equipped only with relatively content-free, domain-general – i.e., empiricist – learning strategies. Nativists then claim that the child must therefore be equipped with an innate, language-specific faculty which serves to close the gap between the grammatical knowledge that children actually acquire and the impoverished environmental input from which such knowledge must otherwise be derived. Therefore, nativists conclude, provided that we correctly understand both the linguistic ability that children acquire and the information available in the developmental environment, the existence of an innate, language-specific faculty is a required part of the best – and indeed the only reasonable – explanation for how language acquisition can occur. More generally then,

3 A more detailed explanation can be found in Laurence and Margolis (2001).
nativists claim that structurally isomorphic arguments from the poverty of the stimulus can be applied, *mutatis mutandis*, to other cognitive abilities for which a similar gap can also be demonstrated. Empiricists, by and large, deny some aspect of the gap (Putnam ???; Goodman ???; Cowie 1999), although such denials have become increasingly hard to sustain, in many domains.

The second kind of argument from the poverty of the stimulus are those derived more directly from empirical research into cognitive development. These are arguments that emphasize *the speed* with which cognitive abilities develop in infants and young children. For example, Johnson and Morton (1991) have shown that infants only hours old have a preferential interest in face-like shapes, and Elizabeth Spelke and her colleagues have demonstrated that four-month old babies have expectations and make inferences about the unity, solidity and normal movements of objects (Spelke *et al.* 1994; Baillargeon 1994). Similar results have also been found in other cognitive domains, including our numerical abilities (Carey 1985; Wynn 1992; Xu and Spelke 2000).

The general strategy behind this kind of argument is, first, to show that the ability in question requires some particular knowledge or understanding specific to the cognitive domain involved, and second, to argue that *whatever* information may be present in the developmental environment of the child, there simply hasn’t been enough time for the child to acquire this knowledge or understanding given the nature of all known domain-general learning processes. Once again, therefore, nativists conclude that there must exist some innate, domain-specific faculty which enables the child to acquire the required understanding in the time observed. In other words, without the existence of such faculties, the environmental information that the child experiences is too impoverished ‘in volume’ to enable her to reach the understanding that she does in the time available.

These different kinds of argument are clearly closely related. Both make empirical claims concerning the nature of acquired cognitive abilities, and both depend upon a detailed understanding of developmental environments and acquisition theory. Moreover, Chomsky’s linguistics-derived arguments have been (and remain) a significant motivating factor behind empirical developmental research in many other cognitive domains. However, differences in the specifics of investigative orientation provide at least one reason to view these approaches as not completely identical, even if such differences ultimately reflect no more than the biases of
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particular research traditions within philosophy, developmental psychology and the other
cognitive sciences. Either way, these kinds of argument provide powerful support for nativist
theory.

Arguments from the poverty of the stimulus are not the only source of evidence relevant
to the contemporary nativist/empiricist debate, however. Nor do such arguments provide the
basis for all of the relevant results from developmental psychology and the other cognitive
sciences. So we will now consider several other sources of evidence that provide the backdrop to
this volume.

3 Psychology and anthropology

Perhaps the most striking aspect of human cognition is also the one that is easiest to miss;
namely, its widespread uniformity and predictability. In our daily lives we tend to focus on the
differences between individuals, and these differences can be the source of huge reward or
suffering in both our personal and professional lives. However, if we take a step back from this
high resolution image, the similarities between all the members of our species become clear
(Brown 1991; Botterill and Caruthers 1999; OTHER REFS). So too, indeed, do the similarities
between humans and many other species of animal on our planet (Gould and Gould, 1995;
Byrne, 1995; Tomassello and Call, 1997). Moreover, a century of work in the cognitive sciences
has shown just how widespread and fundamental these similarities actually are.

Detailed empirical evidence that normal human cognitive development follows a largely
uniform and structured pattern has been present since the work of Piaget (e.g., Piaget 1936, 1937,
1959; Piaget and Inhelder 1941, 1948, 1966). Piaget proposed a model of children’s cognitive
development that involved steady, across-the-board improvement in an individual’s cognitive
abilities, where this improvement was driven largely by the action of environmental stimuli on
domain-general learning mechanisms. However, work since, and in response to, Piaget has
shown that development is in fact a much less unified affair within an individual, even though
uniformity across individuals remains the norm. In other words, we now know that each
individual’s cognitive development follows a domain-specific trajectory for each cognitive
domain (Carey 1985; Karmiloff-Smith 1992; MORE REFS). However, we also know that within
each domain there exists a well-ordered pattern of development, and that this pattern is uniform
for all normal members of our species (Baron-Cohen 1995; Karmiloff-Smith 1992; Stromswold
Moreover, there is now strong evidence that such domain-specific patterning occurs even when environmental input during the developmental process is highly restricted. For example, children develop normal linguistic abilities and at the normal rate even in cultures that address little if any speech either directly or indirectly to developing infants (Marcus 1993; Pinker 1994; Pye 1992). Similarly, blind children acquire language at the same pace and with same developmental pattern as other children (Landau and Gleitman 1985). This kind of evidence points strongly toward the existence of a uniform, species-wide, innate cognitive endowment which consists (at least in part) of various domain-specific faculties. Developmental psychology has thus filled in some of the details of the uniform pattern which Piaget observed, but in a way radically different to that which he would have expected.

In addition to the evidence for cognitive uniformity from developmental psychology, there is increasing evidence in similar vein from anthropological investigation (Atran 1990, 2002; Boyer 1994; Brown 1991; Sperber 1996). For example, Scott Atran argues that comparative data from studies of Maya Indians and rural North Americans support the existence of a common cognitive system specific to our folk-biology – our understanding of the taxonomy of the natural world and of the inter-relations of life-forms within it (Atran, 2002). Similarly, Pascal Boyer has shown that whilst religious concepts and practice may appear to be both culturally diverse and individually idiosyncratic, such concepts and practices are in fact strongly constrained by universally shared systems for folk-psychology, naïve-physics, folk-biology and understandings of artifacts (Boyer 1994, 2000).

What we find, therefore, is that both anthropology and developmental psychology are now converging on a model of human cognition which employs the same notion of innate and universal cognitive faculties that philosophers and linguists initially proposed. Moreover, there is increasing reason to believe that this convergence is not simply fortuitous.

4 Evolution
Evolutionary biology has proved an overwhelmingly successful twentieth-century descendant of Darwin’s (1859, ????) nineteenth-century work. Consequently, the latter half of the twentieth century has seen two significant attempts to apply the theory and methodology of evolutionary biology to human behavior and cognition. The first of these was 'socio-biology' (Alexander
Advocates of socio-biology argue that much of human behavior is as it is because it exhibits ‘adaptive function’. That is, it has been beneficial to humans over evolutionary time and has therefore evolved and been retained due to natural selection. Understanding human behavior in this way has led to successful explanations of many individual and group-level behavioral phenomena, including conflict resolution, mate choice, parental investment and foraging strategies (Barrett et al., 2002; Dunbar ??; Smith and Winterhalder 1992). However, socio-biologists explicitly restricted themselves to explanations of behavior at the functional level. That is, they focused exclusively on the purpose that any given behavior serves in the life-history of an individual organism, and made no claims about the underlying causes of the adaptive behaviors thus observed. At the time socio-biology was first developed, even this limited application of evolutionary theory to human behavior was controversial enough.

The eventual extension of socio-biological ideas to the likely causes of observed behavior resulted in the development of what is termed ‘evolutionary psychology’ (Tooby and Cosmides 1992; Barkow et al. 1992; Pinker 1997, 2002). Here the focus is not on behavior per se, but on the cognitive mechanisms that underwrite it. Evolutionary psychologists argue that natural selection has equipped us with numerous evolved, domain-specific cognitive adaptations, and that these adaptations enable us as individuals to produce rapidly a variety of behaviors, which are more or less appropriate to whatever our current situation requires. Under this interpretation, what has been selected for over evolutionary time are cognitive mechanisms whose interactions can reliably generate behaviors that are positively correlated with our evolutionary fitness. And whilst these cognitive mechanisms evolved as a result of selective pressures in our distant past, they can nonetheless generate behaviors appropriate to more contemporary environments. In other words, evolution has provided us with certain innate, domain-specific faculties and mechanisms which then interact with our current beliefs in local conditions to cause our behavior. Human behavior and cognition are thus both enabled and constrained by our evolutionary history and the selective pressures that this involved.

One consequence of the evolutionary psychology perspective is that the evolved cognitive mechanisms that it proposes may generate behaviors which, whilst they were adaptive at one time in our evolutionary history, are now non-adaptive due to novel factors in our current circumstances. This is the cognitive equivalent of the well-known fact that our evolutionary drive
to consume and store fats and sugars whenever possible now underwrites the high levels of obesity which occur in many parts of the world, resulting from the easy availability of fat-and-sugar-rich diets in the modern world. We have, to put it simply, “stone-age minds in a space-aged environment” (Dunbar, ??), and consequently there is the potential for a mismatch between our cognitive capabilities and our environmental circumstances. (However, this potential mismatch has positive research implications, since empirical evidence of such a disparity will offer support for the claims of evolutionary psychologists.)

Critics often argue that the claims of evolutionary psychologists are in fact little more that post-hoc or ‘just-so’ story-telling (Gould 1997; Rose and Rose 2000). As these critics point out, reconstructions of our past environments are inherently speculative, and they claim that it is therefore a mistake to use the imagined properties of these environments as the basis for psychological theorizing. However, whilst our knowledge of past environments is indeed rather sparse in comparison to our knowledge of more contemporary circumstances, archaeologists are now providing increasing evidence of both the nature of these environments and of the kinds of cognitive behavior that (proto-)humans engaged in within them (e.g., Mithen 1996, 2000; Wynn 1991, 2000).

Moreover, despite the current sparseness of the archaeological record, there are very many properties of our human ancestors and their environments of which we can be (almost) certain. For example: they had two sexes; they chose mates; they lived in a world where self-propelled motion reliably predicted that an entity was an animal and where objects conformed to the principles of kinematic geometry; they had faces; they had color vision; they interacted with conspecifics; they were predated upon; and so on (Cosmides and Tooby, ??; Tooby and Cosmides, 1992). All of these properties can be used to generate novel hypotheses concerning the cognitive mechanisms we may now possess, and there is no a priori reason to think that these hypotheses will be any less productive than those that are evolutionarily agnostic. There may well be no reason to think that hypotheses driven by evolutionary considerations are likely to be any more productive than agnostic ones (though we doubt this), but this is at best an argument for pursuing research programs driven by both kinds of consideration, rather than for ignoring or rejecting the proposals of evolutionary psychologists.

By and large, therefore, there is broad agreement that evolutionary pressures have played some role in determining the content of our innate cognitive endowment. There is also much
healthy disagreement over the exact nature of the innate faculties and mechanisms that have evolved (Carruthers and Chamberlain 2000; Heyes and Huber 2000). Suffice to say that all the authors in this volume, and indeed most other nativists, endorse some degree of evolutionary explanation of the contents and structure of our innate cognitive endowment. And, whilst there exist significant and important differences in just how much of this content and structure can or should be thus explained, there is also a universally shared belief that it is work of precisely the kind that this volume presents that will enable us to resolve these differences.

5 Modularity
Throughout the preceding sections we have spoken of domain-specific cognition, and of the domain-specific faculties, mechanisms and structures that underwrite our cognitive abilities. We will now say a little more about this, and about the increasingly vexed issue of cognitive modularity.

That normal adult cognition consists, to some extent, in domain-specific faculties, mechanisms and structures is beyond any doubt. The sheer volume of data to this effect, derived from studies into the cognitive abilities of normal subjects, subjects who have suffered brain lesions or other trauma, and subjects with abnormal developmental profiles, can admit of no other explanation (REFS). However, the extent to which this domain specificity is indicative of cognitive modularity is much more contentious.

Fodor (1983) provides the modern origins of modular models of cognition. Fodor argues that our ‘peripheral’ cognitive systems – those involved in our senses and our language ability – are modular. What Fodor means is that these systems are innate, mandatory, fast, domain-specific, subject to characteristic patterns of development and breakdown, have proprietary inputs and shallow outputs and, most importantly for Fodor, are informationally encapsulated: their internal processes are impervious to influence from other parts of cognition. The rest of our cognition, Fodor argues, is a-modular, a fact easily demonstrated by the holistic or domain-general, i.e., unencapsulated, nature of our conceptual processing. Since this original definition, he has softened his requirements a little, but for Fodor a module remains “a computational system with a proprietary database…[where] this device operates to map its characteristic inputs onto its characteristic outputs…[and] in the course of doing so, its informational resources are restricted to what is in the proprietary database” (Fodor 2000, p. 63). For Fodor, then, modular
cognitive systems exhibit encapsulation, and central cognition remains resolutely a-modular.

Other researchers have increasingly argued otherwise (Tooby and Cosmides, 1992; Pinker, 1997; Scholl and Leslie, 1997; Carruthers, 2003). However, in so doing they have been required to adjust the definition of a module somewhat. Samuels (2000) provides an examination of such adjustments and of the most prominent and successful current notions of cognitive modularity. So too do many of the papers in this volume. We will therefore restrict ourselves here to a summary of the most salient aspects of this issue.

It is clear that cognitive faculties can theoretically exhibit domain-specificity and/or encapsulation with regard to both the information that they draw on when processing and the computational processes by which such processing is implemented. This therefore allows us to distinguish between representational modules and computational modules respectively. To a first approximation, representational modules are domain-specific bodies of data; computational modules are domain-specific processing devices. Thus, for instance, “a parser might be conceived of as a computational module that deploys the contents of a [representational] module devoted to linguistic information in order to generate syntactic and semantic representations of physical sentence forms” (Samuels 2000, p. 19). Similar points could be made for other cognitive domains.

However, we can also see that whilst these two kinds of module may (often) occur together in some given cognitive domain, it isn’t necessary that they do so. Domain specific cognitive abilities could in theory depend upon representational modules to provide domain-specific information which is then manipulated by various domain-general processes (that is, processes which don’t have the domain-specificity required for them to be considered as computational modules). Conversely, one could imagine that for some domain there exists a computational module designed to take as input the output from other modules so as to generate the representational module for that particular domain. The point to remember, therefore, is that representational modules and computational modules are modules of significantly different kinds, and that their pre-theoretic existence with regard to any given cognitive domain are mutually independent of one another.

One consequence is this distinction is that for any given domain, the contents of either or both kinds of module may be innate. Thus it behooves both nativists and their opponents to be clear about which kind or kinds of module their claims concern. One purpose of this volume, and
of the project of which it is a part, is to provide precisely the clarity required in this regard. Discussions and explanations of the extent to which cognitive development is modular must also take care to observe the representational/computational distinction, and to be equally clear on what precisely is being claimed. Again, many of the papers in this volume have this as an implicit aim.

Further adjustments to the post-Fodorian notion of modularity concern the properties required for a cognitive structure to be modular. In order for the domain-specific faculties found in central cognition to be modular, it is clearly the case that input to these faculties must be (at least partly) conceptual and that their output may be much deeper than that of peripheral systems. Also, such faculties may be more open to influence from other faculties (i.e. to be less encapsulated) than peripheral modules appear to be. However, most of Fodor’s other criteria, e.g., that such faculties are mandatory, fast (relative to other systems), domain-specific, and subject to characteristic patterns of development and breakdown, all remain. So, too, does the claim that at least some of these modules are innate. Thus central cognition can exhibit modularity in a meaningful and powerful sense, even if such modularity is not identical to that which Fodor initially proposed.

There remains, however, a question over just how modular central cognition is. Some theorists defend what is referred to as the ‘massive modularity hypothesis’ – the claim that the human mind consists (almost) entirely of cognitive modules (Sperber 1994; Tooby and Cosmides 1992). Others argue for a ‘less massive’ picture (REFS). On this view certain cognitive abilities are indeed implemented by modular central systems, e.g., our Theory of Mind (Baron-Cohen 1995; Leslie 1994). However, there is also no explicit denial of (and indeed some explicit defense of) the existence of some kind of ‘central executive’ or otherwise ‘integrative’ cognitive mechanism which is domain-general, and perhaps initially largely content-free, and which operates on the outputs of these cognitive modules. Finally, there are those who follow Fodor in steadfastly maintaining that only our peripheral systems are modular, and that the rest of our cognition is entirely a-modular.

Why do certain theorists, and particularly Fodor, resist the pull of the ‘more massive’ accounts? What underwrites Fodor’s skepticism is what he terms the ‘Abduction Problem’ (Fodor 2002). And, in fact, this problem is an instance of the more general question of how an explanation of human cognition in terms of domain-specific cognitive modules can be squared
with the apparently domain-general flexibility of human cognition. This ‘Flexibility Problem’ lies, in various disguises, at the heart of a number of worries, suggestions and theories of many theorists who are nonetheless inclined to different degrees of ‘more massive’ hypotheses. Moreover, it is clearly a problem that needs to be solved if anything more than a moderately modular conception of cognition is correct. However, since some of the chapters in this book deal explicitly with this question (Sperber ch. 4; Carruthers ch. 5; Samuels ch. 7), further discussion can be put to one side. Suffice it to say that many of the authors in this volume endorse some degree of central systems modularity, while nonetheless healthily disagreeing over the extent to which such modularity will ultimately provide the whole story.

Research in philosophy, psychology, anthropology and evolutionary theory thus all offer support for nativist theorizing. However, whilst we have emphasized the connections and similarities between the results from these disciplines, it is important to remember that such connections aren’t necessary ones. That is, one can be a nativist but also reject (many) evolutionary explanations of the innate structures we possess. Similarly, one can accept varying degrees and definitions of cognitive modularity whilst remaining well within the nativist camp. Cognitive science is a multidisciplinary enterprise, and the results of each part of this enterprise are important and defensible independently of the whole. However, as with all scientific inquiry, when evidence from disparate sources converges one should be inclined to see this as offering increasing support for the convergent view. We believe that this volume provides evidence of just such a convergence, and what we hope is that previously skeptical readers will become as inclined as we are to support the resultant convergent view: that nativist theorizing offers the best understanding of our cognitive abilities, and thus of our place in the natural world.

6 A guide through this volume

In the latter half of the twentieth century, then, nativism has gained increasing support from theoretical and empirical work in philosophy, psychology, linguistics, anthropology, evolutionary theory and other cognitive sciences. This work provides the background for the papers in this volume, and also for the larger project of which all three volumes are a part. We will now say a few words about each of the chapters constituting this first volume, highlighting various recurring themes and issues.
6.1 Architecture

The essays in part one all focus on architectural issues, with many of them discussing the question of massive modularity and the problems that the latter view has in accounting for cognitive flexibility.

Marcus (ch. 2) examines an apparent tension created by recent research on neurological development and genetics, on the one hand, and cognitive development, on the other. Work on brain development shows it to be surprisingly flexible, and the human genome appears far too small to specify brain structure to any fine degree of detail, in any case. But on the other hand, work on cognitive development shows that many aspects of cognition are partly or largely pre-specified (see sections 1-4 above). Marcus reviews a number of ways in which the apparent tension between these facts can be resolved. He also presents several models and computer simulations of the ways in which genes code for neural development, showing how such a resolution can be achieved in practice.

Scholl (ch. 3), too, discusses and resolves an apparent tension: this time between innate pre-specification and learning. He focuses on aspects of the human visual system as his key example, showing how the processes involved can be understood in terms of a form of Bayesian inference, in which some aspects are innate and some set by experience. He suggests that this sort of result may generalize to central cognitive systems.

Our first discussion of the flexibility problem for massive modularity is provided by Sperber (ch. 4). He builds on his earlier work on Relevance Theory in linguistics (Sperber and Wilson, 1986/1995) and argues here that massively modular architectures exhibit flexibility largely as a result of the successful application of differential resource allocations between modules. It is thus the cognitive system as a whole that exhibits flexibility, rather than any particular sub-system within it.

Carruthers (ch. 5), too, addresses the flexibility problem, sketching an account in which various cognitive modules combine to provide (the appearance of) domain-general thinking. In particular, he argues that various specific properties of a modular language faculty, in combination with the capacity for imagination and for the generation of cycles of cognitive activity, can enable humans to integrate information across cognitive domains without the need for a distinct, domain-general, central processor.

Shusterman and Spelke (ch. 6), too, defend the view that it is the language faculty that
permits information from different modular domains to be combined. They focus on the integration of geometric and object-property information in particular. Building on previous experimental results, they discuss their recent language training study which appears to demonstrate a causal role for language in enabling the integration of information across these two domains.

Samuels (ch. 7) provides a critical examination of one set of arguments that are thought to support massive modularity, which turn on the claim that modular mental organization is required for cognitive processes to be \textit{computationally tractable}. While insisting that much in cognition must be innately specified, he doubts whether this particular claim (and hence the massively modular version of nativism that it supports) can be adequately defended.

Simpson (ch. 8) attempts to sketch the outlines of what a reasonable form of nativism might look like. He is particularly concerned that the sort of view he develops shouldn’t be confused with the set of more extreme nativist claims that are often attributed to nativists by their opponents.

6.2 Language and Concepts

The essays in part two focus on a variety of nativist claims relating to language and concept acquisition.

Atran (ch. 9) draws a distinction between two kinds of adaptationist methodology. \textit{Strong} adaptationism holds that complex design is best explained by task-specific adaptations to particular ancestral environments; whereas \textit{weak} adaptationism claims that we should not assume that complex design is the result of such narrowly determined task- or niche-specific evolutionary pressures in the absence of substantial corroborating evidence. Atran argues that in certain cognitive domains, particularly folk-biology, strong adaptationism has proved extremely useful for advancing research. But in other domains, particularly language, weak adaptationism has proved the better strategy.

Baker (ch. 10) focuses on two different views of \textit{universal grammar} (one innately endowed component of the language faculty). Most linguists assume that universal grammar is \textit{under-specified} – providing us with an incomplete grammar to be elaborated by learning. But the alternative (defended by Chomsky) is that it is \textit{over-specified} – providing us with a full range of possible grammars from which we select one on the basis of environmental input. Under-
specification is now the dominant view in the developmental sciences, and is often treated as the null hypothesis on grounds of greater possibility, parsimony and simplicity. Baker takes issue with each of these grounds, and concludes that we have in fact no reason to prefer under-specification to over-specification in the context of linguistic development.

Crain et al. (ch. 11) present detailed empirical work on several aspects of children’s linguistic performance, focusing in particular on evidence that even two-year-old children understand that the meanings of Determiners are ‘conservative’, that the meaning of natural language disjunction is ‘inclusive-or’, and that the structural notion of ‘c-command’ governs a range of linguistic phenomena. They employ this and other work to defend three related versions of the argument from the poverty of the stimulus, each of which strongly supports the existence of an innate language faculty

Associationist models of cognitive development come under fire from Gelman (ch. 12). She focuses on the development of naming in young children – the process by which young children learn or otherwise construct the meanings of words and concepts. She presents empirical evidence that by the age of 30 months children have an ‘insight’ into both essentialism and the generic / non-generic distinction, and that these insights are neither directly taught during development nor reducible to information in the child’s developmental environment.

Laurence and Margolis (ch. 13) critically survey the burgeoning literature on the innate bases of our arithmetical concepts and abilities, and examine how these capacities might fit into an account of the development of positive integer representations. They also connect work on arithmetic with research on conceptual development in general, and discuss how these topics relate to, and impact upon, both theoretical accounts of the nature of concepts and Fodor’s (????) arguments against the possibility of certain kinds of representational enrichment.

6.3 Theory of Mind
The essays in part three focus on innateness claims relating to our ability to attribute mental states to one another, which generally goes under the name of ‘theory of mind’.

Povinelli et al. (ch, 14) argue that the evolution of theory of mind in humans opened up much wider opportunities for parent-offspring conflict than had previously been available. In particular, they argue that human infants might have become increasingly skilled at exploiting adults’ capacity for theory of mind, even when the infants themselves have yet to develop such a
capacity. By being innately disposed to exhibit certain social behaviors like smiling, pointing and gaze following, which increase adult care-givers’ *erroneous* attributions of higher-level or adult-like cognitive abilities to the infant, infants could induce care-givers to provide more and/or better care than they would otherwise have done.

Johnson (ch. 15) provides evidence that very young infants (c.12-14 months) distinguish agents on the basis of a number of cues, including conversation-like patterns of interaction with other agents. She also provides evidence that infants conceive of agents as possessing mental states like desire. *Inter alia* she takes up Povinelli *et al.*’s challenge, arguing that the data support her own interpretation better than the claimed existence of a set of ‘releasers’ for innate, but ‘uncomprehending’ social behaviors.

Tager-Flusberg (ch. 16) considers the role played by subjects with *neuro-developmental disorders* in our investigations of cognitive development. She begins by presenting an overview of the methodological reasons for and against using subjects with certain neuro-developmental disorders (e.g., autism and Williams syndrome) to inform debates about normal and abnormal cognitive architecture. She then argues that studies of subjects with these kinds of disorders do indeed have much to offer, and that in fact many useful results have been obtained from previous studies, especially pertaining to the innate basis of theory of mind.

### 6.4 Motivation

The essays in part four all focus on claims about the innate basis of human motivational systems.

Buss and Duntley (ch. 17) apply evolutionary theorizing to a hitherto under-explored domain: *homicide*. To provide a comprehensive explanation of homicide, they propose the existence of suite of *evolved homicide mechanisms* (many of which are motivational or emotional in nature). These are cognitive mechanisms shaped over evolutionary time by selective pressures across a range of adaptive problems to which homicide might often enough have provided the solution. The especially high homicide rates in hunter-gatherer societies suggests that there would have been powerful selective pressures in this domain.

Tooby and Cosmides (ch. 18) ask why it is that, despite the power of poverty of stimulus arguments, many cognitive and behavioral scientists have still not been forced to recognize the truth of nativism. They suggest that this is primarily because the domains in which these arguments have hitherto been applied, e.g., language or naïve-physics, are all ones in which the
knowledge that children acquire is objectively present in their environment. So the possibility always remains open that children could somehow be acquiring this knowledge from the environment through general learning. In the case of motivation, however, this last bastion of resistance is unavailable, since desires don’t serve to represent information which is already present in the environment. (The point of desire is to change the world, not to represent it.) The closest thing to a knock-down argument for nativism can therefore be developed in respect of innate motivational systems, Tooby and Cosmides argue.

Greene (ch. 19) and Nichols (ch. 20) both turn to consider what might be innate in the human capacity for moral thinking and feeling. Greene reviews a variety of sources of evidence for an innate moral faculty, before presenting brain-imaging data in support of the same conclusion. In his view, our moral thought is the product of an interaction between some ‘gut-reaction’ moral emotions (many of which might be shared with our primate cousins) and our capacity for abstract reflection. Nichols focuses rather on the question of what marks off moral norms from rules of other kinds, such as those of etiquette. He argues that what is distinctive of morality is the attachment to a norm of certain sorts of innate emotional reaction (including disgust).

6 Conclusion

These are exciting times for the study of cognition. An unprecedented volume of work is being undertaken, and an unparalleled degree of interdisciplinary discourse is taking place. And as these efforts continue, support for nativist theorizing is rapidly increasing. This volume shows how widespread this support now is, with many philosophers, psychologists, linguists, anthropologists, primatologists, archaeologists and other cognitive scientists all converging on nativist models of cognition and cognitive development. However, this volume also shows how much more work is still to be done, and points to a number of new directions for future research. We believe, therefore, that this book provides a substantial contribution to our understanding of cognition and of the nature of ourselves.

References