



Language, Biology and Cognition

A Critical Perspective

Prakash Mondal

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*To my Khuki,
who always beams with curiosity*

Preface

The biological foundations of language reflect assumptions about the way language relates to biology. Human language has a biological basis more perspicuously because human language is acquired by humans but not by any other species known on the planet. Additionally, the structure of the mental organization is significantly changed when language is acquired by humans. In this sense, language is a special property of the human cognitive system. This suggests that language in virtue of being supported by the biological substrate organizes the structure of mental organization in a dramatic way. Thus, language, biology, and linguistic cognition, the form of cognition that cannot exist minus language, appear to be connected to each other in non-trivial ways. Biological structures including our genetic materials and processes are thus supposed to afford the grounding for human language and the form of cognition it gives rise to. The role of biology can be apprehended not just in the acquisition of language but also in neural processing of language and language disorders. The goal of this book is to offer a critical perspective on the relationship between language, the form of cognition, and biology in order to see whether this can provide consequential insights into the nature of human language itself. While it seems clear

that the biological foundations of language help understand language from a certain vantage point, the assumptions that peddle the theoretical and empirical conceptions of the biological basis of language are not really as convincing as they appear to be. In many cases, they are in fact unfounded on certain clear grounds. Once these grounds are articulated, it may turn out that there is far more complexity to human language than can be grasped through biological constraints and principles which have an undeniable impact on the emergence of language as a capacity, though. This presupposes that the role of biology is limited to certain aspects or dimensions of language that are independent of, and perhaps also segregated from, other facets of human language such as its representational properties (which make up cognitive resources) and also the logical complexities of language. If this is indeed the case, as this book argues at length, the overenthusiasm associated with theories and frameworks of the biological basis of language is misplaced and hence needs to be contained.

As a matter of fact, with the rise of biolinguistics as a field of inquiry marrying linguistics with biology we seem to have come closer to a deep understanding of language and linguistic cognition. It promises to offer an understanding of the cognitive system of language known as 'the faculty of language' as a biologically instantiated and constrained system. Thus, the logical properties attributed to language or to the operations on linguistic constructions within the language faculty are actually biological properties described at some level of abstraction. There is no case of derivation or reduction of language to biological structures. Although the Minimalist model of the language faculty bolsters, and is also supposed to facilitate, this inquiry, this is by no means restricted to those adhering to the Minimalist model of language. Hence, on the other hand investigations into the biological basis of language in many other quarters of neuroscience, linguistics, and psychology proceed on the assumption that the nature of linguistic structures can be traced to certain biological structures and/or processes. Thus, aspects of cognitive structures for language are supposed to be rooted in biological structures and/or processes. Compelling though the logic of such investigations may seem, the fallacies in the reasoning deployed in such investigations may not become immediately apparent. This is exactly

the role this book is intended to play. In a nutshell, this book argues that relations of neurobiological and genetic instantiation between language and the underlying biological substrate are, to all intents and purposes, irrelevant to understanding the fabric of language and linguistic cognition. Crucially, this book aims to offer an antidote to the current thinking embracing ‘biologism’ in linguistic sciences.

I’ve attempted to cover as much of the interdisciplinary territory on language–biology relations as has been possible, hoping to present in the book only the most representative cases of what have been made subject to critical scrutiny. If anything has been missed, the fault lies with me. In fact, readers are encouraged to find out linkages that have been missed. The critique articulated in the book first fleshes out the fallacies in current thinking on language–biology relations and then proposes a subtly different way of looking at the nature and form of language. Readers are asked to assiduously pass through this transition in order that they can relish the ideas to come ahead.

I invite linguists of all brands, philosophers of mind, psychologists, and biologists, especially neuroscientists, to take what they think they can imbibe from the book. Besides, anyone serious about understanding language and how it has got something to do with biology is also welcome. I wish I could have written this book for more audiences, but any group that I may have excluded would recognize that I would then have ended up writing a different book altogether!

Hyderabad, India
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Prakash Mondal

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1

Introduction

The intrinsic nature of language is such that it permits languages to be acquired by both children and adults, to be represented in the brain/mind and also to be used by human beings who achieve linguistic competence within certain biological constraints that modulate or govern the learning and processing of language. Thus, the biological grounding of language makes it possible for the abstract system of language to be instantiated in human beings who then press into service the language capacity to accomplish various actions such as thinking, communicating, conceiving which partake of, exploit and interface with a host of cognitive capacities. From this perspective, it seems reasonable to believe that the biological basis of the language capacity offers insights into the nature of cognitive capacities such as reasoning, learning, memorization, sensory-perceptual conceptualization only insofar as the language capacity is supposed to make transparent many aspects of cognitive structures and mechanisms that constitute the cognitive substrate. The character of the human mind seems to be visible from the biological lens of language once we assume that the nature and form of cognitive structures and mechanisms can be deduced from the biologically grounded connection between the language capacity and other cognitive capacities.

Neurological and genetic studies on the relations between the language capacity and other cognitive capacities such as vision, memory, non-visual sensory perception, learning, reasoning, motor abilities, emotion can thus be believed to shed light on the texture of our cognitive makeup. It may be noted that such studies are supported by the supposition that the biological basis of language itself meshes well with studies on the relationship between language and cognitive capacities and/or processes. From this, it appears that biology acts as a kind of bridge that relates language to cognition given the presupposition that the path from language to cognition cannot be traversed directly.

The aim of this book is to show that the transitions from biology to language and then from language to cognition are not only hard but also invalid on many grounds. This may eventually show that language is far more closely coupled to cognition than is usually thought. Thus the present book will argue that biology cannot be the bridge that relates language to cognition or connects cognition to language because language *in itself* constitutes the system that links to cognition directly without requiring any immediate grounding relation that biology may establish. That is, the purpose of this book is to demonstrate that cognition is not transparent to biology, contrary to mainstream thinking on the relationship between biology and cognition. If cognition is transparent to something, it must be language. This is not, however, to deny that cognition—or language, for that matter—has a grounding in biology, or that cognition is a biological function that modulates many physiological-chemical processes inside organisms (Lyon 2006; Tommasi et al. 2009). In fact, many interactions with the environment that constrain learning, perception, memory, reasoning, action, etc. are instantiated in the physiological and biochemical processes within our bodies. But the crucial point to be noted is that the physical instantiation of cognition in our biological substrate is not sufficient for an understanding of what cognition is, or of how it really works. In other words, just because we understand how X is instantiated in Y, we may not come to understand X. From the fact that we understand how X is instantiated in Y it does not follow that we also understand X. Plus the direction of explanation may not simply go from the physical instantiation of cognition in our biology to an understanding of cognition itself.

The argument to be advanced in the present book is that the direction of explanation instead goes from cognition *as revealed through language* to biology. Thus, biology cannot be the appropriate medium that can give us a purchase on the problem of understanding the intrinsic nature and form of cognition with a special reference to natural language. Language being the *sine qua non* of cognitive capabilities or faculties can be the right link which can take us inside the interior space of our cognition. In this connection, it is also of particular concern to emphasize that the transition from biology to cognition is barely understood, while the path from language to cognition is in a much better shape for an exploration of the issue of how language–cognition relations can help penetrate the realm of cognition by bypassing the instantiation relation with reference to biology.

1.1 On the Notions of Language vis-a-vis Biology

It is necessary to appreciate that language is a very tricky word: some people use it to mean the faculty of language (the system of grammar that is instantiated as a modular system as part of the human mind), or linguistic competence (the competence in language X, for instance), or as a collective term for languages (as in ‘Bengali is my [first] language’). It is thus worthwhile to note that these different entities do not all relate to biology in the same way. When one thinks of language (in the sense of the language faculty) as a critical component of human cognition, language is conceived of as a mental organ instantiated in the cognitive substrate just as the stomach or liver is instantiated in the human digestive system (Chomsky 2000). This conception of language invariably inherits a relationship with biology in the sense that language is now a component of the neural architecture whose properties can be discovered and studied only by relating to the underlying principles governing the development, maturation, and functions of the neurobiological infrastructure. Hence a unification of the cognitive sciences with the biological sciences is often sought on the grounds that many questions

about the grounding or implementation of language within the biological substrate can be faithfully answered as problems in the unification become more and more tractable. Needless to say, this conception of language presupposes an integral or inherent relationship between language and biology since language is itself a biological entity on this view. Now if we turn to another conception of language under which language is thought of as linguistic competence (in a given language), a full-blown linguistic system that has been internalized by a human being is what is at issue. Language on this conception *can* be a biological entity, but this implication is not necessary, for if language equates to linguistic competence, the competence is true of a given language and may well be internalized as a cultural knowledge base from the relevant linguistic community just like rituals are internalized as a system by a human being from the surrounding cultural milieu. Although it is certainly the case that the system that constitutes linguistic competence in a certain language is psychologically represented, it does not follow that the competence can itself be a biological entity. But, of course, if the mature stabilized system that constitutes linguistic competence is thought to have passed through stages of biological growth only to be in the current state, the linguistic competence under this condition can be a biological entity. In fact, this possibility is indeed one such case that is endorsed by Generative Grammar, as the final state of the developing language faculty is characterized as linguistic competence (Chomsky 2000). In short, language recognized as the linguistic competence does not necessarily import an inherent relationship with biology.

We now focus on the third conception of language on which language is taken to be an extra-biological entity—an entity that is collectively realized as a system that can be studied and analyzed. Notably, on this conception language is instantiated not in an individual, but located in the intersubjective collective space of a linguistic community, books, codifying resources, etc. Here language is a sociocultural property whose resources are distributed over a loosely connected range of entities some of which are even inanimate or inert entities. Taken in this sense, language is grounded in the outer world where the symbolic properties of language are shared among groups of human beings with a diverse ensemble of things serving to function as props for the codification,

preservation, and entrenchment of linguistic forms. Language in this sense is remotely related to the biological substrate because the containment within the individual is no longer viable as language becomes a supra-individual entity. In simpler terms, when we say that English has the rule X but not the rule Y, we are making statements about an entity which is not an individual property per se. Biology has got nothing to do with this. But note that one may attempt to draw the biological substance into the ambit of the shared knowledge of language as it sits in the intersubjective realm, by maintaining that the individual knowledge of language is sharable or transmittable only if it is biologically instantiated in a human being (see Mondal 2012). That is, the property of being transmittable is inherited from the property of individual instantiation. Nevertheless, it does not follow that the shared system in itself is a biological property or entity even though the property of sharing obtains when language as a biological entity takes the grounding within the individual. Therefore, the connection between biological instantiation and language as a cultural resource remains tenuous.

Against this backdrop, the current book aims to state something different about the notion of language to be employed with reference to its relationship with biology. The conception of language to be employed in the present context will encompass the first two notions of language (excluding the third) in ways that make it possible to distinguish between the inherently biological conception of language on the one hand and the potential biological conception of language on the other. The idea to be advanced has been largely taken from Katz and Postal (1991), Postal (2003), Mondal (2014), and Levine (2018). It needs to be clarified that these works essentially advance the claim that biological relations are ultimately irrelevant to understanding the basic texture of human language. But it is worthwhile to note in this context that Katz and Postal (1991) and also Postal (2003) essentially support a *realist* view of language which holds that languages or linguistic objects are abstractions, whereas the present work favors a non-cognitivist¹ conceptualist

¹A cognitivist view usually imports an information processing functionalist perspective on the nature of the mind which a non-cognitivist view resists (see Mandler 2002).

view of language on which linguistic structures are themselves cognitive structures. In this sense, it appears that this conception accords well with the central tenets of Cognitive Linguistics (Lakoff 1987; Langacker 1987, 1999), but the crucial difference here is that the present work adopts and refines a *split ontology* of language on which language can be situated in two dimensions—the dimension of psychological or neurobiological instantiation and the dimension of symbolic abstraction. In the case of the former dimension, language or the linguistic capacity is essentially an aspect of the mind/brain and hence a system with finite resources (words, rules, constraints, etc.). But, in terms of the latter dimension, language can be projected into the realm of abstractions where infinite levels of expansion of linguistic forms, abstractions that may have no anchoring in the physical world (such as logical properties and relations found in language), universal categories, etc. can exist. These two dimensions are independent of each other and yet are somehow connected because of the mind's intentional projection of a finite system into a domain of abstractions where infinite extensions are always possible. In simpler terms, when we say that a language can have a sentence of length 10^{10} , we are not, of course, making any claim about the actual working of language on the dimension of psychological or neurobiological instantiation. Rather, we are saying that the given language allows for such an abstract generalization if a different configuration of psychological or neurobiological instantiation were available to humans with far greater cognitive resources. But this leap to this level of abstraction obtains via the mental projection. An analogy from mathematics will be apt here. For instance, even though there are psychological/neurobiological constraints on the mental processing of numbers (the length of numbers factored in) and their calculations (the exact count of numbers manipulated at a time factored in), there is nothing that prevents the human mind equipped with the knowledge of mathematics from concluding, on the basis of the fact that 10 is a natural number, that 10^{10} is also a natural number. Thus, the realm of abstractions where language operates as a pure axiomatic system is distinct from the level of psychological or neurobiological instantiation of language. That this distinction is often confounded by many scholars at the cross section of linguistics and (neuro)biology can be shown by the following textual references. What the current book calls into question is eloquently

described by Salvador E. Luria (1973), one of the earliest proponents of the study of biological foundations of natural language.

To the biologist, it makes eminent sense to think that, *as for language structures, so also for logical structures*, there exist in the brain network some patterns of connections that are genetically determined and have been selected by evolution as effective instruments for dealing with the events of life. (emphasis added, p. 141)

In a similar vein, Brown and Hagoort (2000) state the following by offering certain considerations that they think should be part of accepted common knowledge.

... a great deal of what we know about the structure and functioning of the language system has come from research that has essentially ignored the fact that *language is seated in the brain*. (emphasis added, p. 3)

Likewise, in thinking that a theory of language must be constrained by both what linguistic investigations reveal about the form of language and what neurolinguistic explorations tell us about the brain representation of language, Ingram (2007) states the following.

There are many arguments, but no compelling reasons, why the organization of communication abilities in the brain should be isomorphic with any particular linguistic theory of language structure, unless, of course, *the theory in question were specifically formulated to take account of human brain structure and function*. (emphasis added, p. 41)

This presupposes that taking into consideration the brain representation of linguistic structures is a desideratum to be met for there to be an adequate theory of linguistic structures. There is another revealing passage from Bickerton (2014a) quoted below.

... there could obviously be two ways of describing syntax. One would provide maximal coverage of the empirical data while simultaneously achieving maximal levels of elegance, simplicity, and explanatory power. The other would adhere, as far as possible, to a literal description of what

the brain actually does in order to produce sentences. Would those two descriptions be isomorphic? Not necessarily. The first, constrained solely by the linguistic data, could legitimately use whatever devices might help it achieve its goals of simplicity, elegance, and comprehensiveness, regardless of how its solutions related to what brains actually do. *Should* those two descriptions be isomorphic? Obviously yes. To the extent that they differed, one would simply be wrong, and if they prove instead to be isomorphic, one is redundant. But which is redundant, the knowledge model or the mechanistic model? There can be no question that the former is redundant, since without the latter, there would be nothing to describe. (pp. 75–76, author’s own emphasis)

In the context of a discussion on the invalidity and uselessness of the system of linguistic competence (in the model of Generative Grammar) pitted against a neural processing-based account of language, Bickerton considers it necessary to have an isomorphism between a descriptive account of the neurobiology of grammar and the descriptive system of grammar. Irrespective of whether or not the system of linguistic competence in the model of Generative Grammar is dispensable, it seems clear that Bickerton thinks that a brain-based account of language must guide the construction of a description of linguistic structures that is cognitively meaningful and explanatory.

Pulvermüller (2018) also states what in its spirit chimes with the views of the scholars cited above.

Fortunately, recent neuroscience research has provided important insights into the specific features of human brain anatomy and function, which open new perspectives on answering the big question about the specificity of human cognition by mechanisms rooted in human neurobiology. However, to achieve this, it is necessary to spell out and understand *the mechanistic relationship between language and communication and their basis in neurobiological structure and function.* (emphasis added, p. 1)

Overall, this conveys the impression that the grounding of language in the biological substrate *must* be part of the understanding of the form of natural language. This is exactly what confounds the distinction between the abstract form of natural language and the neurobiological instantiation of language.

The claim to be advanced and defended throughout the current book is that the logical texture of the axiomatic system of language in the dimension of symbolic abstraction reveals many significant generalizations about the nature and form of linguistic cognition. The dimension of neurobiological instantiation is ultimately irrelevant to an understanding of linguistic cognition when looked through the dimension of neural instantiation. The nature and form of linguistic cognition when looked through the dimension of neural instantiation (which is natural because linguistic cognition is a facet of language taken to be a system that is psychologically or neurobiologically instantiated) is something that is pointless, primarily because linguistic cognition is rendered reference-less in lacking what it is constituted of or what it consists in. But, if linguistic cognition is looked through the dimension of symbolic abstraction, many abstract properties of language as a symbolic system render themselves amenable to the unfolding of their inherent cognitive contents. These symbolic properties of natural language(s) do not reside in biological entities or structures because they arise only when the brain extends to connect to the outer world consisting of language users, objects, events, processes, etc., thereby providing the scaffolding for such otherwise biologically meaningless symbolic patterns—which is something along the line of thinking developed in Northoff (2018). The implicit understanding here is that the dimension of neurobiological instantiation is located at a lower scale of realization than the dimension of symbolic abstraction. The central point of the claim put forward here is that reaching the realm of (linguistic) cognition through the higher scale of symbolic abstraction is to be preferred to an entry into the realm of (linguistic) cognition through the lower scale of neurobiological instantiation. It needs to be stressed that the claim here is not simply that there are many aspects of language and cognition that we cannot understand through biology, because this will be trivial on the one hand and on the other hand one can always insist that this is not due to any fault in biological studies or even in biology. Besides, from this it does not also follow that biological studies are not or cannot be explanatory. Although this is largely on the mark, this will miss the point raised here. It is certainly the case that biological studies are explanatory, and that is why we have explanations of various processes

of life, diseases, instinctive behaviors, functions of biological organs, etc. But these explanatory accounts hold only within the domain of biological functions, processes, and entities. Significantly, the cognitive constituents of linguistic forms/structures are such that they are not constituted of biological substance the way bird feathers or cells, for example, are. A biological description, let alone an explanation, of the cognitive constituents of linguistic forms/structures is not actually close to the mark any more than a linguistic account of cell differentiation is biologically close to the mark. Be that as it may, biological accounts in many ways remain valid for language but only when they concern the *envelope* or contours of language as a cognitive system (in the first sense mentioned right at the beginning of this section). That is, biological accounts of the acquisition, development, and evolution of language remain restricted to the external manifestation of the cognitive system of language as a whole—its internal parts, constituents, and structures are inaccessible to biological descriptions. Nor are the internal parts, constituents, and structures of language to be captured by biological processes. Thus, for instance, no one has yet furnished (or perhaps will never be able to furnish) a biologically grounded description of the mental structuring of noun phrases. That is to say that even though biological accounts of language can reach up to the scale or dimension of psychological or neurobiological instantiation, they touch and tap *only* the outer manifestation of the capacity of language, which is after all an expression of the capacity allowing for the structural patterns in language, *but not* what resides inside the envelope. This point will be fleshed out in greater detail as we proceed. As notions of level or scale have appeared in our discussion here, there are many associated concepts structured around them that need to be clarified.

1.2 Linguistic Cognition and the Underlying Biological Substrate

Before we elaborate on the question of how language as a cognitive system can furnish entry into the realm of cognition, we think it necessary to explicate the ways in which cognition as reflected within and through

language—the form of cognition that is constituted by language—can be reckoned to be instantiated in the biological substrate, and also to determine how this instantiation relation turns out to be inadequate on both logical and cognitive grounds. There are in fact two general ways in which cognition as manifested through language can be deemed to be instantiated in the biological substrate. The first route is the genetic level at which the basic biological layout of organisms along with their structures is specified, and the second route is the level of neural organization from which cognition is *naturally* supposed to emerge.² Now at this juncture, it is vital to recognize that the genetic level and the level of neural organization are part of a heterogeneous lattice or hierarchy of levels cutting across systems of molecular, cellular, and tissue-level organizations, neural networks, and whole neural structures/organs. Given that the genetic level and the level of neural organization are levels of description/explanation of a vastly complex scheme having interconnected part–whole relations across levels, it seems also necessary to understand why these two levels can be regarded as the crucial levels that compose the instantiation relation between biology and cognition.

First, the genetic level is, to all intents and purposes, the lowermost level in the heterogeneous lattice/hierarchy of levels appropriate to the biological instantiation of cognition, primarily because the physical level of atoms and other elementary particles that underlies the genetic level is not fine-grained enough for the expression of distinctions and descriptions that make cognition viable. In other words, the physical level underlying the genetic level is not tuned to what variegated facets of cognition constitute and exhibit. On the other hand, the level of neural organization can be considered to be the level that supports the cognitive infrastructure. Since it is situated exactly below the level at which the cognitive machinery works, there is good reason to believe that the level of neural organization can serve to *directly* implement within its ambit the instantiation relation between biology and cognition. Second, even if intermediate levels that can be thought to be

²Once cognition is shown to be related to, and ultimately anchored in, the biological substrate, it can be believed that cognition is thus naturalized.

interposed between the genetic level and the level of neural organization may also look like good candidates relevant to the biological instantiation of the cognitive machinery, these levels do not in themselves suffice to provide an adequate description of the level of cognition since these levels do not have the right (bio)logical structure that can be said to underpin cognitive structures, mechanisms, and processes. Consider, for example, levels of molecular, cellular, and tissue-level organizations. These levels do not possess the appropriate locus of description or explanation for cognitive structures, mechanisms, and processes, in that cognitive functions or capacities and mechanisms are not after all directly installed in molecules, cells, and tissues taken in isolation even if they co-compose the cognitive superstructure. Besides, the genetic level forming the basis of these intermediate levels furnishes all the necessary ingredients as well as the whole infrastructure for the emergence of these intermediate levels, thereby rendering redundant any attempt to trace the appearance of the cognitive superstructure to levels lower than the level of neural organization. To be clearer, it needs to be stressed that the level of neural organization must be construed in terms of individual neurons, neuronal assemblies, neural networks, and whole neural structures/organs. This construal of the level of neural organization in fact renders gratuitous the search for additional levels appropriate to the biological implementation of cognition.

We shall first explore how cognition as reflected through language can be instantiated in our genome. If the instantiation of cognition in the biological substrate is via the genetic level, it seems reasonable to hold that the genetic level could be said to support and thus underpin the formal structure of cognitive representations, processes, mechanisms, and interactions as mediated by language. This looks, on the face of it, like a reasonable way of having linguistic cognition implemented in the biological substrate at the lowest level within the hierarchy of descriptions relevant to the biological implementation of cognition. However, closer inspection reveals that this is illusory for various reasons. First of all, various kinds of cognitive structures that can be bootstrapped from natural language constructions cannot be couched at the genetic level—at least in terms that make them amenable to their

characterization as cognitive structures. Let's take some simple and fairly well-known cases that illustrate quite well what is at stake.

- (1) What do you think you could have done__ to alleviate the poverty and squalor in this town?
- (2) You are the only living soul I can tell my secret to__.
- (3) The more I think of her, the less I feel interest in things around myself.
- (4) Never did he in his wildest dreams think that he would be awarded the coveted prize.
- (5) They cannot in any event take this for granted.

All these sentences mean quite different things but what is more crucial in this context is that their structural differences are indicative of certain significant cognitive distinctions that they give rise to. Additionally, they reveal a number of disparate constructional generalizations which can be conceptualized as constraints on classes of linguistic signs and their components allowing for different degrees of granularity along the lines of Sign-Based Construction Grammar (Sag et al. 2012; see also Goldberg 2006, 2019). Significantly, these sentences uncover certain essentially related fundamental patterns of cognitive structures that can be bootstrapped or derived from natural language. The sentences in (1–2) are clear-cut cases of form-meaning divergence in natural language. That is, the relevant linguistic form appears in a place where it is not interpreted to mean what it means. Thus, for example, the *Wh*-expression 'what' is supposed to be interpreted in the gap shown in (1), and likewise, the noun phrase 'the living soul' is interpreted not where it appears but rather in the gap right after 'to.' These cases show that the cognitive structures that may underlie such linguistic structures can actually contain more than one representation of the same item which correspond, and can thus be linked, to one another. From the example in (3), one can infer that certain cognitive structures can correlate two representations by comparing and contrasting them with one another, as is evident in the presence of 'the more' and 'the less' in two different clauses. From (4) one can reasonably assume that some cognitive structures must have enriched representations that allow a whole