

induced desorption and resonance Raman aspects. A. R. P. Rau (Louisiana State Univ., Baton Rouge, USA) expounded the intricacies involved in solving time-dependent operator equations.

K. Miyazaki (Kyoto Univ., Japan) presented the results of his experimental investigations on high harmonic generation from atoms and molecules in intense laser fields and pointed out the discrepancies between experiment and theory that remain to be explained. T. Seideman (NRC, Canada) discussed the theory of shaping, steering and squeezing molecular beams with light. H. Shimomaru (Tokyo Metropolitan Univ., Japan) drew similarities in his talk between interaction of intense laser fields with molecules and collisions involving molecules and fast beams of highly-charged ions. J. H. Sanderson (Univ. College London, UK) gave an account of a new set of experiments being carried out on molecular ionization in femtosecond laser fields.

The grand finale of the extensive talks and intensive discussions on intense laser fields and their interaction with matter was in the form of yet another talk by S. L. Chin, but this time, on

investigating the propagation and filamentation of Ti-sapphire laser pulses in the atmosphere with the aid of colourful slides. That all these investigations are not confined to the realm of ivory towers but are very much down to earth (and linking earth to the heavens) was emphasized by Chin by pointing out to their potential utilization in detection of chemical and biological molecules in the atmosphere and in controlling lightning.

It used to be said that India was lagging behind the West by 10 years in Science and Technology. This gap has been reduced considerably in recent times, thanks to improvements in telecommunication through phone, fax and more importantly, email. Still, if we want to be equal partners in the global playing field, there is need for instant exchange of ideas. This is where meetings and conferences play an important role. Because that is where we learn what *is* happening and not what happened some time back (as reported in the refereed Journals) and also some of the nitty-grittys which will probably never be spelt out in written form. With the dollar-rupee conversion rate being

so high, it is becoming more and more difficult for Indians to travel abroad for meetings. Even when they do, they do so in small numbers. One way out of the situation is to organize international meetings in India and bring together young Indian researchers to interact with the active workers from all over the world.

Deepak Mathur and his colleagues must be congratulated for their organizing this timely discussion meeting and choosing the right ambience for academic discussions. All the participants, regardless of their status (from the junior-most research scholar to the most eminent practitioner in the field) stayed in the same hotel, dined and debated together, thus getting the most out of the Discussion Meeting. As the participants were checking out of the hotel, it was clear from their faces that it was time (and money and effort) well spent. They were richer with ideas and now could go back to their labs to pursue them further.

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## RESEARCH NEWS

# Another brick in the Tower of Babel: The search for an universal language

Anindya Sinha

'And the whole earth was of one language, and of one speech. And it came to pass, as they journeyed from the east, that they found a plain in the land of Shinar, and they dwelt there. And they said to one another, Go to, let us make brick, and burn them thoroughly. And they had brick for stone, and slime had they for mortar. And they said, Go to, let us build us a city and a tower, whose top may reach unto heaven; and let us make us a name, lest we be scattered abroad upon the face of the whole earth. And the Lord came down to see the city

and the tower, which the children of men had builded. And the Lord said, Behold, the people is one, and they have all one language; and this they begin to do: and now nothing will be restrained from them, which they have imagined to do. Go to, let us go down, and there confound their language, that they may not understand one another's speech. So the Lord scattered them abroad from thence upon the face of all the earth: and they left off to build the city. Therefore is the name of it called Babel; because the Lord did there confound the

language of all the earth: and from thence did the Lord scatter them abroad upon the face of all the earth.'

*Genesis 11: 1-9*

The mystery of the origins and development of the human languages has fascinated scholars for well over 300 years. Historically, one major line of argument has been that the study of linguistic development in children (language *ontogenesis*) would provide clues about the origins of language in

the human race (language *phylogenesis*). Some interesting similarities had also been noted between the vocal tracts of infants and those of nonhuman primates. However, the major problem that remained was the wide gap between the emotional expression of infants and the propositional content of adult language, which studies of language acquisition have not been able to bridge completely, even today.

A number of theories have been put forward in an effort to understand language acquisition<sup>1</sup>. Chronologically, one of the earliest hypotheses viewed language acquisition as a process of imitation and reinforcement. Children learn to speak, according to this popular view, by copying utterances made by adults around them; firm imprinting and learning then occur by the corrections and repetitions that adults provide. Although children do imitate significantly, especially in learning sounds and vocabulary, it is now clear that little of their grammatical ability can be explained in this way. An important evidence for this criticism comes from the way children initially deal with irregular grammatical patterns. When an exultant child says 'When I wented there I seed many sheeps', it is clearly not imitation (since no self-respecting adult would ever say 'wented' even to a child!), but a reasoning process of analogy which makes the child assume that grammatical usage is regular and thus allows it to deduce what the correct form ought to be.

The limitations of the imitation hypothesis directly led to an alternate view that children must be born with an innate capacity for language development, and this predisposition to acquire the structure of language instinctively must be coded for in the human brain<sup>2</sup>. One of the foremost proponents of this view (with the exception of the indefatigable Charles Darwin who, as always, had the first word even on this issue), and one whose work has most profoundly influenced the way most linguists and non-linguists think of language today is Noam Chomsky. (A remarkable indicator of his influence is that he is currently among the ten most-cited writers in the humanities, just behind Marx, Lenin, Shakespeare, the Bible, Aristotle, Plato and Freud, and ahead of Hegel and Cicero!)

In a series of papers spanning three decades<sup>3-6</sup>, Chomsky has provided some of the most detailed descriptions of many of the key features of modern-day language and speculated on the underlying brain mechanisms that have made humans unique in terms of their sophisticated linguistic abilities. Chomsky clearly hypothesized that only humans have an autonomous module in their brain – the language organ – that possesses combinatorial mechanisms and provides algorithms for the specific structuring of language in certain ways. He further went on to suggest that it was possible to formulate a single set of rules, which he called 'universal grammar', from which all possible grammatical sentences can be derived for any language. According to his 'principles and parameters' theory, the structuring of language is guided by a number of super-rules or principles. These principles, though universal and innate, are usable within each language only after they are combined with that language's particular setting for the order parameter. Thus when children learn a specific language, they do not have to learn a large number of rules, because they are born knowing the super-rules. They just have to learn what the order parameter relevant to that language is; this now serves as a mental switch which automatically makes available a large body of rules to the child. If Chomsky is correct and increasing evidence suggests that he might be so, it could pave our way to understanding how a child masters the complexities of spoken grammar in a remarkably short period of time.

In support of his postulate of an universal grammar, Chomsky and other linguists have performed numerous painstaking technical analyses of ordinary sentences spoken by a variety of ordinary people in different languages. Although too elaborate to report here, Chomsky's principal argument for the innateness of his universal grammar is one that he calls 'the argument from the poverty of the input'. This is based on the performance of very young children, unexposed to conventional rules of grammar, who almost invariably make 'correct', though technically more complex, grammatical constructions of sentences in preference to relatively simple linear, but 'incorrect', constructs. Evidence of a different nature,

independent of the Chomskyan school, has also come from studies like that of Greenberg who, in his analysis of thirty disparate languages spread across the world (including Basque, Berber, Burmese, Finnish, Hebrew, Hindi, Maori, Masaai, Mayan, Nubian, Quechua, Serbian and Swahili), discerned at least forty-five universals in the order of words and morphemes (smallest meaningful parts of a word)<sup>7</sup>.

One of the most ardent supporters as well as critic of Chomskyan thought in current times, Steven Pinker, echoes Chomsky in believing that all humans are indeed born with a universal grammar, the so-called 'language instinct'<sup>8</sup>. He too suggests that this instinct, possibly lateralized to the left hemisphere of the brain, constrains the range of variation that spoken language can have; a view of restrained diversity in fundamental unity.

Where Chomsky has been most heavily criticized, however, is in his firm opinion that our use of language for communicative purposes is merely accidental and that the theory of natural selection is lacking as an account of the design and function of the language organ<sup>5,6</sup>. Linguists like Pinker<sup>8</sup> and biologists like Hauser<sup>2</sup> have strongly criticized Chomsky and other earlier eminent workers like Bickerton<sup>9</sup> (who proposed that modern language originated abruptly from an ancestral proto-language by a single macromutation) on this issue. They have effectively argued that the capacity for language is not a mere by-product of having a large brain and that Darwinian natural selection is the only mechanism which can explain the evolution of such an adaptive trait as language with its complex design features. Pinker also provides evidence of genetic variation that could serve as the raw material on which gradual processes of selection could act. These include the normal, and sometimes rather predictable, variation in grammatical competence across individuals and the documented evidence of a remarkable inherited deficiency in grammatical ability within a particular family<sup>10</sup>.

But to turn to universal grammar again, Pinker argues that before the existence of universals within and across our spoken languages can be accepted, two alternative explanations must be ruled out<sup>8</sup>. The first of these

possibilities is that language originated only once, and all existing languages are the descendants of that proto-language and thus retain some of its basic patterns. The explanatory power of this view has, in fact, been rejected by most linguists for two reasons. First, in spite of major and radical disruptions in the transmission of languages across generations, rarely are there any similar breaks in the universals of these languages. Second, if universals are simply what are transmitted down generations, there should be strong correlations between specific branches of the linguistic tree and the structural differences that exist across the languages which belong to these branches. However, since many closely-related language families seem to exhibit a wide gamut of grammatical variation, there does not appear to be any correlation between the grammatical property of languages and their positions in the family tree of languages. It is therefore, rather unlikely that language universals have been passed down from the hypothetical proto-language of the human race.

The second possibility that one must consider before an universal language instinct can be accepted would argue that language universals may simply be a reflection of universals of thought or mental processing of information that are by and large independent of language. For example, the subject may precede the object in a sentence ('Tiger eats deer') in many languages because the subject of an action verb is often the causal agent which comes before the effect, and this may be a general mental construct of a logical mind. However, such functional explanations have usually proven to be rather tenuous and do not appear to work for most universals<sup>8</sup>. Given these arguments, the only conclusion that seems to be fairly acceptable to most linguists of today is that a basic grammatical instinct, not directly attributable to history or cognition, underlies all the world's naturally-spoken languages.

Assuming, therefore, that a language instinct and a universal grammar does exist within us all, it becomes imperative that the crucial properties of such a grammar be defined, and their underlying presence demonstrated in the 5000-odd languages that are in use in the world today. This is obviously an enor-

mous task. Nevertheless, the relentless pursuit in this direction by Chomskyan linguists has been successful to a great extent in uncovering a number of basic rules which could constitute an essential part of our universal grammar<sup>7</sup>. In addition, it is perhaps even more significant that support for the presence of a language instinct is also emerging from areas beyond the realms of spoken language.

A recent rather interesting paper<sup>11</sup> by Goldin-Meadow and Mylander is a case-in-point. These two linguists intensively studied the acquisition of gestural language in two small groups of deaf children, approximately 4 to 5 years of age, with severely reduced conventional linguistic input, in two different cultures (North American and Chinese) across the world. These children were congenitally deaf but with no recognized cognitive impairment of any kind, and were unable to acquire speech in any form. They had also never been exposed to any conventional sign language system. Although their normal parents attempted to communicate with them through speech, much of their interactions occurred through fairly effective action and gestures.

What is most fascinating is that the communicative gestures independently evolved by both groups of children were not only structured like natural language at the level of words and sentences, but also strikingly resembled each other in several prominent structural features. Unlike hearing children or adults who rarely string their gestures into a meaningful series, these children often conveyed their thoughts through gesture sentences. These sentences closely resembled the ergative pattern<sup>1</sup> that predominates in a number of natural languages. In this pattern the actor in an intransitive sentence (tiger in 'tiger runs') is linguistically distinguished from the subject in a transitive sentence (tiger in 'tiger eats deer') but follows the same case and position (within the sentence) as the object (deer) of the proposition. This kind of a construction, remarkably enough, *not* being present in Mandarin or in English, conclusively established that the grammatical structures underlying the gesture sentences of these children were not derived from that of the languages spoken by their parents.

Children in both cultures also produced complex sentences, with a combination of more than one proposition linked together in sequence, to a very similar extent; their mothers produced a significantly smaller proportion of such sentences. Moreover, the actual structuring of these sentences was also very different. Those produced by the children were again rich in ergative structuring with intransitive actors being represented at high rates, comparable to those of objects of transitive sentences. The mothers were much more variable and did not exhibit any consistent patterning of intransitive actors. Complex sentence structuring by the children, although evolved in different cultures, was thus much more similar to each other than it was to those of their respective sets of mothers. This was further evidence that the children seemed to be themselves responsible for evolving the spoken-language-like structure of their gestural systems. Generative capabilities of this kind is a hallmark of a true natural language.

How did these children evolve such a strikingly similar system of gestural communication? Can we be confident that the structuring of their sentences truly represents an innate universal grammar? Would children of all cultures, deprived of stereotypic linguistic stimuli, develop a comparable grammar? Would chimpanzees find it easier to learn sign language if certain kinds of structuring, like the ergative pattern, are incorporated into the language? If indeed the grammar evolved by these children and present in some natural languages represent that of an ancestral proto-language, why, when and how did the other modern languages diverge from this structure?

The steps to the pinnacle of the Tower of Babel are many and they are steep.

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ACKNOWLEDGEMENTS. I would like to thank Niraj Joshi for making me read Steven Pinker, and M. G. Narasimhan for making me rethink Noam Chomsky.

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## OPINION

# Haldane's God and the honoured beetles: The cost of a quip

*K. N. Ganeshiah*

## Haldane's God

God must be crazy – crazy about beetles! Why else should He create a beetle in every four of the species He gave life to on the earth! – thus wondered Haldane. Of the estimated 1.82 million species described so far<sup>1</sup>, about 400,000 species are beetles. This relative abundance of beetle species apparently prompted Haldane to quip about the nature of the Creator: **God must have an inordinate fondness for beetles.** The meaning of this statement, the veracity of its attribution to Haldane (versus Huxely) and the circumstances that led Haldane to utter these words have all been thoroughly thesised and have served staple for several writers<sup>2–4</sup>. Pages have been written examining whether Haldane's quip was 'inordinate fondness for beetles' or 'special preference for beetles'<sup>2,5</sup>. In fact there is an inordinate fondness among biologists to quote Haldane's quip. In the process the fascinating diversity of the beetles has been eulogized.

Often the most celebrated statements such as this by Haldane that get established due to the authority commanded by their authors, stand as strong and opaque barriers between our beliefs and the reality. This is especially true if these statements are personal opinions inferred from hard facts and not the laws that can be falsified. While the facts on which the opinion rests, offer quite a strength to the statement, the authority of the owner of the statement

shields the inferences drawn such that the quip lives longer than its utility and conveys a different meaning than is probably implied by the facts. Haldane's quip on the nature of God appears to be one such statement that is strongly perpetuating an yet untested and possibly a dubious belief about beetles that they possess an 'unparalleled diversity'<sup>2</sup>. It is indeed surprising and unfortunate that, in the process of 'tracing the history of this canonical one liner'<sup>2</sup>, the most important implication of the quip for the biologists has been sidelined. As it is said, the silence serves as a sign of unspoken approval; and in this sense the silence of the biologists has also contributed to the perpetuation of this belief. The fact is that it is not known if the beetles exhibit an unparalleled diversity compared to other insects or organisms. Consider, for instance, the following alternate interpretation of the same facts.

## The other God

God must be crazy and crazy about redundancy of life He created. Why else should He create a beetle in every four of the species He gave life to on the earth! While the 400,000 species of beetles fall into a mere 138 groups (families), 125,000 flies (Diptera) fall into almost equal number of (115) families: the butterflies and moths that constitute less than half the number of species of beetles (about 150,000) fall

into about 108 different groups (families; Table 1). Thus there are more species in any family of beetles than in that of flies or of butterflies. Since each family constitutes a group of species that share a common set of features different from other families, there must be many more species of beetles that are almost similar among themselves than are flies or butterflies. In other words, there appears to be a lot of redundancy in His creation of beetles than in other groups. God seems to have run out of ideas to inject diversity while creating beetles.

## Diversity versus redundancy

Thus two contrasting opinions may be derived from the same facts: one suggesting that beetles are more diverse and the other suggesting that they exhibit a lot of redundancy. But Haldane's quip is perpetuating the first of these alternate interpretations and it is imperative that we assess the two alternatives seriously.

In fact Haldane's quip could not have emerged had he thought that God was fond of abundance and redundancy. After all, sand particles are more abundant than beetles and Haldane did not say that God has an inordinate fondness for sand particles (though he is supposed to have stated God's fondness for stars too.) Apparently Haldane equated the number of species with the variety among beetles. Supporting this view, for