

Conduct -ing the dolphin choir



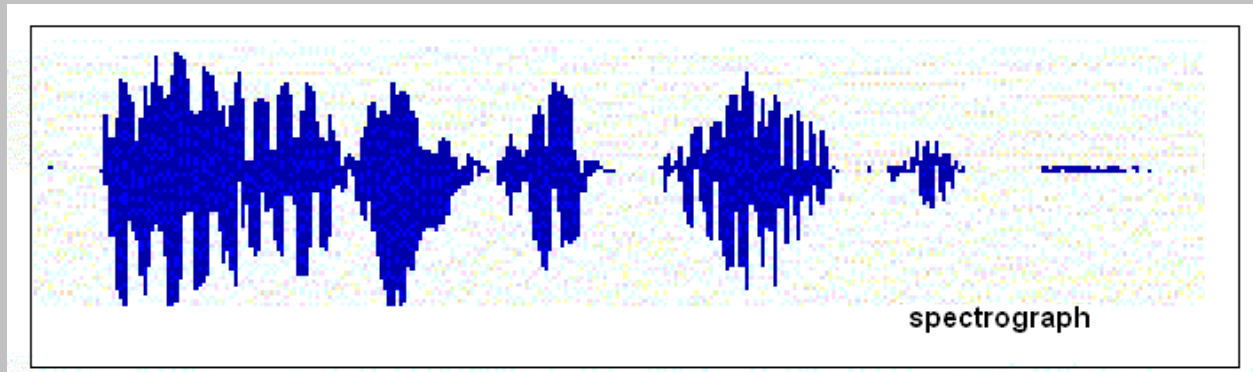
Software that detects musical melodies has been used to identify dolphin whistles, says S.Ananthanarayanan.

The question of whether animals have a language that can compare with that of humans has been an intriguing question. That animals communicate is obvious. Dogs bark to warn an intruder and flocks and herds stay in contact with the help of sounds. Bees are known to use signals based on movement and ants leave a trail of scent to point the way to food. But is this language in the sense that humans use sounds?

The distinction is that the human baby learns not just sounds and words, but also grasps very early the rules of grammar, which enable the baby to form and understand sentences that have not been heard before and are being used for the first time. It is language that has made it possible for there to be a Shakespeare or a Milton, and also a Newton or Einstein. Seeing similarities in the structure of almost all human languages, there are suggestions that there exists a ‘universal grammar’, which is ‘inborn’ in humans, in their very genetic make-up. And there is research to discover if there are signs of grammar in animal communication, in birdsong, for instance.

A serious contender for language ability status is the dolphin. Long studied as a mammal with very high intelligence and hence highly trainable, groups of dolphins have also displayed remarkable communication activity and the nature of their cries, or whistles, has been of great interest. But scientists have considered the whistles mainly as sounds, and analyses have been into patterns of frequency and amplitude, which are the scientist words for pitch and loudness. The dolphin’s whistle is thus been analysed with complex instruments, and is represented by a

spectrograph, or a visual display of the varying loudness of different frequencies in a complex sound.



Dolphin whistles

The dolphin, in its part has displayed more and more interesting features of the way it communicates. Scientists Stephanie L. King and Vincent M. Janik from the University of St Andrews in Scotland recently reported that dolphins develop their own, individual, signature whistles, which they use to identify themselves and which can be imitated by other dolphins, apparently to address one another! That animals can use specific sound signals when presented with specific object or class of objects has been known and the *Bottlenose dolphin* is capable of learning to make specific sounds to report that an object is there, or even that it is not there. But what King and Janik found was that there were features in the whistle that coded the individual's identity, independent of voice features.



Dr Janik had earlier reported that the whales often used this signature whistle in big group settings, like when several pods of dolphins meet at sea. When meeting strangers in the wild, dolphins whistle signature tunes that may be the animal equivalent of "Hello, my name is...", There is evidence that dolphins can recollect these specific whistles of individual dolphins after a long lapse of time, even twenty years!

The method King and Janik used for their studies was to record the whistles of dolphins and to play them back to other dolphins or the same dolphins in different situations. These studies showed that one dolphin's whistle was clearly its own, and it could be identified by its whistle or be addressed by that whistle too.

Melodic pattern

But analysis of whistles or of the different sound signals with spectrographs has been scarcely possible as large sampling is needed and the method is times consuming. This is where the journal, *PLOS-ONE (Public Library of Science)*, reports an important advance in the analysis of dolphin whistles. Researchers, Arik Kershenbaum, postdoctoral fellow at the National Institute for Mathematical and Biological Synthesis, University of Tennessee, Leela S Sayligh and Vincent M Janik have applied a method used to automate the identification of musical melodies to dolphin whistles and they find that the ‘signature’ cries of individual dolphins have distinct melodic patterns.

Melody consists of series of sounds of different pitch and duration, set to a given rhythm. The notes of different pitch are represented in western music by markings on grid of five parallel lines, with each higher line or space indicating a sound of higher pitch. In Indian music, the notes have individual names, like sa, re, ga, by which their relative pitch can be made out. In representing sound in this way, it is a relationship of a series of sounds that is shown, and not the actual frequency and loudness are every instant, as in the spectrograph. The coding in a given melody was further simplified in what is known as the *Parson’s Code*, where what is recorded is only whether each note is at the higher, lower or the same pitch, as the previous one. The picture shows the notes in the song, Twinkle, twinkle, little star, a song familiar to many, with the rising and then falling pairs of notes, in western and Indian notation. Also indicated is the Parson’s code, where the letter ‘r’ means, ‘same pitch’, ‘u’ means, ‘higher pitch’ and ‘d’ means lower pitch.

The image shows a musical staff in 2/4 time with a treble clef. The melody is written with quarter notes and a final whole note. Above the staff, the Parson's Code is written as a sequence of letters: 'r u r u r d d r d r d r d'. An arrow labeled 'start' points to the first note. Below the staff, the lyrics are written in two lines: 'Twin-kle, twin-kle, lit-tle star, How I wond-er what you are.' and 'sa sa pa pa dha dha Pa, ma ma ga ga re re Sa'.

The Parsons code, where only higher or lower, not even how much higher or lower, is considered, is not really a way to record or reproduce the sounds but it is a simple and still a unique pattern of practically all tunes. In the task of detecting a song with the same tune, in a data base of thousands of songs, the Parsons Code helps carry out the search in seconds, using a computer. One purpose could be to find a specific recording from a jumbled collection, or it could be to detect if a snatch of tune has been pirated and used anywhere else, even worldwide.

Parsons Code becomes a handy tool for analysis of Dolphin sounds. Each snatch of whistle can be readily broken into its series of rising, falling or level components and the Parsons Code of different sounds is then a matter of comparing text! "The Parsons code is a robust way to

compare dolphins' signature whistles because it is able to home in on the variation in frequency that actually matters. It discards the information that isn't useful for the analysis," says the paper's lead author, Arik Kershenbaum. With mounting evidence that dolphins' calls represent sophisticated communication, analysis of their content would be crucial to classifying them and to study how they appear in the course of social behavior of the animals.

