Do Dolphins Think without Language?
by Ralph Strauch

THE EVIDENCE—both anatomical and behavioral—is strong that dolphins and whales are highly intelligent. It seems plausible that their capabilities for thought and communication match or exceed those of humans in richness and complexity, but that they use nothing remotely resembling the sequential strings of symbols we call language. But there is no reason, in principle, why such creatures might not be able to create, use, and communicate equally complex concepts and ideas through a totally nonlinguistic medium.

We humans live on the surface of the planet in a transparent medium (air) in which we can see a long way. We have a highly developed sense of vision from which we get much of our information about the external world. Most things are opaque to visible light, so that we see the world as made up of solid objects with well-defined boundaries.

Hearing plays a distinctly secondary role for us, and we use it quite differently. We hear sounds produced by our surroundings — voices, footsteps, the wind, machinery operating. All sound results from movement or other activity on the part of the thing producing the sound, so we think of sound as something a creature or thing *does* or *makes,* in contrast with visual appearance, which is something a thing intrinsically *has.*

Seeing with sound

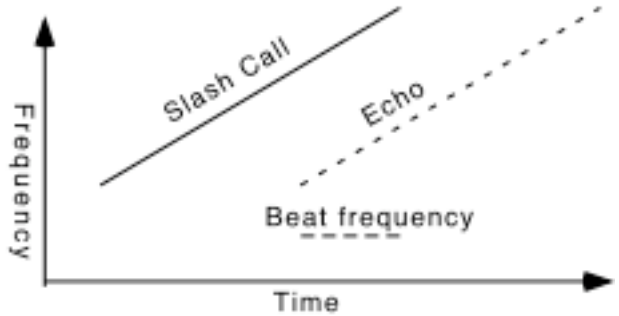
Dolphins, such as the bottlenosed dolphin *(Tursiops truncata),* for example, live in a very different environment, and perceive it very differently. The sea is often murky, growing darker with increasing depth. Vision is a less useful sense underwater than on the surface, and underwater creatures use it less than humans do. The dolphin's primary sense is acoustic. But unlike our passive sense of hearing, the dolphin has an active sense in that it sends sound out into its environment and then perceives its surroundings on the basis of the echoes that come back.

Most things we look at are opaque to light, while many things of interest to the dolphin (such as fish or other dolphins) are at least partially transparent to sound. Instead of the kind of surface image we are used to, the dolphin probably "sees" things in three dimensions. To a dolphin, then, a statue of a dolphin would appear quite different from a real dolphin, even though they might look identical to us.

We perceive different wavelengths of light as different colors, and we think of color as an attribute of the object reflecting the light. A dolphin may not perceive anything like color acoustically, and it probably uses acoustical wavelength differences quite differently. The smallest object that can be distinguished (with either light or sound) approximates the wavelength of the illumination. The wavelengths of visible light are on the order of a millionth of an inch, so play no role in ordinary vision. The acoustic wavelengths used by the dolphin range from a few feet to fractions of an inch, however, so that an object may "look" quite different, depending on the wavelength used to view it. The dolphin seems to utilize low-frequency scans to get a coarse overall picture of the environment, and shifts to higher frequencies to examine things in more detail.

The dolphin emits different kinds of sound patterns in its echolocating, getting different information back as a result. As it moves around, it often emits a sound pattern the frequency or pitch of which rises linearly with time. The graph of this pattern has the visual appearance of a slash mark (/) and for this reason dolphin-researcher John Lilly has labeled it a "slash call." A dolphin placed in an unfamiliar environment (such as a new oceanarium tank) often swims emitting slash calls for a while, apparently exploring its new surroundings. As it becomes familiar with the area, its echolocating decreases.

The speed of sound in seawater is approximately 5,000 feet per second, so the leading edge of a slash call lasting one-half second will travel 2,500 feet before the call ends. The echo of an object 500 feet away will return while the last three-fifths of the slash call is still going out, and the outgoing call will interfere with the returning echo. The dolphin will hear what is known as the "beat frequency" difference between the two interfering signals. (You may have experienced this phenomenon when tuning a musical instrument. If the instrument is slightly out of tune with the standard against which it is compared, the difference can be heard as a regular beat.) The shape of the slash call is such that the beat-frequency difference will depend only on the distance between the dolphin and the object returning the echo. If the dolphin and object are both motionless, the beat frequency will remain constant, while if the dolphin is closing on the object, the beat frequency will fall.



The dolphin can determine direction stereophonically and distance and relative motion from the beat frequency. The slash call and its echo, then, provide a low-resolution image of the dolphin's environment. This image will be quite different from the visual images we see, but it is probably as meaningful to the dolphin as our visual images are to us.

Language defined

To see what the differences between dolphin and human perception imply about communication and language, the term *language* must first be defined. For current purposes, *language may* be said to involve the use of sequential strings of symbols to represent ideas and aspects of the world of interest to the users of the language. Words are the symbols used by ordinary spoken language, and we combine those words into phrases, sentences, and larger units to produce more complex meaning structures. This definition encompasses many forms of human communication but not all. It covers spoken and written natural language, computer languages, and "sign language." It excludes "body language," touch communication, and still and moving pictures.

Human language evolved to serve two basic functions — communication and reasoning. Language is also used to record and preserve information, but that was unimportant from an evolutionary point of view. Language of the complexity we use today requires a highly developed intellect, and it seems likely that the intellect and the language evolved concurrently, each aiding and supporting the other. Language may have begun with the use of sounds to claim territory, attract a mate, or warn of danger. It may have evolved to the use of specialized grunts to symbolize important happenings or characteristics of the environment — food, water, a place to hide from the elements, etc. With these specialized symbols available, humans could begin to formulate and communicate increasingly complex thoughts, such as better descriptions of the land across the mountains or how to hunt wild boar. Together with human's evolving ability to use tools, this would have enhanced the biological advantage of intelligence, thus encouraging the evolution of greater intelligence. This in turn would make more complex language possible, continuing the process.

High intelligence is intimately connected with the ability to communicate complex ideas, with descriptions of the surroundings among the more important types of ideas communicated in the early evolutionary stages. In humans, the form that this communication took was language, because the mode available for communication (acoustic) was different from the principal mode of perception used (visual imagery). If someone who went over the mountains wanted to tell his group about it, he had to use abstract symbols (words) to describe the water, game, or other things he had seen there.

Mind-to-mind transmission

The dolphin's situation is quite different. It communicates using the same acoustic sense with which it perceives, and it is probably capable of directly transmitting imagery to another dolphin. It has the ability to communicate, in other words, in a manner that would be analogous to direct transmission of visual imagery from one human mind to another. The dolphin constructs its image of the environment from the pair of acoustical waveforms arriving at its two acoustic receptors. The dolphin also has two separate sound-producing organs which it can use together as well as independently. It can thus transmit as well as receive stereophonically.

Think about a dolphin that has been the underwater equivalent of over the mountains and wishes to tell its peers about the experience. It does not need to pick out a few important elements of the experience to represent symbolically; it can share the full experience. By stereophonically reproducing the waveforms it received while it was echolocating, the dolphin can communicate the full acoustic image of what it "saw," placing it directly in the minds of those it is communicating with. It could also selectively filter and interpret that experience, highlighting aspects that it wished to emphasize and playing down aspects it wished to de-emphasize. With such a capability, there would be no need for the kind of linear symbolic representation we know as language.

It is not known for sure that the dolphin does this. Understanding and interpreting its communication lies far beyond current human capability. We do know that it communicates, however, and that it communicates varied and complex patterns of sound.

Humans use language for far more than simple descriptions of their surroundings. We think and communicate about abstract ideas — mathematics, philosophy, politics, etc. — as well as about feelings and emotions. We have no way of knowing whether the dolphin thinks about similar subjects or not. But the medium it has for thought and communication is certainly rich enough to support such; thoughts. When we think about how far humans have come, starting with a series of grunts, the possibilities open to species with larger brains and the ability to manipulate and communicate three-dimensional imagery seem awesome.

This article originally appeared in *Sea Frontiers*, Vol. 30 No. 2, March-April 1984. It is adapted from *THE REALITY ILLUSION: How you make the world you experience*, originally published in 1983, reprinted in 2000 by Somatic Options and available at www.somatic.com

Ralph Strauch, Ph.D., teaches self-awareness and movement in Pacific Palisades, California, using the Feldenkrais Method, and was formerly a Senior Mathematician with the RAND Corporation. He is the author of *THE REALITY ILLUSION: How you make the world you experience*, and *Low-Stress Computing: Using awareness to avoid RSI.*

Ralph Strauch, Ph.D
Somatic Options
P.O. Box 194
Pacific Palisades, CA 90272
rstrauch@somatic.com
www.somatic.com