

ADDITIONAL QUESTIONS FROM DR. DOYLE'S WEBINAR

- What tools are used to measure the negative one slope in dolphins, babies, humans. Etc... Is it a back and forth communication that is measured or is it just for a single source that is measured?

We plot the frequency of occurrence (on a logarithmic scale) of the signals, for example for the human letter Zipf Plot we would graph "e" which occurs about 8% of the time, on down to "q" which occurs about 0.1% of the time. For the Zipf Plot we measure a whole compilation of that communication system.

- Do you think your presence modifies whale behavior? Do they react to you?

Yes, to some extent we do affect their behavior (the babies are sometimes curious and come over to us). But humpback whale feeding mostly ignores us - one of the reasons we chose them to study.

- Human languages have different patterns, for example the Finnish language where L is often followed by another L. Might whales also have different languages between various societies?

Yes, we know that orcas and some whales have different dialects which show where they came from.

- In WA State there is concern expressed that Navy flight training at high decibels disturbs whale communication. Do you share that concern?

I was not aware of flight training interfering with whale communication, but we are trying to mitigate the effects of Navy sonar on whale populations — a work in progress.

- Farmers have long known, beneficially, that plants communicate with animals and/or vice versa, but finding its beneficiality is problematic. For instance a farmer might make a rather wide circle with his tractor around a mama quail because of her communications . Isn't such emotion as maternal instinct, which is found in all cultures a good starting place?

Yes, we are tasked at the moment with finding out about empathy in humpback whales and we are indeed starting with the mother-calf relationship. There are papers by the scientist named "Morton" that indicate that a kind-of baby talk may exist in other species.

- Have you or a colleague written software to help analyze humpback sounds, and is more computer analysis a key to becoming able to communicate the whales?

Yes, we have software that does the information theoretic analysis so we can mathematically determine the internal rule complexity of a communication system.

- Why must the Shannon rule be obeyed for intelligent communication? Does Human music (rock & roll) fall within the Shannon rule?

Interesting question. The Shannon Entropy measures syntactic structure without which complex relationships between signals cannot be transmitted. An alien communication system may be far more complex than ours, but they would have to obey rules of information theory in order to communicate structural relationships between ideas. We'll have to look at Rock and Roll!

- Do you (or SETI) have thoughts on the Pentagon's recent statements about real UFOs flying around? Any thoughts on the Stars Academy?

One of the difficulties of investigating UFOs is that the observers do not have specifics about the location. A lot of UFOs are military tests done by humans. I looked up Stars Academy and got several hits, so I'm not sure which one the question refers to.

- Couldn't extraterrestrials communicate in a way that is beyond or outside the realm of what we have determined as necessary per our established information/communication theory? Or do we assume that any communication or signals that we detect would necessarily conform to our communication models?

I think civilizations significantly more advanced than ours would likely use a much more advanced communication system that we might not recognize. But if we could detect their signals, and classify them correctly, they would have to obey something like the rules of information theory to transmit information. A redundant signal would not provide much information, and a random, never repeating signal would not either. Information theory lies in between these two mathematical distributions.

- Some years ago you mentioned an experiment you were thinking of doing that would try to determine the presence of extra-terrestrial observers of light lensing around distant galaxies. Is that still something you are working on?

Yes! Thanks for remembering! We are presently working on performing this experiment using the Moon, as it is a lot easier to start at home (so to speak). We will get our first data in a couple of weeks.

- How does oil drilling affect the dolphins and whales that you are studying? Also, do you know how submarines and cruise ships affect them?

Hunting for petroleum using seismic explosives is detrimental to whales and dolphins in the area where these blasts go off. But these circumstances are definitely being debated and some mitigation will be taking place soon. About one humpback whale every year gets hit by a cruise ship. However, we are studying ways to playback sounds that will better warn the humpback away. In general I think cruise ships are the best way for thousands of people to see Alaska while having a minimum impact on the Alaskan ecosystems.

- Has the Drake Equation had the opposite effect of the Copernicus model on man's place in the universe? As the theological implications of the Copernicus model was fully accepted, world belief shifted away from man as the center of the universe, away from man as the favored creation of a divine being. This view has prevailed for 450 years. 60 years after the Drake Equation was proposed, society has started to digest the implications of this equation, especially the "L" parameter. The existential threats to the longevity of advanced societies such as nuclear war, global warming, meteor impacts, resource exhaustion, pandemics, etc., suggest that civilizations may not survive long enough which argues that $N=1$, just us on earth. Despite the recent explosion of exoplanets discoveries by the Kepler telescope, has the realization that mankind on earth may be unique in the universe started to shift scientific thought back to pre-Copernicus belief that man on earth might be governed by divine influence?

I think that natural science is becoming more metaphysical, and as one result our value system is definitely taking the environment and other species significantly more into account. No doubt Earth is unique, but in detail, not necessarily in the overall expression of Life. I think along with the more metaphysical approach of science comes a broader conception of what life is, and broadens the search for extraterrestrial intelligence. We live in a much, much larger universe than people from Copernican Revolution days did — 10,000 miles compared to 13.8 billion light years (just what is visible).