1. Search strategy based on key assumptions
   a. Recent increases in estimated number of ET Civilisations
   b. Recent biological and sociological theories:
      i. Biology: Co-Evolution
      ii. Sociology: Cooperative Civilizations
   c. New Communications Technologies

2. Implications for applying this model to potential ETI Communications
   a. Potential benefits
   b. Signal interpretation/response strategy
   c. Protocol revisions needed
Cosmic Convergent Evolution CCE

CCE offers an integrative new vision of evolution, life and intelligence.

CCE provides certain ecological and sociological niches that are not Earth-specific or human-specific and are archetypal throughout the universe. These are all evolutionary inevitabilities, where our counterparts are across the galaxy. There may be countless technological civilizations throughout the universe and the ones that do make it may look familiar to us.


This perspective suggests cognitive universals underpinning the behaviour of animals with brains. Consideration of what we can know of intelligence in beings elsewhere in the universe obliges us to recognise universal and local factors relevant to SETI. E.g. linguistic communication turns out to be constrained by local circumstances even though the existence of linguistic activity will be universal in intelligent beings.

Cooperative Civilisations

A civilization which has managed to survive far longer than us doesn’t make sense in an uncooperative development. The pressure of long-term survival of limiting population requires an evolutionary trend that increases our intelligence, this continues to evolve into a cooperative civilisation to take on planet scale problems.


In this universe there may exist many different kinds of creatures with widely varying levels of sentience and cognitive awareness. Some societies may possess more information than others; some beings may process information faster or more efficiently than others. Thus there is a natural ordering or continuum of all living things. Those entities which are more negentropic¹ are better serving their mission of life in the universe; hence they are inherently "more ethical." Those beings which engender the same negentropy¹ as others are "equally ethical."

### N Civil. Parameters

|--------|----------|---------------------|-----------------|---------------|---------------------------|-------------------------|

<table>
<thead>
<tr>
<th>( N_* )</th>
<th>( f_{pl} )</th>
<th>( n_{hab} )</th>
<th>( f_L )</th>
<th>( f_C )</th>
<th>( f_T )</th>
<th>( L/T )</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 Bn</td>
<td>520 Bn</td>
<td>104 Bn</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

### N = 40,000 (optimistic), \( \frac{1}{2} \) (pessimistic) 600

(Bn = Billion)

# of technological civilizations in Milky Way, right now.

Spacing Between Civilizations

Calculating the spacing can be made by assuming the Galaxy is a disk 100,000 light-years across and 1,000 light-years thick.

If civilizations are distributed uniformly within the Galaxy, then estimates of their numbers have important implications for the spacing between planetary civilizations and for the possibility of communication between them.

The results would demonstrate significance of lifetime on the ability to travel between civilizations, exchange communications or receive signals indicating intelligence. Success in contacting extraterrestrial consciousness becomes much more likely if the average lifetime of galactic civilizations is in the millions of years.
N civilizations are uniformly spaced within a cubic lattice with sides of length \(d\). Each civilization sits in an average volume of \(d\) cubed. \(N\) multiplied by \(d\) cubed equals the volume of the Galaxy, from which the separation \(d\) can be calculated.
<table>
<thead>
<tr>
<th>Civilizations</th>
<th>0</th>
<th>3</th>
<th>33</th>
<th>333</th>
<th>3,317</th>
<th>1,539</th>
<th>33,170</th>
<th>619</th>
<th>287</th>
<th>331,695</th>
<th>287</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacing, light-years</td>
<td>-</td>
<td>51,166</td>
<td>15,427</td>
<td>4,864</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
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<td>Civilizations</td>
<td>1</td>
<td>33</td>
<td>332</td>
<td>3,317</td>
<td>33,170</td>
<td>619</td>
<td></td>
<td></td>
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<tr>
<td>Spacing, light-years</td>
<td>-</td>
<td>15,427</td>
<td>4,864</td>
<td>1,539</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Civilizations</td>
<td>10</td>
<td>332</td>
<td>3,317</td>
<td>33,170</td>
<td>331,695</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Spacing, light-years</td>
<td>9,025</td>
<td>4,864</td>
<td>1,539</td>
<td>619</td>
<td>287</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civilizations</td>
<td>30</td>
<td>1,000</td>
<td>10,000</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spacing, light-years</td>
<td>16,180</td>
<td>2,802</td>
<td>923</td>
<td>428</td>
<td>199</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The idea that any form of electromagnetic signal would be used as a form of communications is one that we are used to from our everyday lives. A major issue occurs when we extend this to long range communications where long range is measured in units of the distance between stars or galaxies.

The idea that civilizations that are widely spaced would communicate in "real time" with each other with any form of electromagnetic signal thus seems highly illogical.

Super Luminal or faster than light communications may be the method of transferring information over galactic distances.
SUPERLUMINAL COMMUNICATION
FASTER THAN LIGHT MESSAGING
Quantum Super Luminal Communications R&D

- A range of laboratory verifiable results of quantum entanglement has provided the basis to develop experimental QSC instrumentation

- QSE Communications Ltd (UK)
- Airbus Industries (EU)
- University of Science and Technology of China (achieved $10^5 \text{ c}$)
- Space Exploration Ltd
TRANSVERSE WAVES WITHIN THE ELECTROMAGNETIC SPECTRUM

LONGITUDINAL WAVES

TRANSVERSE WAVES WITHIN THE ELECTROMAGNETIC SPECTRUM
2016 launch of faster than light (FTL) or Quantum Superluminal Communications (QSC) system (10 years in development)

Instant 2 way communications. (No matter what the distance)

Tracking, recording and communications station
Kingsland Observatory

E. Ansbro & E.V. Harris, “The possibility of detecting a signal from extra-terrestrial intelligent civilization using quantum superluminal communications”. JBIS, March 2017 (under review)
Communications Centre at SETI KINGSLAND

The operator has to be present to communicate in real time.

Signal to noise ratio is improved by de-noising programmes.
Antennae are omni directional for all sky coverage.
# Comparison of characteristics in Communications

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Radio</th>
<th>Optical</th>
<th>Infrared</th>
<th>Longitudinal</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Targets</td>
<td>multiple</td>
<td>single</td>
<td>Single &amp; Multiple</td>
<td>All Sky</td>
<td>All Sky &gt; 100k Lt yrs</td>
</tr>
<tr>
<td>Wavelengths</td>
<td>100 MHz-100 GHz</td>
<td>100s MHz to 100s THz</td>
<td>3-15 microns</td>
<td>1-15 GHz</td>
<td>Long. 1.5 GHz (2016-17)</td>
</tr>
<tr>
<td>Signal</td>
<td>EM (ETI or EI)</td>
<td>EM (MS, ETI-I or EI)</td>
<td>EM (MS, ETI-I)</td>
<td>Longitudinal (ETI-I, EI)</td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>FTL</td>
<td>Long. $10^5$ c</td>
</tr>
<tr>
<td>METI</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>FTL</td>
<td>Long. $10^5$ c</td>
</tr>
<tr>
<td>Kardashev Classes 1-4</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

**MS = Mega Structures; ETI-I = Intentional; EI = Earth Intentional**
### Possible ET Civilisation Detections in our Galactic Neighbourhood

<table>
<thead>
<tr>
<th>AGE Years</th>
<th>OPTION</th>
<th>TRAVEL Type</th>
<th>COMMUNICATIONS Type</th>
<th>KARDASHEV CLASS</th>
<th>DETECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1</td>
<td>Space + Time</td>
<td>EM/QSC</td>
<td>0 to 0.7</td>
<td>YES</td>
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<tr>
<td>3000</td>
<td>2</td>
<td>FTL</td>
<td>EM/QSC</td>
<td>1</td>
<td>YES</td>
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<tr>
<td>7000</td>
<td>3</td>
<td>FTL</td>
<td>EM/QSC</td>
<td>1.5</td>
<td>YES</td>
</tr>
<tr>
<td>10,000</td>
<td>4</td>
<td>FTL</td>
<td>EM/QSC</td>
<td>2</td>
<td>YES</td>
</tr>
<tr>
<td>1 Mil</td>
<td>5</td>
<td>FTL</td>
<td>EM/QSC</td>
<td>3</td>
<td>YES</td>
</tr>
</tbody>
</table>

FTL = Faster Than Light, QSC = Quantum Superluminal Communications, EM = Electromagnetic Spectrum, Kardashev Class 0.7 = Earth Civilisation

E. Ansbro & E.V. Harris, “The possibility of detecting a signal from extra-terrestrial intelligent civilization using quantum superluminal communications”. JBIS, March 2017 (under review)
NLL4SETI

Natural Language Learning for the Search for Extraterrestrial Intelligence NLL4SETI.

Utilises statistical distributional universals of language which are computable and diagnostic. Algorithms which recognise language like structuring in a potentially wide range of digital data sets

Ref: J.R. Elliott, Detecting the Signature of Intelligent Life, Acta Astron. 2010
ETI Signal

Interpretation

Socio cultural

Language

Signal type

ETI Civilisation Signal

Socio Cultural

Advanced

Response

Holding Signal
Communications with Extraterrestrial Intelligence

The inherent nature of Quantum Super Luminal communications (QSC) opens up the possibility for contact.

However, QSC opens up challenges for both contacter and contacted in respect to applying real time communications.

In particular, after contact, selecting the right protocols for socio cultural and language interpretation is vital to solve urgently.

This scenario may also be challenging to sustain for a long duration in our relationship with an ETI civilisation.
Assuming the message(s) are interpreted, the following values provide a two way instant communications for our civilization and the ETI civilization:

1. It addresses the timescales comparable to human lifetimes or at least the longevities of human institutions.
2. Long interactions can take place with long messages as opposed to potentially short “we exist” announcements.
3. The interaction may result with a meaningful relationship to progress to new initiatives and developments.
Even the remote possibility of contact with an ET civilisation raises a whole variety of questions. One such question is: Who should represent the Earth in the event of communication?

Who should coordinate response to ETI contact? The United Nations or other human representatives?

The arrival of QSC is a disruptive technology that is now being applied to SETI. Providing real time communications

Contact with ET Civilisations has agenda issues from an Earth based civilisation. What about the ET agenda?
What have we learned?

- Various methods have been used to search for extraterrestrial intelligence, including radio and optical SETI.
- Our attempts to communicate have been more limited. They are split into two types – electromagnetic messages and physical messages.
- Research into Cosmic Convergent Evolution and exoplanets within the habitable zones possibly increases the number of advanced ET civilisations who may be using QSC.
- This model counters the anthropomorphism embraced by adherents of the Fermi Paradox.
- QSC is a complimentary area for SETI.
- Whatever we think about extraterrestrial intelligence and the probability of its existence it is worth considering new protocols for detection. This means that language interpretation in real time is an urgency to be addressed.
- New policy initiatives are required now in respect of the arrival of QSC.
Thank You