Breakthrough Listen Working Group Statement
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This document, authored by the Breakthrough Listen Working Group, is meant to give scientific background on our work; outline our goals for the Workshop; and raise themes and questions that other Working Groups may or may not want to respond to as part of their Statements.

SETI + Breakthrough Listen: Background

In 1960, the first modern SETI experiment was undertaken in West Virginia by Frank Drake's Project Ozma, looking at two stars using a single, tunable radio channel. The six decades since have seen huge advancements in technology, which now allow billion-channel radio spectrometers to search hundreds or even millions of targets for signs that intelligent life may have arisen not just on our own planet, but elsewhere.

Breakthrough Listen is taking data with the Green Bank Telescope in West Virginia (the world's largest steerable radio telescope), and the Parkes radio telescope in Australia. We are also undertaking a search for powerful lasers using the Automated Planet Finder (a robotic optical telescope equipped with cutting edge spectrograph technology) in California. Listen has also signed collaborative agreements with the Jodrell Bank Observatory in the UK and the FAST radio telescope in China. Pilot programs are now being launched with MeerKAT and MWA, two of the precursor instruments to the international Square Kilometre Array telescope, that when constructed in the next decade will be the most powerful SETI instrument yet developed.

As SETI scientists, we use sensitive instrumentation to pick up signals over a range of frequencies of electromagnetic radiation (usually focusing on visible light, and the radio spectrum). Then we ask three questions: 1. Is there a signal present, or only noise? 2.Is the signal natural or artificial? And, 3. If artificial, is it human-generated?

To answer these questions, we tend to look for signals that are narrow in frequency, time, or both. SETI astronomers call any detectable indicator of technology a "technosignature." We distinguish between the *detection* of an engineered (or artificial) signal and *communication*. The former does not necessarily imply the latter.

We can't be sure that extraterrestrial civilisations will choose to transmit narrow-band signals, or even that they will use radio or laser communications at all, but if they are deliberately trying to attract attention, a narrow-band radio or laser signal is a great way to do so. Both are capable of traversing interstellar and even intergalactic distances, and tend to stand out against the background of natural signals and noise primarily because they span just a narrow range of frequencies. Moreover, irrespective of the intentions of a putative extraterrestrial civilization, the detection of spectrally or temporally compressed electromagnetic radiation represents one of the best known means of remotely sensing an extraterrestrial technology, and by extension, an

intelligent civilization.

The third question is much more difficult. We're looking for a needle in a haystack of human-generated interference: from cell phones, wifi, satellites, airplanes, and all of the accoutrements of modern technological life. And the kinds of signals we look for are based on extrapolating from our own technology. We imagine ETI might develop advanced methods of communication or propulsion with signatures that are detectable at large distances. We use a variety of methods to try to ascertain if a signal is coming from our local (human) environment, but mostly we do this by seeking signals that are localized at some position on the sky. If a star moves overhead over the course of the night, any apparently artificial signal transmitted by a technological civilization located in that star system should move with it (and should go away when the telescope is pointed elsewhere) and will thus stand out against local interferers that don't show such behavior. In short, we are searching for signals that appear to be both non-local and artificial. You can read more about the Breakthrough Listen science program at U.C. Berkeley here, as well as watching a short video aimed at public audiences, "If We Heard from Aliens, What Would It Look Like?"

Goals for the Workshop

Three years into the Breakthrough Listen Initiative, the team at U.C. Berkeley's SETI Research Center now seeks to meaningfully engage with scholars who think with and around SETI as a way to socially, historically, and philosophically analyze our own science search. Our main question is: What are we missing?

We view Making Contact 2018 as the launch point for the Breakthrough Listen team to start intellectual collaborations with other researchers. Our team consists of expert astronomers, digital engineers, programmers, and data analysts, and we're not seeking advice on the technical aspects of designing a SETI survey, or looking to speculate about extensions to the known laws of physics. But we are looking for help from experts outside our métier to explore possible motives, development, and sociology of extraterrestrial intelligence, the means by which an interaction with humanity might play out, and the implications for our society of a detection. We are open to unexpected viewpoints.

This Workshop is a launching point for the Breakthrough Listen team to develop tools to critically engage questions and issues that surround SETI research. We hope that listening to thinkers from other disciplines will permit us to broaden the discussion surrounding the search for intelligent life beyond Earth.

Themes and Questions for Working Groups

*We have generated some loose questions that you **may or may not choose** to respond to in your Working Group Statement. These are meant to be generative, rather than limiting, questions and themes, and the groups are welcome to respond to questions not directed at their disciplines.*

General

- How do fields outside data science and astronomy define intelligence, and how do they

distinguish between “artificial” and “natural” or “biological” intelligence.
- How do other fields define the word “artificial?” SETI scientists often use the word “artificial” to describe any signal produced by intelligent civilizations (including humans) and “natural” to be anything not caused or affected by intelligent life. What does this language say about the way we view intelligence and technological capability vis-a-vis other processes in the universe? What does it say about the way we view human intelligence vs. the intelligence of other terrestrial life?
- Why, or why not, might altruism, intelligence and technological capability be related?

AI & Data Working Group

- What do we mean by "communication,"by "technology," and by "intelligence," and is agreeing on a definition for these terms important or largely irrelevant to the success of the SETI endeavor?
- The Rio Scale was formulated as a tool to assess the likelihood that a claimed signal is due to ETI, assessing the physical reality of what’s been detected, the credibility of the claim, and the quality of the observational data. It is also intended to aid us in communicating the scientific method to the public. Work is currently ongoing to expand this to a "Rio Scale 2.0". We want to avoid attributing meaning or intention to potential signals, but questions remain: What might we be missing? Does the Rio Scale fulfill our wish about creating a more “objective” scale?

Anthropologists Working Group

- In sifting for technosignatures, we’re basically looking for humans on steroids because we’re not very good at envisioning something we can’t conceive. We’re looking for a highly advanced version of ourselves that makes the same kinds of technology. How can we best prime ourselves to be sensitive to something at the edge of our conception of human “intelligence”?
- How can we, or even should we, think through the problem of anthropocentrism that guides our search?

Future Studies Working Group

- SETI has been described as the "archaeology of the future." If the lifespan of a typical communicating civilization is short, our chances of finding it are slim. Conversely, if civilizations live for millions of years, if we make contact, it will likely be with a civilization much older than our own. How might our species develop in the far future, and what might this have in common with the development of civilizations in general? Must civilizations rise and fall, or does an inexorable path of development eventually lead to technologies beyond our wildest imaginings? Is understanding the motivations of an advanced ETI necessary for making a detection, never mind achieving communication?
- Arthur C. Clarke suggested that “Any sufficiently advanced technology is indistinguishable from magic.” Nick Bostrom’s theory of “superintelligence” suggests that we may not even have the brain capacity to try to figure out how an advanced intelligence might choose to operate. Is it feasible or advisable to imagine, project, or speculate about an advanced civilization? How would their technology develop, and how

would we achieve sufficient common ground to even recognize it, never mind communicate with it? What would a civilization a billion years ahead of ours even look like? What would its motives be? Why might it choose to make its presence known?

History, Policy, & Ethics Working Group

- How can BL better historically contextualize major SETI events like the birth of radio SETI; cyclical funding; the launch of Breakthrough Listen? What might the historical/cultural/political context teach us about the way the search is being performed?
- What are the potential ethical ramifications for making contact?
- SETI's underlying ethos has been that educating the public at large, even before a confirmed detection is made, is a good thing to do because we expect that a valid discovery will be incredibly important and disruptive. Is that what we should be doing? If so, how can we do that better? How do we do outreach that goes beyond merely educating the public about what SETI does? How can we communicate the awe and wonder of the deeply profound question that SETI work seeks to answer in the most inclusive and global way possible?

Indigenous Studies Working Group

- We acknowledge that, by and large, SETI endeavors have been directed by Westerners steeped in a particular knowledge tradition. How can we engage a broader community, and ultimately the entire world?
- Although we only know of one inhabited planet, there are nevertheless many species, and within species, many tribes and clans. What lessons from interspecies communication or from cross-cultural communication are SETI scientists not appreciating?

Literature, Language, & Storytelling Working Group

- What could drive an ETI to spread across the galaxy? Are there necessarily drivers for settlement at all?
- Is an unsustainable growth in resource consumption inevitable for an ETI?
- How do the stories we tell ourselves — about intelligence, gender, technology, nature, language — shape, or perhaps hinder, SETI projects?

Situated Knowledges and Feminist Epistemology

- Is the idea of growth / consumption / domination in SETI a product of certain aspects of human cultural history? What alternatives are there?
- How can the idea of "situated knowledges" inform our search? How can we better theorize Others using this tool? How can it help us beware of our limits of knowledge?