How humans matter now: the relevances of anthropology and archaeology for the new SETI.

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1. Anthropology, Reloaded, for the New SETI

Anthropology – the holistic study of all human beings, past and present, in terms of our biology, language, culture, and technology, including the subfields of sociocultural anthropology, biological anthropology, linguistics, palaeoanthropology, and archaeology – is and should be relevant to SETI. But *how*, exactly?

The terrain of anthropology has long been involved in the discourses of SETI, in terms of the potential characteristics of alien societies, the processes of intercultural contact, and potential social impacts of detection, *etc*. [1], [2], [3]. But this work may be as fully realized as possible, until/unless data from an extraterrestrial detection are added into the mix [4]. We are unlikely to be in physical proximity with ETI, and if other intelligences exist, they will not be just like us, and so all our anthropological expertise with humans will be informative primarily about ourselves. So, how *does* anthropology matter to SETI now?

I propose that anthropology should be integrated into SETI in three ways: as a data-rich evolutionary-historical science devoted to the only species we know of that has produced a technological civilization capable of communicating at interstellar distances; as a set of methods and perspectives which can reflexively refine our ability to step outside familiar mindsets to confront alien ways of being; and as a way of thinking about what it means to be human in a complex environment including myriad other life forms, equivalent in importance to ourselves. I recommend below that we should maximize our use of the Earth dataset about *Homo sapiens* while, simultaneously, reflexively considering how we see and think. Specifically:

- the archaeological record is a goldmine for SETI, if used to examine the emergence and sustainability of complexity from a cross-cultural comparative perspective (rather than in a unilineal evolutionary narrative, as is the tradition within SETI).

- we should examine human failures and successes in recognizing unfamiliar intelligence and agency (other animals and past humans) in our own world, to develop an intellectual toolkit that refines our thinking.

- we should adopt new thinking from anthropology and biology which foregrounds the reality that humans coevolved with other intelligent animals and with our microbiomes.

2. Humanity's past: the archaeological goldmine, social evolution, and SETI

Obviously, in SETI, we must overcome anthropocentrism, but the history of *Homo sapiens* and our relatives is still a crucial resource. There is a phenomenal, continually expanding dataset concerning human cultural complexity and cultural evolutionary transitions, including technological development and sustainability. I submit (with respect for previous efforts) that this incredible dataset has been used suboptimally in SETI, and that we can do better [4-6].

My key propositions follow. First, while SETI discourse (idiosyncratically) conflates the human experience into a unilineal evolutionary narrative, it will enormously enhance accuracy and insights if we split the dataset and use a comparative approach. Humanity's story, writ large, is not unified – not one species, not one path to complexity, not one science, not one path to technology… and, arguably, not one "L", either [5, 6]. Second, archaeological data speak to questions core to SETI, *e.g.* about the emergence and intensification of complexity, the relative roles of contingency and convergence, the sustainability of complexity, and variable ecological footprints [5]. Third, it is best to design our own cosmos-oriented studies about cultural and technological evolution, fusing the strengths of the social sciences and hard sciences, rather than borrowing research designed for other purposes [5].

SETI should reengage now with palaeoanthropology and archaeology, for the same reasons that it is timely to plan a new scientific roadmap for SETI: recently developed technologies and unprecedented accessibility of data. Cross-cultural research across the sweep of human time is easier than ever before. The technologies now used in astrobiology are also revolutionizing our understanding of humanity's colonization and occupation of Earth.

3. What Have We Missed, and Why? Anthropology and Recognizing The Other

Refined search technologies and methods are certainly essential for next-generation SETI, but we can further develop our intellectual toolkit as well. I propose that we examine recent human failures and successes in uncovering and recognizing evidence of unfamiliar intelligence, past and present, in our own world.

We might begin with biology and the behavioural sciences, interrogating the remarkable difficulty Western science has had in recognizing and acknowledging intel-

ligence in animals [7,8]. This is a *cultural* problem: traditional cultures worldwide and Japanese scientific traditions have had less difficulty seeing and naming intelligence in nature [9]. Much more must be said about how to overcome this problem, including the chauvinisms which slowed the recognition that plants, too, sense and respond to their environments [10].

Next, although it is crucial for SETI to avoid anthropocentrism, we need not ignore 'anthropos.' Rather, we must escape the 'centrism.' In expanding SETI's intellectual framework, we can use anthropology and archaeology's extensive experience in circumventing ethnocentrism. Also, archaeology gives us over a century of experience in learning how to look for presences that are difficult to imagine or recognize. Archaeology's breakthroughs are frequently generated by prior failures to recognize other people's agency, signatures, or existence – failures due to our search/study technology *and* our habits of thought. Examples abound. For centuries, the extensive pre-European anthropogenic environment modification in the Americas went unrecognized, because the European settler culture saw the Americas as a virgin wilderness and didn't understand indigenous resource use and management [11]. Finally, researchers *learned how to see it*, due to a cognitive adjustment as well as technological advances.

I am not suggesting that in Earth's archaeological record there is evidence of ETI, just waiting to be recognized. Rather, I am noting that all science operates on assumptions which must be identified and challenged. We could tackle this head-on by examining failures and successes in fields analogous to SETI, in a comparative investigation that cross-cuts scientific disciplines, examining paradigm changes in recognition and acknowledgement of intelligence and agency.

4. Are We Alone? Never! Recognizing our integration, connection, and dependencies

A new story is emerging about humanity, which acknowledges that other species are an inextricable part of our evolutionary journey, rather than incidental companions. Human beings didn't become globally dominant planetary engineers and spacefarers, on our own: we needed other complex and intelligent species to do it. Many long-held views of human evolution have been too anthropocentric, insufficiently acknowledging the evolutionary role of our biological communities, from our fellow mammals to our microbiomes.

On the smallest scale, it is now evident that our microbiomes are highly consequential [12]. The implications for the present discussion are extensive, in at least three ways. First, the microbiome complicates the question of the unit of selection: should evolution be described in terms of the host + microbial symbiont, or in terms of the holobiont/metaorganism/superorganism? [13, 14, 15]. The integration of the ongoing explosion of microbiome data into evolutionary theory and community ecology will transform thought about human evolution. Second, some of humanity's most distinctive traits – high cognitive functioning and sociality – are now known to be profoundly influenced by our microbiome [16,17]. Not only do host-microbe associations critically affect mammalian and primate brain development, but social contact behaviors may even be related to beneficial microbe transmission [18,19], perhaps in some cases with the microbiota as the "puppeteer" [20]. Third, evolutionary changes in the human microbiome correlate with known transitions in hominoid (human/ape) evolution [21], and the newly feasible analysis of ancient human microbiomes preserved in dental calculus [22] promises to rewrite our understanding of ancient human ecologies, and may indicate significant coevolution with our microbiomes at crucial evolutionary transitions. This will shed new light on the emergences of intelligence, sociality, communication, and technology and environmental modification.

Back at the macroscale, examples abound. The intelligence and sociality of dogs enormously increased human hunting efficiency and survival, enabling our geographical expansion [23]. More recently, the labour of domesticated animals has contributed immensely to escalating political complexity (including warfare and information conveyance) and technological achievements over the past 5000 years: horses are a spectacular example [24]. It is often said that humanity today stands on the shoulders of giants. We now need to recognize that most of them were not human – and integrate this recognition into holistic, planetary models of biological, social and technological complexity.

So, how can we shift our thinking about humans? Here are three ways forward. First, the recent unification of archaeological, historical, and molecular data in the study of many domestication events, continues to shed insight into how humans harnessed (literally and figuratively) the power of other intelligent, social animals. Second, in economics and environmental policy, "ecosystem services" and "natural capital" are now acknowledged as key to present and future economic and social stability [25, 26]. Some models from these fields may be useful [e.g. 27]. Third, in cultural anthropology, new "multispecies ethnography" moves past the human exceptionalism which only sees other life forms "as part of the landscape, as food for humans, as symbols" [28 p.545], to instead pay attention to how "encounters between *Homo sapiens* and other beings generate mutual ecologies" (546).

5. Conclusion

SETI's new roadmap will be an unprecedented multidisciplinary synthesis. Data, methods, and perspectives from anthropology and archaeology could contribute significantly. Transcending anthropocentrism in SETI does not mean ignoring *Homo sapiens*; rather, it requires that we make the most of our data concerning human beings, contextualize ourselves within our biomes, and learn how to better recognize intelligence and agency around us. Finally, this discussion is focused on the theme of how we can be fair in our thinking about other forms of life. I therefore hope that the ethical questions which next-generation SETI brings into focus, will be addressed as integral to the science.

(A) Which Question(s) of the *Alien Mindscape* article is your white paper is relevant to? Ultimately, the notes above intersect with all three inquiries defined in the Call – *i.e.* about the abundance and diversity of intelligent life in the Universe, how intelligent life communicates, and how we can detect intelligent life.

(B) How can Big Data Analysis can help you advance this project/concept (and which datasets/ databases)? Mining ethnographic and archaeological datasets (eHRAF, various archaeological data repositories) will help in understanding cultural/techological evolutionary transitions. Reviving and extending the *Intelligence in SETI* database (Marino and Denning) will help in considering the linkages of different sensory capacities and intelligences on Earth. Searches of existing literature on scientific surprises/creativity/paradigm shifts, and of different scholarly engagements with multispecies systems, will yield useful conceptual insights. Searches of bioethics literature and codes of conduct will help forecast the distant future postdetection challenges for astrobiology and help us prepare responsibly.

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