International Journal of Astrobiology (2024), **23**, e24, 1–17
doi:10.1017/S1473550424000156

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

Inferring their minds and analysing our beliefs: on the contribution of (exo)psychology to the search for extraterrestrial intelligence

Niklas Alexander Döbler[1,2,3] and Claus-Christian Carbon[1,2,3]

[1]Department for General Psychology and Methodology, University of Bamberg, Bavaria, Germany
[2]Research Group EPÆG (Ergonomics, Psychological Æsthetics, Gestalt), Bamberg, Bavaria, Germany
[3]Bamberg Graduate School of Affective and Cognitive Sciences (BaGrACS), Bamberg, Bavaria, Germany
Corresponding author: Niklas Alexander Döbler; Email: niklas.doebler@uni-bamberg.de

Received: 6 December 2023; **Revised:** 28 June 2024; **Accepted:** 2 July 2024

Keywords: exopsychology, extraterrestrial intelligence, psychology, SETI, technosignatures

Abstract

Exopsychology is a sub-discipline of psychology concerned with how humans contemplateextraterrestrials as well as forming hypothesis about how these beings may think, feel and behave. While researching the former is undoubtedly a subject for empirical science, aspects of the latter remain uncertain. Given the contemporary scientific insight, it may still be possible to identify a set of cornerstones and eventually create a space of possible configurations of the extraterrestrial mind. Here, we identify three basic compatibility requirements: first, any form of life must navigate internal and external (environmental) demands and thus actively ensure the compatibility of its current state with the same demands. Second, any advanced cognitive development and the emergence of remotely detectable technosignatures require not only the relevant capabilities for manipulation but also compatibility with a permissive environment. Lastly, requirements also concern the compatibility of extraterrestrial thinking and behaviour with our search method. In its most basic understanding, search for extraterrestrial intelligence (SETI) searches for *something done by somebody.* However, the meaning of this simple formula and the psychological theory behind it is underdeveloped. Hence, psychological aid is needed to assist SETI in its effort to reveal whether galactic information indicates the presence of a mere object or activity of an identified subject with whom humans may establish contact. The fact that people believe in and search for extraterrestrials emphasizes that psychology should pay attention to this domain of phenomena. Hence, different imaginations of the extraterrestrial, ranging from benign to cruel, from superior to equally developed, are briefly discussed regarding their emergence and function as coping and motivating mechanisms for the uncertain search.

Contents

Introduction

At least four times different authors discussed the possibility of extending psychology from life on Earth to inhabitants of other planets (see Freitas, 1984; Baird, 1987; Harrison and Elms, 1990;

Anton and Schetsche, 2023).[1] Recently, the idea of marrying psychology with the search for extraterrestrial intelligence (SETI) and establishing a so-called *exopsychology*[2] was re-proposed and re-defined. Instead of solely focusing on extraterrestrial minds and behaviours (Harrison and Elms, 1990), modern exopsychology was defined as the discipline of psychology: "that investigates the cognition, behavior, affects, and motives of extraterrestrial agents and the human-specific representation of them" (Döbler and Raab, 2021, 700). Without any reference to 'intelligence' in their definition of exopsychology, Döbler and Raab suggested to use "extraterrestrials" as label for the type of extraterrestrial cognitive agents SETI is looking for – a proposal we will follow throughout this paper.[3]

As tempting and fascinating as it may be to contemplate how extraterrestrials may think, any attempt to do so must address the elephant in the room. To be more precise, it must confront the fact that we do not know if there is even an elephant. After all, there is no consensual accepted proof of the emergence and existence of life on celestial bodies beyond Earth.

Psychology is nowadays an established empirical science. It builds on observation. But if there is nothing to observe, the quest of conducting a psychological examination of our hypothetical extraterrestrial neighbours may appear senseless. Well aware of this constraint, Döbler and Raab (2021) left a loophole by extending the exopsychological research interest to human representations, beliefs and conceptions of extraterrestrial life and intelligence. We will comment on the importance of this extension later. For now, the question of how we can research something for which we have no evidence, e.g. extraterrestrial minds, is still pertinent. One might even go so far as to claim that this fact disqualifies this part of exopsychological research *a priori*. Yes, we can research the facets of the human belief in extraterrestrial life (e.g. Swami *et al*., 2009, 2011; Dagnall *et al*., 2011; Chon-Torres *et al*., 2020; Döbler *et al*., 2023), but is someone seriously convinced that we can say anything about the mind of extraterrestrials?

We ground the proposal for the possibility of doing so based on what we call the *compatibility requirements*. As elaborated in the eponymous Section, this argument focuses on the physiological and psychological requirements that must be met for extraterrestrial life to evolve towards the type of extraterrestrial cognitive agent SETI may be able to detect. Linking these thoughts to the human factor within the search, we also emphasize the requirements that must be met for the possibility that humans detect extraterrestrial technological activity. We will then champion the importance of exopsychological research by touching on the psychological role extraterrestrials occupy. Meant to emphasize the action-guiding function of beliefs and fantasies, e.g. as present in the cultural display of extraterrestrials, we highlight psychological presumptions also transgress the hard science of conducting SETI. Our thoughts lead us to the conclusion that exopsychology is inevitably about us; how we approach the unknown.

Compatibility requirements

Directly addressing the limits of our observational capacities, Baird (1987) eventually conceded and stated that conducting exopsychology requires a first contact between alien life and humans. Harrison and Elms (1990) were more optimistic and proposed "disciplined speculation" (p. 216). Harrison (1993) later elaborated on the underlying challenge:

> By refusing to speculate we avoid the risk of projecting human qualities onto aliens, over-generalizing findings based on studies of terrestrial species and cultures, and abandoning empiricism. … At the same time, if we discourage speculation we may overlook potentially helpful intellectual frameworks, ignore useful hypotheses derivable from empirical findings on Earth, and abandon a useful exercise that could better position us to understand extraterrestrial intelligence. (p. 190)

[1]Schetsche and Anton first mentioned exo psychology in the German version of their book (see Schetsche and Anton, 2019).

[2]It was formulated unrelated to exo-psychology as proposed by Timothy Leary (1977), which primarily investigates human consciousness and neuroanatomy in outer space.

[3]This terminology does not deny that other people will dominantly refer to these beings as 'extraterrestrial intelligence'.

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

The modern conception of exopsychology (see Döbler and Raab, 2021) affirms the latter approach. Therefore, the distinction between so-called *inadmissible* and *admissible anthropocentrism* was proposed (Döbler and Raab, 2021): Accordingly, the starting point is an irreducible and impossible-to-avoid anthropocentric position. We are always thrown back to our existence on the pale blue marble we call home.[4] Its properties, position in space–time, and the human configuration directly determine the kind of galactic observations we can make. Yet, this should not leave us utterly pessimistic. Why should we discard the only example of life we are aware of in the universe? Is not the affirmation of an alleged non-generalizability of earthly processes and beings the ultimate terra- and anthropocentric position?

Instead, we should try to find those features in our condition that can be projected to potential extraterrestrials. Identifying admissibly generalizable features begins with the aforementioned 'disciplined speculation'. Insights about the conditions of humanity and life on Earth are used to create a space of possibilities and iteratively narrow down the possible configurations of extraterrestrial life and its mind (Döbler and Raab, 2021). Although empirical confirmation is still limited, we can produce some "plausible hypotheses" (p. 211) by identifying generalizable theories and concepts (Harrison, 1993) and discarding overly specific and inadmissible hypotheses. This way, we can identify universal principles that govern the activity and mind of life in the universe (Harrison, 1997).

Requirements for life and technosignatures

How these hypotheses can be generated was shown by Harrison (1993, 1997), who discussed the applicability of the living systems theory (e.g. Miller, 1965) within SETI. His attempt is one of the most comprehensive attempts to identify basic rules and principles that can explain terrestrial and hypothetical extraterrestrial phenomena at various stages of social organization. Although also dedicated to the general task, we will refer to different literature and theories. Nevertheless, we will follow Harrison's example by starting with one of the most profound requirements for SETI: life.

Here, we start with the trivial premise that life emerges on celestial bodies like planets and moons. SETI projects typically target stars (e.g. Isaacson *et al*., 2017; Smith *et al*., 2021). But this, of course, is merely an auxiliary method. In fact, SETI wants to detect a technosignature from one of the planets that orbit the star and may be habitable (Tarter, 2001). The respective celestial body provides the environment in which life can emerge. For a comprehensive overview of the astrobiological requirements for this process, see Irwin and Schulze-Makuch (2020).

This life will probably not manifest as fully fledged space-faring civilization but has some more humble beginnings. Throughout an indeterminate time, external and internal demands will create conditions lifeforms must adapt to ensure organizational persistence, i.e. survival (Maturana and Varela, 1987; Di Paolo, 2005; Barandiaran *et al*., 2009). Success within this activity is required if the single lifeform shall ever start the evolutionary process that may lead to species that are interested and capable of space exploration (see Baird, 1987) or at least bring forth the required abilities for the production of technosignatures (Döbler and Raab, 2021; Döbler and Carbon, 2023). This is an oversimplification, for sure, but it is meant to lead us to a crucial insight. The fact that life is tied to an environment that enables its existence, in addition to the requirement of showcasing the type of activity sufficient for survival (Di Paolo, 2005; Barandiaran *et al*., 2009), opens up the possibility that individual life forms may begin to exploit the material environment for the latter purpose increasingly. Such individual behaviour may culminate in cultivated and more sophisticated creative engagements and the production of remotely detectable technosignatures (Döbler and Carbon, 2023). After all, active adaptation of the environment to ease goal achievement is a powerful behavioural strategy (Kirsh, 1996).

One defining feature of life is the creation of a boundary that demarcates 'internal' and 'external' (Irwin and Schulze-Makuch, 2020). Humans usually use the concept of the body to refer to this

[4]The more precise term would be 'habitat', but in a glimpse of anthropocentric vanity, humans declare the whole planet to their 'home'.

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

boundary. Yet, the fleshly assemblage of limbs is neither a linear delivery service to a hard-wired grey matter central processor nor an obsequious executor of a superior will (Kiverstein, 2012). Human cognition can be seen as *embodied*, and we have good reasons to believe that across different lifeforms in the universe, complex cognitive skills require the same kind of embodied sensor-motoric input from the extraterrestrial body (Dunér, 2019). Although there is disagreement about the meaning, requirements and implications of embodiment (Wilson, 2002; Ziemke, 2003; Kiverstein, 2012), we can find common ground in the notion that bodily processes and activities inform and influence what humans call mind: '"The body is not, as is conventionally held, a passive external container of the human mind; it is an integral component of the way we think. In other words, the mind does not inhabit the body; rather, the body inhabits the mind" (Malafouris, 2013, 60). The applicability of this theory for non-human beings is, for instance, impressively shown by the complex de-centralized cognitive architecture of terrestrial cephalopods (Hochner, 2012).

Given the astronomical distances SETI deals with, a proxy measure is used to infer the presence of potential 'intelligent' life. Instead of looking for the eponymous behaviour-independent intelligence, SETI is looking for remotely detectable technosignatures, i.e. signs of material activity that are so significant that they are observable from lightyears away (Sheikh, 2020, 2021; Döbler and Carbon, 2023).[5] Because technology is seen as the product of intelligence, the theory suggests that once you have found indices of the former, the latter can be reliably inferred (Tarter, 2001).[6] A recent definition proposed by Sofia Sheikh puts all these pieces together:

> A technosignature is a physical feature whose presence or abundance is a result of the presence of a being that has engaged in goal-directed, intentional manufacture. Here, manufacture is the process of using a tool (something itself manufactured, or gathered from the environment) to manipulate a material in order to create a new form, demonstrating its makers' formal or informal physical knowledge. (Sheikh, 2021, 19)

Although the approach of Döbler and Raab (2021) and this definition were developed independently, note how this definition also does not make any reference to intelligence and highlights the agentic ("intentional manufacture") and cognitive abilities ("demonstration of knowledge") of the responsible being.

Technosignatures often imply large-scale environmental manipulation at some point in their emergence (e.g. Lockley and Visioni, 2021; Socas-Navarro *et al*., 2021). In this sense, a certain level of agentic capability, i.e. the ability for environmental manipulation (Döbler and Raab, 2021) or, more basically, the ability of the organism shape its relationship with the environment according to a self-defined purpose (Virenque and Mossio, 2024), is required. How this ability is exercised hinges on the environment, the extent to which it allows certain actions and whether these possibilities (so-called *affordances*) are made sense of (Döbler and Carbon, 2023). The complexity, skill level and richness of possible behaviours correlate with various cognitive abilities (Döbler and Carbon, 2023). Thus, exopsychology affirms "the *evolutionary astrocognitive premise*: Cognition in the universe develops through evolutionary processes of adaption to a specific but changing environment and the challenges it presents" (Dunér, 2019, 706, italics from the original). In summary, exopsychology posits the extraterrestrial as a *highly skilled* and *high-cognitive agent*, i.e., an extraterrestrial (Döbler and Raab, 2021; Döbler and Carbon, 2023) (Fig. 1).

Moreover, we have reasons to believe that the demands and timescale needed to create remotely detectable technosignatures require a certain level of sociality (Dunér, 2019). Not necessarily in the sense that extraterrestrials will gather and celebrate Oktoberfest in space – no, we cannot make detailed

[5]For the sake of the argument, we exclude any discussions of so-called biosignatures, which are understood as direct indices of biological processes (Catling *et al.*, 2018). Note that, in some sense, technosignatures also indicate manufacturing biological agents, but with different implications and presumptions.

[6]It would be unfair to claim that SETI scientists have not reflected on equivalating intelligence with technology (e.g. Sheikh, 2021). Furthermore, the 'Ad Hoc Committee on SETI Nomenclature' also mentioned the potential problems with this conceptualization yet advocated for a pragmatic use (Wright *et al.*, 2018).

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

Figure 1. *Exopsychology avoids reference to extraterrestrial beings as 'extraterrestrial intelligence'. To make this distinction clear and highlight the agentic capabilities of these beings, it suggests the use of the noun 'extraterrestrial'. The depicted symbol is meant as a graphical representation of this concept. It was created by Niklas Döbler and first proposed in Döbler and Carbon (2023). It is free to use for everybody under a CC BY-NC license (see supplementary information and the OSF: https://dx.doi.org/10.17605/OSF.IO/Z278G).*

statements about the exact social organization. Still, we can state that social coordination, division of activities and transmission of knowledge tremendously ease the production and maintenance of certain behaviours (Tennie *et al*., 2009; Dunér, 2019; Döbler and Carbon, 2023), so that embodied activity that leads to technosignatures we can detect is characterized by sophisticated patterns of socio-material coordination (Döbler and Carbon, 2023). Condensation of these thoughts to SETI-theory, means that:

> [C]ognitive flexibility has thus emerged through a bio-cultural coevolution of the embodied mind, due to its benefits for survival, orientation, and adaptation to a variable environment in a Darwinian struggle for existence. …[M]ind is thus a product of the interaction between the body and the surrounding environment, both the physical and cultural environments. … Extraterrestrial minds, like terrestrial minds, have adapted to their specific environment and the specific social interactions between the minds of their species. SETI research is, to a large extent, an endeavor to understand how intelligent life interacts with its environment and communicates information about its perspective on the surrounding world. (Dunér, 2019, 707)[7]

We have now identified basic cornerstones or functional properties of how the extraterrestrial mind may work. Our thoughts are not meant to map the necessary and inevitable trajectory of cognitive development in the universe but to identify the features extraterrestrial life likely must develop to produce technology, whose indices may or may not be detectable by us. Similar to the attempts made by Harrison (1993, 1997), this was done by identifying the basic requirements of the behavioural output SETI is looking for. Given the general broadness of our proposal, we can reasonably assert admissible generalizability, i.e. identify "analogous structures and processes" within the extraterrestrial mind and behavioural repertoire (Harrison, 1997, 145). Like Harrison, we do not claim that human and extraterrestrial minds converge in every detail but that the basic principle of organismic activity in a permissive

[7]In his discussion Dunér (2019) equates cognitive flexibility with intelligence. It was argued that intelligence is not really useful within SETI, because it is too much influenced by the human notion and thus inadmissible anthropocentric (Döbler and Raab, 2021). This does not mean that we can never ascribe intelligence in this context. It just highlights its inherent bias (Döbler and Carbon, 2023).

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

environment may serve as the first and crucial step to explain the development of the capabilities SETI theoretically assumes and practically searches for.

The idea to directly extrapolate from the human condition is not new. Hart (1975), for instance, proposed a similar approach. Stating that not all "extraterrestrials must behave as we have" (p. 132), he nevertheless suggested that the historical fact of human colonization is likely to be found in at least one other species as well. However, since the galaxy was obviously not colonized yet, Hart infamously concluded that extraterrestrials do not exist.

Note the subtle difference between rationales like this and what we propose as exopsychological method. Theoretical works within SETI often rely on arguments that equate possibility with probability (Rescher, 1985): 'We show behavior X so all of them will do so too', respectively 'X possible and reasonable so some of them will do it for sure'. Although Hart (1975) eventually rejects the first one (not *all* extraterrestrials will colonize the universe), he nonetheless embraces the second argumentation by stating that if colonization as a behavioural principle emerges within a civilization, its members will swiftly and reliably transgress to the universe as well (Kuiper and Morris, 1977 employ a similar argumentation). This inadmissible anthropocentrism can be best described by propagating an "inevitable unilineal evolutionary track" based on the human example (Charbonneau, 2021, 83) and without further justification other than we displayed this behaviour. Exopsychology proceeds more cautiously. It is much more concerned with finding the psychological and environmental requirements, i.e. the condition of possibilities of a certain behaviour (Döbler and Raab, 2021). Doing so treats the human condition as one possible but not the sole possible configuration (Döbler and Raab, 2021). Some of our characteristics may indeed be universal, but using the fact that we exhibit them as the sole argument is not sufficient to draw this conclusion.

Instead, we must mind what we call the *extraplanetary gap*. We simply cannot assume that mental and behavioural processes that have been proven effective on Earth or any other celestial body produce the same beneficial outcomes in novel environments like space or other habitats of life (Dunér, 2011). That is, we need an additional theoretical framework to assess the connections between the evolutionary products on the surface of a celestial body and their manifestations beyond the same surface. Take, for example, space exploration. For *Homo sapiens*, it was argued to originate in the "human desire for exploration" (Dunér, 2011, 117). Indeed, exploration is a very typical human behaviour, and it is said to fulfil the fundamental need for competence-oriented interaction with the environment (Deci and Ryan, 2000) or be a critical component of understanding aesthetic preferences (Kaplan, 1987). However, since the relevant motivations and personality traits are not evenly distributed among humans (DeYoung, 2013), is this desire alone sufficient to propose human respectively extraterrestrial interstellar space exploration? Should we not be attentive to cultural and more contingent factors that can easily minimize conditional probabilities (see Rescher, 1985; Ashkenazi, 1995)? We should. Possibility is not probability.

Thus, a critical examination of the cultural fictions and influences we subject ourselves to when discussing and conducting SETI is needed (Charbonneau, 2021). As comprehensibly argued by Charbonneau (2021), this includes acknowledging our historical and situated perspective on the universality of human traits and concepts that further hinder generalizability. We should not reject the idea that some of our features may be universal. Still, identifying such requires more data and systematic analysis, which psychology can make an essential contribution to (Harrison, 1997).

Astrobiology hosts a vivid discussion about the potential inevitability of the emergence and trajectory of the evolution of life (e.g. De Duve, 2011; Morris, 2011; Schulze-Makuch and Bains, 2017). We find an akin line of strong deterministic thinking throughout all branches of historical SETI theory (Charbonneau, 2021). In hindsight, contingencies move to the background, and our technological and scientific development will always appear smooth, convenient and "inevitable" - too smooth (Rescher, 1985, p. 418) . Hence, care is urged when frivolously applying the same argument to psychology in general and exopsychology in particular. Post-hoc rationalization, systematic biases and constructive memory (see Summers, 2017; Oeberst and Imhoff, 2023) are only some aspects that make it hard to use historical knowledge to predict the future. These processes work together

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

so that past events appear *necessary* in the strongest sense, i.e. structured in a way that discards every possibility rather than the one that manifested (Žižek, 2014). We can, of course, contemplate the counterfactual. Still, our everyday behaviour and thinking are generally interwoven with our ideologically situated comprehension of the world, which retroactively posits the present as the inevitable result of the past (Žižek, 2008 [1989]). Aware of this constraint, exopsychology – when theorizing about the minds, behaviours and cultural ramifications of extraterrestrials – rarely discusses the coming inevitable. Instead of the allegedly unavoidable future, it is more concerned with the past because there, we can identify the requirements of the possibility and probability of the present and past and thus the conditions for the future.

Requirements for detection

Due to the reliance and importance of material products and technological transformations for our self-understanding as humans (Ihde and Malafouris, 2019; Döbler and Carbon, 2024), any reference to technology when we imagine the extraterrestrial and what we consider to be intelligence seems to be a trace of our self-understanding. However, we should not forget that non-technological extraterrestrial, i.e. beings whose activities do not produce what we would identify as technosignatures, may exist as well. Still, due to its reliance on technosignatures and other remotely detectable signals and structures, SETI paradigmatically filters species we can contact. Those who have historically exercised particular material abilities, which might be thought to have evolved in mutual association with cognitive abilities, are more likely to pass this filter. The exact mental configuration of these extraterrestrials remains unknown, but they are more likely to be identified as 'intelligent'.

Paradoxically, this seems to lead us to an old accusation against SETI: the reproach that it assumes that intelligence is tantamount to the ability to build a radio telescope (Mayr, 1985). However, since exopsychology rejects the label of 'intelligence' as rather useless for SETI (Döbler and Raab, 2021; Döbler and Carbon, 2023), we are able to dodge the bullet here. Yet, this does not mean that we can escape the fact that extraterrestrial capacities must be specifically configured to make it possible and sufficiently probable to exercise the behaviour that produces the outcomes our scientific instruments can recognize and which we can reliably attribute back to the originating agent.

Here, we slightly disagree with Sheikh and her assertion that a technosignature is always a technosignature, "regardless of whether it is perceptible or recognizable by human technologists" (Sheikh, 2021, 19).[8] Any indices of technological activity may be picked up by a species different from humans, rendering it a technosignature *for them*. Yet, since *we* are humans, indices of technological activity gain their ontological status as technosignature only once we have developed a practical understanding of the related terms, alongside the behavioural, cognitive and technological capacities to perceive them (Döbler and Carbon, 2023). This way, any sign of transformative engagement with the material environment can become a technosignature, given that our observational capabilities can identify them as such, and our scientific conclusions attribute them to technology.

Observing the technosignature is the starting point for inferring the hypothesized capabilities' actual presence. Since they are the condition of possibility for any contact, these capabilities must exist prior to any contact, even though they can only be validated post-contact (Döbler and Raab, 2021; Döbler and Carbon, 2023). The need for external human evaluation seems inevitable in any contact scenario that is meant to be successful. Yet, note how the concept of 'intelligence' is fundamentally produced and affirmed by the adherence to socially conveyed intraspecies normativity (Döbler and Raab, 2021; Döbler and Carbon, 2023). The proposed argument against intelligence goes as follows: one could argue that a reasonably general definition of intelligence is about successful problem-solving. However, such a position meets its limitations once we acknowledge that *our* problems and solutions are not universal and thus cannot serve as a criterion for assessing intelligence in an inter-species

[8]Sheikh's interdisciplinary informed work on technosignatures is impressive and provides a much needed theoretical framework for scrutinizing SETI's premises.

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

context. Moreover, as pointed out elsewhere, any living species on Earth has successfully solved the fundamental problems that challenge its survival (Raup, 1992). Championing a species-specific understanding of problems and intelligence may be suitable for an intraspecies hierarchy but then defeats the purpose of inter-species comparison in the universe. Cognition and agency, on the other hand, are largely dependent on self-defined, non-human rules, so operating with these concepts renders the extraterrestrial less dependent on the human and more suitable for interspecies comparison (Döbler and Raab, 2021; Döbler and Carbon, 2023). That is why we essentially affirm the technosignature definition by Sheikh (2021) and its non-reliance on intelligence. Therefore, we can rephrase and affirm the initial reproach as follows: exopsychology assumes that intelligence can only be ascribed once extraterrestrials have exercised their cognitive and agentic abilities in a way comprehensible to humans. Intelligence is the result of the first contact and not its requirement (Döbler and Carbon, 2023).

Still, SETI remains inherently limited by our technological capabilities, search strategies and employed concepts (Bradbury *et al*., 2011; Ćirković, 2013; Döbler, 2020; Döbler and Carbon, 2023). Since *we* are looking for *them*, we inevitably introduce a "human factor" (Döbler and Carbon, 2023), a variable that easily can lead us to deadlocked avenues of inquiryr (Rescher, 1985). Nevertheless, if sufficiently attuned to the divergences it can process and detect, the same factor, boiled down to the minimum of all specifications, can serve as a link between our minds and theirs (Döbler and Carbon, 2023). Since we have the cognitive capacities for meaningful interaction with the environment, including interaction with social agents, understanding them depends on us.

Here, we can and should certainly consider hypothetical beings within our Universe that are 'absolutely strange' to us and with whom there is no chance to establish contact (Schetsche, 2004; Schetsche *et al*., 2009). However, given the contemporary strategies, these beings will never produce the behavioural output SETI is looking for. Not because they are incapable of producing any behavioural output but because we fail to recognize the meaning of such (See Anton and Schetsche, 2023). The physical existence of these entities does, of course, not hinge on our recognition, but their existence *for us* does (Döbler and Raab, 2021). Extraterrestrials whose behaviorproduced a signal that is unrecognized by us will remain absolutely strange to us. By exploring the conditions of the human failure of recognition, exopsychology may be able to identify a broad space of possibilities for failure.

The how of exopsychology

If located within an overarching SETI agenda, psychology, through its specialized exopsychological descendent, can tune in to the interdisciplinary chorus that may boost SETI's success probability (Harrison and Elms, 1990; Döbler and Raab, 2021). Even the inevitable human factor is far from bad news. Instead, based on our example and scientific knowledge about life on Earth, it allows us to determine a range of configurations for human SETI to succeed. Imagine it a little like interstellar dating. We have a basic understanding of the traits needed to establish an essential compatibility for example, in terms of sensory access to the environment (Anton and Schetsche, 2015) or realization of its behavioral possibilites (Döbler and Carbon, 2023). Although the exact appearance, hobbies, character and so on are unknown, we know that, ultimately, they must be compatible with us. The key takeaway is that the human condition is equally linked to the success and failure of SETI. Anthropocentrism can be both an obstacle for SETI *and* a valuable tool. It is only reasonable to presuppose a certain level of compatibility. Without such, the extraterrestrial being remains beyond the brink of identification and interaction and, therefore 'absolutely strange' (Schetsche *et al*., 2009).

The compatibility requirements, therefore, refer to the requirements that (A) must be met for life to survive, (B) for eventually engaging in the type of behaviour that leads to the emergence of technosignatures and (C) the compatibility of their thinking and behaving with our method of search. If none of these are met, SETI cannot succeed (Döbler and Raab, 2021; Döbler and Carbon, 2023). Hence, the laconic answer to how we can do exopsychology is: 'by doing psychology'. This requires closely examining the tool we use to explore the extraterrestrial mind: humans.

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

Beliefs and fantasies matter

For SETI to be conducted and eventually succeed, humans must at least consider the possibility that life exists beyond Earth. Starting and maintaining the search, they must act *as if* the conditions of possibility for life and the emergence of technosignatures are actually given. SETI cannot be conducted from a pure agnostic and passive position. It requires active scientific exploration and empirical observation and, as such, must presuppose the possible existence of external events that can effect the observational setup and their reliable attribution to causing conditions (Radder, 2021). One might be consciously aware that this is a purely logical requirement and that our beliefs can change. Yet, presupposing that there is no life beyond Earth, renders conducting SETI senseless. Deliberately assigning a random probability to the possibility of extraterrestrials may express uncertainty, but effectively conducting SETI requires accepting that among the myriads of signals, we are able to detect some may and can indeed be traced back to the activity of extraterrestrials. This, of course, does neither tell us where they are, how many there are, nor what their activity will exactly look like.

Exploration of attitudes towards SETI and concrete representations pre-detection can not only help to enhance search strategies if necessary (Ćirković, 2013; Döbler, 2022) but also provide a preliminary information basis for the prediction of post-contact reactions. Recent works approached post-contact behaviour experimentally (Kwon *et al*., 2018) and narratively (Anton and Schetsche, 2023). Moreover, a series of investigations employ fictional extraterrestrials to experimentally explore the importance of varying properties for social perception among humans. This way, the importance of communal traits (Chu and Martin, 2021), gender (Martin and Mason, 2022) and moral conduct (Phillips, 2022) for the ascription of humanness to extraterrestrials was revealed. Nonetheless, these investigations are heuristically at best – the uncertainty is too great because we neither know how exactly the other will be nor how and if the contact will be established.

In fact, SETI is a scientific project that must deal with a lot of uncertainty – starting from where to look (for an overview of possible locations, see Isaacson *et al*., 2017) over how to look (Ćirković, 2013) to what to look for (Bradbury *et al*., 2011). Even the underlying aspects remain unclear, as we – even on Earth – lack a definitive definition of 'life' (Cleland and Chyba, 2002; cf. Irwin and Schulze-Makuch, 2020) and 'intelligence' (Legg and Hutter, 2007; Cocodia, 2014). Very basically, SETI can be understood as determining whether galactic information indicates the mere presence of an object or is related to the activity of an identified subject. The status latter is not tantamount to the presence of an agent but the result of a scientifically informed process of ascribing interactional capabilities (see Schetsche, 2004; Schetsche *et al*., 2009). Hence, reduced to the bare minimum, SETI is looking for *something done by somebody*. There are many different ideas about who the somebody is and why they did what they did. The point is, however, that there is a limited discussion about the comprehensive range of the psychological requirements, implications and presumptions of elevating something done by somebody to statements like 'there are extraterrestrial probes in the solar system investigating Earth' (see Benford, 2019).

Nevertheless, the various SETI projects approach this paradigm very pragmatically. The fact that it is conducted tells us that the involved scientists submitted themselves to some notions and that these are motivationally sufficient. Even looking for objective evidence of their activity, they implicitly make statements about the extraterrestrial mind and their behaviour (Döbler and Raab, 2021).

This again chains the extraterrestrial to us. The idea of the former is what we are looking for, an observation most beautifully brought to paper by Stanislaw Lem in his 1961 novel *Solaris*:

> We don't want to conquer the cosmos, we simply want to extend the boundaries of Earth to the frontiers of the cosmos. … We are humanitarian and chivalrous; we don't want to enslave other races, we simply want to bequeath them our values and take over their heritage in exchange. We think of ourselves as the Knights of the Holy Contact. This is another lie. We are only seeking Man. We have no need of other worlds. We need mirrors. We don't know what to do with other

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

> worlds. A single world, our own, suffices us; but we can't accept it for what it is. We are searching for an ideal image of our own world: we go in quest of a planet, of a civilization superior to our own but developed on the basis of a prototype of our primeval past. (Lem, 2002 [1961], 72)[9]

It should be clear by now that we do not fully share the pessimistic undertone of this quote but rather conceive a healthy amount of anthropocentrism as necessary for the success of SETI. However, this does not mean that we should leave our presumptions unchallenged. Such a challenge needs the scientific dissection of held beliefs and manifested presumptions. From a psychometric perspective, this includes the identification of psychological determinants of the belief in extraterrestrials (e.g. Routledge *et al*., 2017; Döbler *et al*., 2023), as well as a descriptive account of its structure (e.g. Swami *et al*., 2009, 2011; Bainbridge, 2011; Dagnall *et al*., 2011) and prevalence (e.g. Pettinico, 2011; Persson, 2012; Chon-Torres *et al*., 2020).

These studies are more concerned with the individual level. However, this bears the risk of neglecting the overarching cultural and historical perspective. The presumptions cultivated there will not only determine whether but also how the search is conducted. Belief in extraterrestrials can be upheld in partial disconnect from SETI's success but, at the same time, can steer this scientific project into more or less promising grounds. The pop cultural influence on and for the manifestation of these beliefs and representation cannot be overstated and has been discussed many times (e.g. Engelbrecht, 2008; Hurst, 2008; Wright and Oman-Reagan, 2018; Micali, 2019; Anton and Schetsche, 2023). Here, the interdisciplinary work highlighting the cultural and historical embedding of science is invaluable for SETI (e.g. Denning, 2011; Traphagan and Traphagan, 2015; Charbonneau, 2021; Traphagan, 2021). Overall, the role of science fiction remains ambiguous. On the one hand, it reproduces beliefs and conceptualizations that have little to nothing to do with how SETI is actually conducted but can also provide a productive space for meta-discussions about the meaning of space exploration and humanity's stance in the cosmos (Wright and Oman-Reagan, 2018). If we are really interested in how people think about extraterrestrials, then we must also recognize the following:

> Just as Orientalism produced formative imaginative geographies, SETI also created a mental playground, an 'imaginative cosmos,' in which astronomers could superimpose their cultural fantasies and predictions of an exotic other which may or may not exist. … The extraterrestrial is the ultimate Odalisque, a vision of possibilities upon which SETI scientists could project their desires and fantasies, and as we shall see, as with the Odalisque, SETI scientists' strategies often reflected common assumptions about power and gender. (Charbonneau, 2021, 81)

Charbonneau further elaborates that thinking about extraterrestrials often employs a notion of cultural evolution that propagates a particular steady telos towards perpetuating technological progress. The impact of this fantasy is manifold. Benevolently, it projects the possibility of a bright future ahead of us: 'If all civilizations develop the capabilities of interstellar travel, why should we be exempt?' But it can also hint at the possibility of technological self-destruction in the near future (see Lemarchand, 2004; Lemarchand and Lomberg, 2011).

Consistent extraterrestrial technological progress is often intertwined with the fantasy of the benevolent space messiah or the malicious space conquerors. These particular fantasies are tangibly manifested in the various cultural portrayals of the extraterrestrial trope (Ruppersburg, 1987; Hurst, 2008; Micali, 2019). Moreover, they can be found within the idea of 'ancient aliens', the theory that past visitations of extraterrestrials have significantly influenced human cultural development or even created the human species (for an overview and critical appraisal, see Jüdt, 2008). We can further find their workings in the mainstream SETI discourse, for instance, in the *Zoo-hypothesis*, which suggests that the perimeter around Earth and the planet itself was demarked as a no-interaction zone (the Zoo), and extraterrestrials are thus monitoring our activity (e.g. Ball, 1973), the idea of a galactic community of morally mature

[9]Micali (2019) discusses this quote and the conveyed idealization of the extraterrestrial from a literature perspective.

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

civilizations with restrictive terms of membership (e.g. Kuiper and Morris, 1977), or the arguments against active messaging extraterrestrials, due to the possibility provoking a hostile reaction (e.g. Vakoch, 2017; Jebari and Olsson-Yaouzis, 2018). Even a religious motive, in the shape of creationism or phantasmatic omnipotence, may sneak into the debate. The hypothesis of 'directed panspermia', for instance, denotes the possibility that life was planted (created?) on Earth by extraterrestrials (Crick and Orgel, 1973). In addition, physicist John D. Barrow (1999) discussed the possibility of so-called Type Ω civilizations that are capable of manipulating the universe down to the fabric of space and time. Some would be inclined to call such beings divine. The extent to which SETI resembles a 'religious quest' (Michaud, 2007) depends largely on the attributed properties and the assumed relationship of their carriers to us. Analysing these attributions is not a sole matter of physical possibility but also concerns the functional role within the landscape of human imagination and fantasy.

This is perfectly exemplified by the recently emerging debates about the origin of unidentified aerial phenomena (UAPs – formerly known as UFOs: unidentified flying objects). We do not want to go into much detail about the different possibilities and general discourse. Further, note that SETI and UAPs are not necessarily connected. For a brief overview of the general phenomenon, see Yingling *et al*. (2023) or Anton and Vugrin (2022). We also do not want to discuss whether some of these phenomena are indeed signs of extraterrestrial activity. Instead, we want to focus on a specific question: Why do some humans want or do not want UAPs to be factual extraterrestrials? Why are they not satisfied with weather or military-based explanations or explicitly precluding the possibility of the extraterrestrial? On the affirmative side, results from Routledge *et al*. (2017) suggested that believing that UAPs are extraterrestrials is positively associated with a lack of personal meaning. Littig (1971) found a positive correlation between affiliation motivation and the affirmation of the statement that UAPs are from outer space. Evaluating why some deny that UAPs are extraterrestrials, Wendt and Duvall (2008) proposed that by lifting the so-called "UFO taboo" and taking this possibility into consideration, state governments undermine their political claim on what Wendt and Duvall call anthropocentric sovereignty.

Mind the comments by Charbonneau (2021) on how extraterrestrials are intermingled with the projection of desires and how the issue of contact is a generay topic of myths and ancient tales (Denning, 2011). Moreover, note how prevalent tropes in the fictional and scientific discourse often revolve around well-known psychological anxieties like "cultural desintegration," "physical annihilation" destruction (Anton and Schetsche, 2015, p. 37, own translation). After all, the hypothetical confrontation with highly capable extraterrestrials directly touches upon the possibility of experiencing a novel 'narcissistic injury of humanity' (Freud, 1920), a possibility linked to a possible disastrous outcomes for our self-conception (Anton and Schetsche, 2015).

Keeping this in mind and following a cultural application of Lacanian psychoanalysis, as prominently conducted by Slovenian philosopher Slavoj Žižek, we may identify reasons for the prevalent fantasy of the benevolent/malicious extraterrestrials that found their way from cultural depiction into the scientific discourse. This is meant as a simplified reading of Žižek's approach to Lacan. It shall serve the purpose of getting an improved understanding of the mechanisms that may render the extraterrestrial Other the canvas for our desires and fantasies. Even if exopsychology can identify some guiding stones of the extraterrestrial condition, their motivations and especially their potential attitudes towards us remain a mystery. We can use contemporary science to approximate the prevalence of life in the universe (e.g. Westby and Conselice, 2020; Snyder-Beattie *et al*., 2021; Song and Gao, 2022). Yet, suppose they exist; we neither know what they want from us nor if they recognize and value our mental abilities the same way as we do (Szocik and Abylkasymova, 2022). Hence, it may be fruitful to examine how the different fantasies of extraterrestrials, from cruel conquerors over neutral chatbots to friendly aliens from the neighbourhood, all serve as an answer to the impenetrable motives of the Other. Functionally speaking with Lacan, fantasy is meant to cope with the unbearable fact that the so-called *desire of the Other* remains forever hidden from us; that we have no conclusive answer to what Lacan calls "*Che vuoi?"* (What do you want?) and that we are "incapable of translating this desire of the Other into a positive interpellation, into a mandate with which to identify" (Žižek, 2008

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

[1989], p. 128). The necessity to answer this question emerges from the need for identification, of fixating our relationship with the Other and thus avoiding the anxiety of not knowing what we are for them (Žižek, 2008 [1989]). Imagine a dating situation where you are highly interested in continuing and advancing towards a romantic relationship. Is not the most stressful part to bear the uncertainty of not knowing what you are for the Other; what they want from you?

The interesting twist now is that the Other in SETI is a non-observed one. Still, SETI addresses one concrete version of this Other. How is this possible? We again find a solution if we understand that the pre-contact extraterrestrials might have:

> the status of an object in the Lacanian sense. Why? Because it [(the extraterrestrial)] is an object produced by the signifying texture itself. It is a kind of object that came to exist as a result of all the fuss about it. … The paradox, then, is that the process of searching itself *produces* the object which *causes* it: an exact parallel to Lacanian desire which produces its own object-cause. (Žižek, 2008 [1989], 180 italics from the original)

This means that all the conceptual and pragmatic presumptions that make the SETI possible in the first place (intelligence, technology, etc.) create an Other that, by definition, is at the brink of intersubjective comprehension but to which we nevertheless attribute interactive abilities (Schetsche *et al*., 2009). In a circular movement, then, our attempts to understand what we have created posit the alleged desire of the Other in a way that either affirms (they are benevolent) or counteracts (they want to destroy us) the search for them. Consequently, sustaining or aborting the search then affirms these ascriptions. Hence, statements about the attitude of extraterrestrials towards us are, foremost, *our* answer to *our* fantasy of the alien, both emerging from *our* incapability to tolerate the uncertain. They first manifest in cultural depictions, but since extraterrestrials are also the matter for a legitimate scientific effort, both spheres bleed into each other. Actively looking for something other than humans, SETI is paradigmatically xenophile. Yet, since *they* are expected to communicate with *us*, SETI is also somewhat xenophobic, in the sense that the Other and their desire shall better not be too strange.[10] Some explanations of why we have not made first contact yet may be seen as an attempt to process the unbearable "great silence"(Brin, 1983). An answer to the question about the motives of the Other. Some of us want contact, but why does the Other not feel the same?

This brings us closer to why we should be concerned with exopsychology in the first place. The more common but no less true answer is that SETI and all the scientific disciplines involved, regardless of future success, promote self-reflection and thus understanding of humanity's place in the universe (Kuiper and Morris, 1977; Harrison, 1997; Döbler and Raab, 2021). A more provocative answer would be: 'Because we can!' It is rather irritating when scientific work is criticized solely based on its investigative subject. After all, judgement about the relevance of the latter can be highly subjective. Why should I care about some nebulas thousands of lightyears away? What is the matter with some atoms colliding in a billion-dollar apparatus when I cannot pay my bills?

But suppose we affirm that science and psychology are valuable and honourable practices. In that case, the fact that humans think about extraterrestrials leads us to the even more provocative and final answer: 'Because we have no choice!' Once the idea of the extraterrestrial other was formulated, we could not return anymore. Psychologically speaking, first contact occurred the moment humans started to imagine extraterrestrial worlds and fantasize about their inhabitants (Döbler and Raab, 2021). But the implications of the general premise are too strange; fearing the unknown is too primary (Carleton, 2016). It indeed seems like that the Other must be a twisted version of our know features to be comprehensible (Micali, 2019): the often bemoaned metaphorical distorted view into the mirror (e.g. Harrison, 1993; Anton and Schetsche, 2015). When investigating the whole landscape of psychological phenomena, psychology must, therefore, confront the fact that people look in this mirror while also addressing why they are so fascinated doing so. This can help so that the type of compatibility we

[10]This observation was brought forward by Jonah Lutz who kindly allowed us to use it.

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

try to create is informed by an honest acknowledgement of our limitations, biases and the astrophysical and -biological reality rather than being ultimately captured by an imaginary Other that serves no function other than confronting ourselves with ourselves.

Even if publication opportunities are rare and the scientific sub-community is tiny, psychology would be well advised not to exclude certain areas from its research from the outset just because related research reduces career opportunities or the prospect of third-party funding. A psychology that takes its subjects and practitioners seriously must examine the idea of extraterrestrials with the same seriousness as any other idea. A psychology that is open to scientific insight must not shy away from contrasting its theories against the whole landscape of the environmental conditions, including outer space (Döbler and Raab, 2021). A kind of psychology genuinely interested in interdisciplinary collaboration cannot afford to ignore astrobiology and -physics. In addition, all other disciplines should not think that SETI is possible without reference to psychology.

Conclusion

This article elaborates on methodological and paradigmatical aspects of exopsychology. Finding and contacting extraterrestrials requires a certain compatibility between them and us (Döbler, 2020; Döbler and Raab, 2021; Döbler and Carbon, 2023). Like others (e.g. Dunér, 2019), we argue that a certain level of embodied activity in interaction with a permissive environment is the *sine qua non* for the behavior that can produce remotely detectable technosignatures. It is further argued that this sort of activity can bring forth cognitive patterns comparable between extraterrestrials and humans. When thinking about extraterrestrials, we must be attentive to our human bias in two ways. First, we must be aware of its existence, and second, we must concede that completely eliminating the same bias is impossible. Emerging from this tension, we find research opportunities, as well as the possibility for enhanced self-understanding.

Without a first contact, the specificity of statements is highly constrained. However, this does not prevent laypersons or scientists from dwelling on the sheer extraterrestrial possibilities. Those sceptical of the "disciplined speculation" proposed by Harrison and Elms (1990) within the exopsychological agenda may nevertheless agree that exploring the structure and content of the respective human beliefs is very much within empirical reach. These beliefs are linked to SETI's chance of successfully finding extraterrestrial life, as well as a reaction from 'The Other Side' in case of a factual first contact. At the same time, these beliefs and the postulated strangeness posit the qualities of ourselves to which the other is alien (Engelbrecht, 2008). Exopsychology is, therefore, directly linked to (human) psychology, human self-conception – It helps to approximate the human mind, which seems not satisfied by the Earth but desires the extraterrestrial. Within this endeavour, the final and most important yet currently unanswered questions are if there really is someone outside who did anything and, if yes, whether *we* can identify this anything as something.

Acknowledgements. We thank Jonah Lutz and Thomas Kollmann for their input. We would also like to thank the anonymous reviewers whose comments helped to enhance the quality of this text.

Author contributions. NAD.: writing – original draft; conceptualization and writing – revision. CCC: writing – original draft; supervision; writing revision – editing and suggestions.

Competing interests. None.

References

Anton A and Schetsche M (2015) Anthropozentrische Transterrestrik [Anthropocentric transterrestrics]. *Journal of Anomalistics/Zeitschrift für Anomalistik* **15**, 21–46.

Anton A and Schetsche M (2023) *Meeting the Alien: An Introduction to Exosociology.* Wiesbaden: Springer VS.

Anton A and Vugrin F (2022) 'UFOs exist and everyone needs to adjust to that fact.' (Dis)information campaigns on the UFO phenomenon. *Journal of Anomalistics/Zeitschrift für Anomalistik* **22**, 18–35.

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press

Ashkenazi M (1995) Will ETI be space explorers? Some cultural considerations. In Shostak S (ed.), Progress in the Search for Extraterrestrial Life: Proceedings of the Bioastronomy Symposium 1993 Santa Cruz, California. 507–517.
Bainbridge WS (2011) Cultural beliefs about extraterrestrials: a questionnaire study. In Vakoch DA and Harrison AA (eds), *Civilizations beyond Earth: Extraterrestrial Life and Society*. New York; Oxford: Berghahn Books, pp. 118–140.
Baird JC (1987) *The Inner Limits of Outer Space*. Hanover, London: University Press of New England.
Ball JA (1973) The zoo hypothesis. *Icarus* **19**, 347–349.
Barandiaran XE, Di Paolo E and Rohde M (2009) Defining agency: individuality, normativity, asymmetry, and spatio-temporality in action. *Adaptive Behavior* **17**, 367–386.
Barrow JD (1999) *Impossibility: the Limits of Science and the Science of Limits*, Pbk. Edn. New York: Oxford University Press.
Benford J (2019) Looking for lurkers: co-orbiters as SETI observables. *The Astronomical Journal* **158**, 150.
Bradbury RJ, Ćirković MM and Dvorsky G (2011) Dysonian approach to SETI: a fruitful middle ground? *Journal of the British Interplanetary Society* **64**, 156–165.
Brin GD (1983) The 'Great Silence': the controversy concerning extraterrestrial intelligent life. *Quarterly Journal of the Royal Astronomical Society* **24**, 283–309.
Carleton RN (2016) Fear of the unknown: one fear to rule them all? *Journal of Anxiety Disorders* **41**, 5–21.
Catling DC, Krissansen-Totton J, Kiang NY, Crisp D, Robinson TD, DasSarma S, Rushby AJ, Del Genio A, Bains W and Domagal-Goldman S (2018) Exoplanet biosignatures: a framework for their assessment. *Astrobiology* **18**, 709–738.
Charbonneau R (2021) Imaginative cosmos: the impact of colonial heritage in radio astronomy and the search for extraterrestrial intelligence. *American Indian Culture and Research Journal* **45**, 71–94.
Chon-Torres OA, Ramos Ramírez JC, Hoyos Rengifo F, Choy Vessoni RA, Sergo Laura I, Ríos-Ruiz FGA, Murga-Moreno CA, Alvarado Pino JPL and Yance-Morales X (2020) Attitudes and perceptions towards the scientific search for extraterrestrial life among students of public and private universities in Peru. *International Journal of Astrobiology* **19**, 360–368.
Chu C and Martin AE (2021) The primacy of communality in humanization. *Journal of Experimental Social Psychology* **97**, 104224.
Ćirković MM (2013) Who are the SETI sceptics? *Acta Astronautica* **89**, 38–45.
Cleland CE and Chyba CF (2002) Defining 'life'. *Origins of Life and Evolution of the Biosphere* **32**, 387–393.
Cocodia EA (2014) Cultural perceptions of human intelligence. *Journal of Intelligence* **2**, 180–196.
Crick FHC and Orgel LE (1973) Directed panspermia. *Icarus* **19**, 341–346.
Dagnall N, Drinkwater K and Parker A (2011) Alien visitation, extra-terrestrial life, and paranormal beliefs. *Journal of Scientific Exploration* **25**, 699–720.
Deci EL and Ryan RM (2000) The 'what' and 'why' of goal pursuits: human needs and the self-determination of behavior. *Psychological Inquiry* **11**, 227–268.
De Duve C (2011) Life as a cosmic imperative? *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* **369**, 620–623.
Denning K (2011) Is life what we make of it? *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* **369**, 669–678.
DeYoung CG (2013) The neuromodulator of exploration: a unifying theory of the role of dopamine in personality. *Frontiers in Human Neuroscience* **7**. https://doi.org/10.3389/fnhum.2013.00762
Di Paolo E (2005) Autopoiesis, adaptivity, teleology, agency. *Phenomenology and the Cognitive Sciences* **4**, 429–452.
Döbler NA (2020) The concept of developmental relativity: thoughts on the technological synchrony of interstellar civilizations. *Space Policy* **54**, 101391.
Döbler NA (2022) Where will they be: hidden implications of solutions to the Fermi paradox. *International Journal of Astrobiology* **21**(4), 200–204. https://doi.org/10.1017/S147355042200012X
Döbler NA and Carbon C-C (2023) Affordances in outer space: forms of life, material engagement, and meaning within space exploration and SETI. *Acta Astronautica* **210**, 350–363.
Döbler NA and Carbon C-C (2024) Adapting ourselves, instead of the environment: an inquiry into human enhancement for function and beyond. *Integrative Psychological and Behavioral Science* **58**, 589–637.
Döbler NA and Raab M (2021) Thinking ET: a discussion of exopsychology. *Acta Astronautica* **189**, 699–711.
Döbler NA, El Amri Y and Carbon C-C (2023) Is there anybody out there? Can individual loneliness, need for closure, and religiosity predict the belief in extraterrestrial life and intelligence? *Discover Psychology* **3, 21**. https://doi.org/10.1007/s44202-023-00076-4
Dunér D (2011) Astrocognition: prolegomena to a future cognitive history of exploration. In Landfester U, Remuss N-L, Schrogl K-U, and Worms J-C (eds), *Humans in Outer Space – Interdisciplinary Perspectives*, Vol. **5**. Wien: Springer-Verlag, pp. 117–140.
Dunér D (2019) Mind in the universe: on the origin, evolution, and distribution of intelligent life in space. In Kolb VM (ed.), *Handbook of Astrobiology*. Boca Raton: CRC Press, pp. 701–716.
Engelbrecht M (2008) Von aliens erzählen [Telling about aliens]. In Schetsche M and Engelbrecht M (eds), *Von Menschen und Ausserirdischen: Transterrestrische Begegnungen im Spiegel der Kulturwissenschaft [About Humans and Extraterrestrials: Transterrestric Encounters in the Mirror of Cultural Science]*. Bielefeld: Transcript Verlag, pp. 13–29.
Freitas RA (1984) Xenopsychology. *Analog Science Fiction/Science Fact* **104**, 41–53.
Freud S (1920) One of the difficulties of psycho-analysis. *International Journal of Psychoanalysis* **1**, 17–23.

Harrison AA (1993) Thinking intelligently about extraterrestrial intelligence: an application of living systems theory. *Behavioral Science* **38**, 189–217.
Harrison AA (1997) *After Contact: The Human Response to Extraterrestrial Life*. New York: Plenum Press.
Harrison AA and Elms AC (1990) Psychology and the search for extraterrestrial intelligence. *Behavioral Science* **35**, 207–218.
Hart MH (1975) An explanation for the absence of extraterrestrials on Earth. *Quarterly Journal of the Royal Astronomical Society* **16**, 128–135.
Hochner B (2012) An embodied view of octopus neurobiology. *Current Biology* **22**, R887–R892.
Hurst M (2008) Dialektik des aliens: darstellungen und interpretationen von ausserirdischen in film und fernsehen [Dialectics of the alien: portrayals and interpretations of extraterrestrials in cinema and TV]. In Schetsche M and Engelbrecht M (eds), *Von Menschen und Ausserirdischen: Transterrestrische Begegnungen im Spiegel der Kulturwissenschaft [About Humans and Extraterrestrials: Transterrestric Encounters in the Mirror of Cultural Science]*. Bielefeld: Transcript Verlag, pp. 31–53.
Ihde D and Malafouris L (2019) Homo faber revisited: postphenomenology and material engagement theory. *Philosophy & Technology* **32**, 195–214.
Irwin LN and Schulze-Makuch D (2020) The astrobiology of alien worlds: known and unknown forms of life. *Universe* **6**, 130. https://doi.org/10.3390/universe6090130
Isaacson H, Siemion APV, Marcy GW, Lebofsky M, Price DC, MacMahon D, Croft S, DeBoer D, Hickish J, Werthimer D, Sheikh S, Hellbourg G and Enriquez JE (2017) The *Breakthrough Listen* search for intelligent life: target selection of nearby stars and galaxies. *Publications of the Astronomical Society of the Pacific* **129**, 054501.
Jebari K and Olsson-Yaouzis N (2018) A game of stars: active SETI, radical translation and the Hobbesian trap. *Futures* **101**, 46–54.
Jüdt I (2008) Aliens im kulturellen gedächtnis? Die projektive rekonstruktion der vergangenheit im diskurs der präastronautik [Aliens in the cultural memory? The projective reconstruction of the past within the discourse of ancient astronauts]. In Schetsche M and Engelbrecht M (eds), *Von Menschen und Ausserirdischen: Transterrestrische Begegnungen im Spiegel der Kulturwissenschaft [About Humans and Extraterrestrials: Transterrestric Encounters in the Mirror of Cultural Science]*. Bielefeld: Transcript Verlag, pp. 81–103.
Kaplan S (1987) Aesthetics, affect, and cognition: environmental preference from an evolutionary perspective. *Environment and Behavior* **19**, 3–32.
Kirsh D (1996) Adapting the environment instead of oneself. *Adaptive Behavior* **4**, 415–452.
Kiverstein J (2012) The meaning of embodiment. *Topics in Cognitive Science* **4**, 740–758.
Kuiper TBH and Morris M (1977) Searching for extraterrestrial civilizations: the search for extraterrestrial intelligence should begin by assuming that the galaxy has been colonized. *Science (New York, N.Y.)* **196**, 616–621.
Kwon JY, Bercovici HL, Cunningham K and Varnum MEW (2018) How will we react to the discovery of extraterrestrial life? *Frontiers in Psychology* **8**, 2308.
Leary T (1977) *Exo-Psychology: A Manual on the Use of the Human Nervous System According to the Instructions of the Manufacturers, Limited First Edition*. Los Angeles, Cal: Starseed/Peace Press Inc.
Legg S and Hutter M (2007) A collection of definitions of intelligence. In Goertzel B and Wang P (eds), *Advances in Artificial General Intelligence: Concepts, Architectures and Algorithms*, Vol. **157**. Amsterdam, Washington: IOS Press, pp. 17–24.
Lem S (2002) *Solaris, Kilmartin J and Cox S (Trans)*. San Diego: Harcourt Brace & Co, Original work published 1961.
Lemarchand GA (2004) The Technological Adolescent Age Transition: A Boundary to Estimate the Last Factor of the Drake Equation. 213, 460. Presented at the Bioastronomy 2002: Life Among the Stars.
Lemarchand GA and Lomberg J (2011) Communication among interstellar intelligent species: a search for universal cognitive maps. In Vakoch DA (ed.), *Communication with Extraterrestrial Intelligence*. Albany, NY: State of New York Press, pp. 371–395.
Littig LW (1971) Affiliation motivation and belief in extraterrestrial UFOs. *The Journal of Social Psychology* **83**, 307–308.
Lockley A and Visioni D (2021) Detection of pre-industrial societies on exoplanets. *International Journal of Astrobiology* **20**, 73–80.
Malafouris L (2013) *How Things Shape the Mind: A Theory of Material Engagement*, First MIT Press Paperback Edition. Cambridge, MA: The MIT Press.
Martin AE and Mason MF (2022) What does it mean to be (seen as) human? The importance of gender in humanization. *Journal of Personality and Social Psychology* **123**, 292–315.
Maturana HR and Varela FJ (1987) *Der Baum der Erkenntnis [The Tree of Knowledge]*. Bern, Munich: Scherz.
Mayr E (1985) The probability of extraterrestrial intelligent life. In Regis E (ed.), *Extraterrestrials: Science and Alien Intelligence*. Cambridge: Cambridge University Press, pp. 23–30.
Micali S (2019) *Towards a Posthuman Imagination in Literature and Media: Monsters, Mutants, Aliens, Artificial Beings*. Oxford: Peter Lang.
Michaud MAG (2007) *Contact with Alien Civilizations: Our Hopes and Fears about Encountering Extraterrestrials*. New York, NY: Springer New York. https://doi.org/10.1007/978-0-387-68618-9
Miller JG (1965) Living systems: basic concepts. *Behavioral Science* **10**, 193–237.
Morris SC (2011) Predicting what extra-terrestrials will be like: and preparing for the worst. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* **369**, 555–571.

Oeberst A and Imhoff R (2023) Toward parsimony in bias research: a proposed common framework of belief-consistent information processing for a set of biases. *Perspectives on Psychological Science* **18**(4), 1464–1487. https://doi.org/10.1177/17456916221148147

Persson E (2012) The moral status of extraterrestrial life. *Astrobiology* **12**, 976–984.

Pettinico G (2011) American attitudes about life beyond earth: beliefs, concerns, and the role of education and religion in shaping public perceptions. In Vakoch DA and Harrison AA (eds), *Civilizations Beyond Earth: Extraterrestrial Life and Society*. New York, Oxford: Berghahn Books, pp. 102–117.

Phillips B (2022) 'They're not true humans': beliefs about moral character drive denials of humanity. *Cognitive Science* **46**, e13089.

Radder H (2021) Empiricism must, but cannot, presuppose real causation. *Journal for General Philosophy of Science* **52**, 597–608.

Raup DM (1992) Nonconscious intelligence in the universe. *Acta Astronautica* **26**, 257–261.

Rescher N (1985) Extraterrestrial science. In Regis E (ed.), *Extraterrestrials: Science and Alien Intelligence*. Cambridge: Cambridge University Press, pp. 83–116.

Routledge C, Abeyta AA and Roylance C (2017) We are not alone: the meaning motive, religiosity, and belief in extraterrestrial intelligence. *Motivation and Emotion* **41**, 135–146.

Ruppersburg H (1987) The alien Messiah in recent science fiction films. *Journal of Popular Film and Television* **14**(4), 158–166. https://doi.org/10.1080/01956051.1987.9944222

Schetsche M (2004) Der maximal fremde – Eine hinführung [The strangest stranger – an introduction]. In Schetsche M (ed). *Der maximal Fremde. Begegnungen mit dem Nichtmenschlichen und die Grenzen des Verstehens [The Strangest Stranger. Encounters with the Non-human and the Limitations of Understanding]*. Würzburg: ERGON Verlag, pp. 14–21.

Schetsche M and Anton A (2019) *Die Gesellschaft der Außerirdischen: Einführung in die Exosoziologie [Meeting the Alien: An Introduction to Exosociology]*. Berlin: Springer-Verlag.

Schetsche M, Gründer R, Mayer G and Schmied-Knittel I (2009) Der maximal Fremde. Überlegungen zu einer transhumanen Handlungstheorie [The strangest stranger. Thoughts on a transhuman agency theory]. *Berliner Journal für Soziologie* **19**, 469–491.

Schulze-Makuch D and Bains W (2017) *The Cosmic Zoo: Complex Life on Many Worlds*. Cham: Springer.

Sheikh SZ (2020) Nine axes of merit for technosignature searches. *International Journal of Astrobiology* **19**, 237–243.

Sheikh SZ (2021) *Observational and Theoretical Studies of Radio Technosignatures and Pulsars*. Doctoral Thesis, Penn State University. Available at https://www.proquest.com/docview/2577490180?pq-origsite=gscholar&fromopenview=true

Smith S, Price DC, Sheikh SZ, Czech DJ, Croft S, DeBoer D, Gajjar V, Isaacson H, Lacki BC, Lebofsky M, MacMahon DHE, Ng C, Perez KI, Siemion APV, Webb CI, Drew J, Worden SP and Zic A (2021) A radio technosignature search towards Proxima Centauri resulting in a signal of interest. *Nature Astronomy* **5**, 1148–1152. https://doi.org/10.1038/s41550-021-01479-w

Snyder-Beattie AE, Sandberg A, Drexler KE and Bonsall MB (2021) The timing of evolutionary transitions suggests intelligent life is rare. *Astrobiology* **21**, 265–278.

Socas-Navarro H, Haqq-Misra J, Wright JT, Kopparapu R, Benford J and Davis R (2021) Concepts for future missions to search for technosignatures. *Acta Astronautica* **182**, 446–453.

Song W and Gao H (2022) The number of possible CETIs within our galaxy and the communication probability among these CETIs. *The Astrophysical Journal Letters* **928**, 142.

Summers JS (2017) *Post hoc ergo propter hoc* : some benefits of rationalization. *Philosophical Explorations* **20**, 21–36.

Swami V, Furnham A, Haubner T, Stieger S and Voracek M (2009) The truth is out there: the structure of beliefs about extraterrestrial life among Austrian and British respondents. *The Journal of Social Psychology* **149**, 29–43.

Swami V, Pietschnig J, Stieger S and Voracek M (2011) Alien psychology: associations between extraterrestrial beliefs and paranormal ideation, superstitious beliefs, schizotypy, and the Big Five personality factors. *Applied Cognitive Psychology* **25**, 647–653.

Szocik K and Abylkasymova R (2022) If extraterrestrial intelligence exists, it is unable to recognize humans as intelligent beings. *International Journal of Astrobiology* **21**, 462–468.

Tarter J (2001) The search for extraterrestrial intelligence (SETI). *Annual Review of Astronomy and Astrophysics* **39**, 511–548.

Tennie C, Call J and Tomasello M (2009) Ratcheting up the ratchet: on the evolution of cumulative culture. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* **364**, 2405–2415.

Traphagan JW (2021) Should we lie to extraterrestrials? A critique of the voyager golden records. *Space Policy* **57**, 101440.

Traphagan JW and Traphagan JW (2015) SETI in non-western perspective. In Dick SJ (ed.), *Impact of Discovering Life Beyond Earth*. Cambridge: Cambridge University Press, pp. 299–307.

Vakoch DA (2017) Hawking's fear of an alien invasion may explain the Fermi Paradox. *Theology and Science* **15**, 1–5.

Virenque L and Mossio M (2024) What is agency? A view from autonomy theory. *Biological Theory* **19**, 11–15. https://doi.org/10.1007/s13752-023-00441-5

Wendt A and Duvall R (2008) Sovereignty and the UFO. *Political Theory* **36**, 607–633.

Westby T and Conselice CJ (2020) The astrobiological Copernican weak and strong limits for intelligent life. *The Astrophysical Journal* **896**, 58.

Wilson M (2002) Six views of embodied cognition. *Psychonomic Bulletin & Review* **9**, 625–636.

Wright JT and Oman-Reagan MP (2018) Visions of human futures in space and SETI. *International Journal of Astrobiology* **17**, 177–188.

Wright JT, Sheikh SZ, Almár I, Denning KE, Dick SJ and Tarter JC (2018) Recommendations from the Ad Hoc Committee on SETI Nomenclature. Available at https://arxiv.org/ftp/arxiv/papers/1809/1809.06857.pdf

Yingling ME, Yingling CW and Bell BA (2023) Faculty perceptions of unidentified aerial phenomena. *Humanities and Social Sciences Communications* **10**, 246.

Ziemke T (2003) What's that thing called embodiment. *Proceedings of the Annual Meeting of the Cognitive Science Society* **25**, 1305–1310.

Žižek S (2008) *The Sublime Object of Ideology*. London: Verso, Original work published 1989.

Žižek S (2014) *Event: Philosophy in Transit*. London: Penguin Books.

https://doi.org/10.1017/S1473550424000156 Published online by Cambridge University Press