

Thinking ET: A discussion of exopsychology

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ABSTRACT

Despite lacking scientific proof, thinking about extraterrestrials and extraterrestrial intelligence is part of our psychological reality. It is often stated that cultural and scientific reception and representation of these strange entities suffer from anthropocentric bias. To profoundly investigate such bias and the minds of extraterrestrials, we propose a revised definition for the psychological discipline called “exopsychology.” We define exopsychology as a sub-discipline of psychology, which investigates the cognition, behavior, affects, and motives of extraterrestrial agents and their human-specific representation. It is argued that the concept of intelligence is not suited for application in SETI. Thus, inherent in exopsychology is the conception of extraterrestrials as higher-order cognitive agents and as strangest strangers. We discuss the possibilities and limitations of conclusions about extraterrestrials, which leads us to hypothesize that limited statements about them might be possible, even though still influenced by anthropocentrism. We argue that it is possible to utilize anthropocentric knowledge and distinguish between admissible and inadmissible anthropocentrism. Although the first contact between extraterrestrials and humanity might never occur, scientific thinking about extraterrestrials will improve our understanding of ourselves and our place in the universe.

1. Introduction

The search for extraterrestrial intelligence (SETI) is sometimes critically referred to as a mirror view that will only result in the search for ourselves, but not in finding the actual alien [1–5]. This accusation is leveled particularly against the so-called *orthodox SETI* and its focus on radio emission detection [6]. Based on Cocconi and Morrison’s pioneering work [7], this strategy has been heavily criticized in the scientific debate around SETI [1,4,6,8–10]. Such criticism is not denying SETI projects’ legitimacy but instead points to instrumental problems with humanity’s efforts to make contact [11]. One terminus that is commonly used within this line of criticism is “anthropocentrism,” which means “relating everything to the ways of humankind” [12]. An overly anthropocentric approach to SETI is likely to increase the chance of false negatives or false positives [8,11–13]. In the latter case, human observers confuse natural phenomena with evidence of the activity of an extraterrestrial intelligence [14,15]. In both cases, the overall probability of SETI success threatens to decline. However, as we will discuss later, anthropocentrism may potentially provide an approach to extraterrestrials’ minds. To that end, anthropocentrism must be handled with

great care and examined regarding its admissibility in specific areas [16]. In advance of the forthcoming remarks: We do not propose to see humanity as fundamentally special or exceptional, as other forms of anthropocentrism declare [17], but as a starting point for thinking about extraterrestrials. The point of reference of our assumptions may be humanity, but to use an insight of modern physics: no place in the universe is more central than the other [18]. Thus, *Homo sapiens* is one possible manifestation of life in the universe, but by no means the normative one.

We are well aware of the possible pitfalls of this approach. However, our thinking about extraterrestrials has to start somewhere. Hence, when we use the human condition to build our model of possible extraterrestrial configurations, we are doing it on the Boxian premise that *all models are wrong, but some are useful* [19,20]. To minimize potential bias, we must furthermore analyze the human condition to identify generalizable characteristics. This does not only include assumptions about the physical condition of extraterrestrials but also their mental processes.

The ability to produce technology that can be detected by human observers, and lead to the success of SETI, has to have a psychological basis. This article aims to provide an extensive psychological perspective

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on the mind of extraterrestrials, human SETI efforts, and the factors that contribute to the emergence of technology. To this end, we provide an updated version of the idea of a psychological discipline concerned with the minds of extraterrestrials: *exopsychology*. We will then proceed by discussing the notion of intelligence and its usefulness in an interstellar context. Following our arguments, we will call for the replacement of intelligence with the concepts of agency and (higher-order) cognition. We identify these concepts as the conditions of possibility for the emergence of technology and thus as the true SETI desiderata and the more helpful notion in describing behavior across different celestial bodies and instances of life. The orientation on fundamental insights on agency of cognition provides a fruitful scientific groundwork for the psychological investigation of the minds of extraterrestrials. Lastly, we will combine these theoretical thoughts with the notion of admissible anthropocentrism, hoping to enhance the success probability of future SETI efforts and the general understanding of the human mind in a stellar context.

2. Proposal of exopsychology

Some scholars accuse orthodox SETI of being an interdisciplinary failure [6], and a recent series of publications emphasize the role of an interdisciplinary approach to enhance our understanding of extraterrestrials [2,21–23]. Psychologist Albert A. Harrison was a lifelong advocate for integrating psychology into SETI research [12,24,25]. However, it was Robert Freitas [26] who first discussed the possibility of a psychological discipline investigating the minds of extraterrestrials. He called it “xenopsychology.” Later publications by Baird [13] and Harrison and Elms [25] concurred using the term “exopsychology” instead. Recently Schetsche and Anton [2] reintroduced the idea of such a discipline.

Harrison and Elms [25] provided the only definition of exopsychology to date: “as the prediction, study, and interpretation of the cognitive, affective, and behavioral aspects of extraterrestrial organisms” [25]. Based on these initial thoughts, we redefine exopsychology in this paper as *the psychology discipline that investigates the cognition, behavior, affects, and motives of extraterrestrial agents and the human-specific representation of them*. Psychology pursues the empirical quest to describe, explain, predict, and modify human and animal behavior, cognition, and affective and motivational states. Exopsychology joins this task but adds extraterrestrial agents as additional subjects of interest. It also investigates human behavior and thinking regarding extraterrestrials. Exopsychology tries to identify universal determining factors of the behavior and thinking of entities throughout the universe. By doing so, exopsychologist may orientate on *Homo sapiens*, the Earth, its eco-, and star system as part of the methods to achieve this overarching goal. However, while humanity progresses with exploring the universe, other extrapolation points may be found and utilized. To minimize bias possibly evoked by using a human and Earth-related model, accurate positioning of humanity and its spatial, temporal, and epistemological stance in the universe is necessary.

Just like Harrison and Elms [25], and notably because of the definitional problems surrounding this term, we do not refer to “intelligence” in our definition. By not including “organisms,” our definition does include postbiological and artificial civilizations. We acknowledge the extraterrestrial as strangest stranger, a concept we will discuss in a later section, and that provides a set of minimum requirements for the possibility of interaction but leaves further space for additional essential questions necessary to be examined case by case [27]. In addition to helping to identify and evaluate these categories of strangeness, exopsychology can assist in reducing strangeness and establishing communication. However, to do so, we must assess the human side of the equation too.

We shall, therefore, examine the human representation of extraterrestrials. This representation is said to be systematically biased towards anthropomorphism and anthropocentrism [1,2,8], which will influence

our search process [8]. Furthermore, the human cultural display of extraterrestrials is likely to impact our reaction and interpretation of any first contact [2,12].

Anthropocentrism refers to the habit of equating parameters such as thinking, appearance, and developmental trajectories with those exhibited by humanity [12]. In the maladaptive manifestation of this perspective, humanity becomes the literal center of experience in the universe, leading to an asserted position of moral specialty, either spatiotemporally or in terms of relevance [17].

Anthropomorphism describes the usage of human characteristics to describe and explain behavior and mental states of non-human lifeforms and entities [28,29], such as thinking patterns, desires, goals, and intentions [30]. Fisher [31] distinguishes between the ascription of human characteristics (interpretative anthropomorphism) and the idea that entities have a similar physical appearance as humans (imaginative anthropomorphism). Both forms occur in our thinking about extraterrestrials. Interpretative anthropomorphism, for example, when we imagine extraterrestrials as interested in space exploration. Imaginative anthropomorphism is most evident in the myriad cultural representations of aliens as humanoids.

Anthropocentrism puts us at serious risk of primarily engaging in an overly anthropomorphic portrayal of extraterrestrials. However, in planning and predicting first contact scenarios, SETI must also consider the psychological and physiological state of humans as well as the spatiotemporal, cultural, and technological context. Complete elimination of the *conditio humana* in SETI is neither possible nor helpful for its enterprise. Humanity’s characteristics determine our perception of the universe and, therefore, any conclusion we can draw about the presence of other agents as well as any human reaction to their detection.

Extraterrestrials are already here. Their cultural and scientific representations are penetrating the borders of the human mind. Thus, thinking about extraterrestrials is already part of our reality. Therefore, it is only necessary and consequent to unite SETI and psychology and thus to create an expanded version of exopsychology incorporating how humans think about aliens.

3. Intelligence in the universe?

The first task of exopsychology is a critical examination of some of the presumptions of SETI. Here, intelligence stands out, as this concept is eponymous to one of the key aspects of SETI and of general psychological interest. Even though intelligence has no standard definition [32], this ominous ability distinguishes SETI from the merely astrobiological search for extraterrestrial life. Various authors have critically examined SETI’s alleged presumption of human-like intelligence [9, 33–36]. Here, Raup [14] concluded that “the *manifestations* we ascribe to an intelligent being, and which are crucial to the SETI strategy, can be produced by an *unintelligent* organism and the mechanics for accomplishing this is the ubiquitous process of adaptation.” [14] (italics from the original). Furthermore, prominent SETI critique vituperatively observed that “SETI naively assume [s] that ‘intelligence’ means developing a technology capable of intragalactic [...] communication” [37]. This accusation still haunts the general SETI debate. In their recommendations on the appropriate nomenclature, the SETI Ad Hoc committee describes intelligence as “the quality of being able to deliberately engineer technology which might be detectable using astronomical observation techniques” [38]. While the authors acknowledge the difficulties of equating technology and intelligence, recent SETI enterprises emphasized the significance of technology traces, so-called technosignatures, to find extraterrestrial civilizations [39–43]. Critically here is the notion that these technosignatures do not necessarily comprise a deliberately sent signal but may also manifest in the unavoidable byproducts of industrialization, measurable in the planetary atmosphere [39,42]. The focus on how SETI can detect extraterrestrial civilizations has undeniably expanded and utilizes a very pragmatic approach to intelligence. The logic is simple, in the case of the discovery

of an extraterrestrial phenomenon that is technological in origin, there would be strong evidence for the existence of extraterrestrial life. However, even with a very pragmatic approach to intelligence, the question about the constituting biological and psychological factors of these technosignatures remains. Therefore, even if they are primarily looking for technosignatures, every SETI researcher has implicit presumptions about the entities that generated the technosignature, even if those same researchers acknowledge the limitations of empirically investigating those presumptions.

Overall, a non-anthropocentric definition of intelligence might be impossible as our own ability to perform specific tasks is often taken as reference point [44,45]. As we will argue, SETI is not mainly looking for manifestations of intelligence but rather the presence of cognition and agency. We understand agency as the ability to deliberately transform the environment and cognition, in its most advanced manifestation, as the general knowledge of how to perform and reflect on these transformations. Although interstellar communication does build heavily on the prevalence of suitable technology, intelligence is not the key aspect here, as it is too dependent on an external normative standard and far too idiosyncratic.

A certain degree of cognition and agency are the conditions of possibility not only for the development and usage of any technology but also for general communication between extraterrestrials and humans. Furthermore, these two concepts are less reliant on the presence of an observer, who defines what qualifies as “intelligent.” Note that cognition and agency may be the constituting factors, but their presence does not inevitably determine any space exploration efforts or convergent technological development. Overall, we do not lose but instead gain epistemological power if we substitute intelligence with cognition and agency.

One axiom of our approach is that interaction with extraterrestrials in a contact scenario would allow certain conclusions to be drawn about their characteristics, as pointed out by Hövelmann [46]. Hövelmann himself examined some of the characteristics of the human condition regarding their generalizability. We want to affirm and expand on the hypothesis of Hövelmann [46] that extraterrestrials must be able to act for any SETI effort to succeed. We will now combine and complement this idea with insights into the phenomenon of cognition.

4. Cognition and agency throughout the universe

4.1. A general approach to cognition

Cognition can be defined as the activity, acquisition, organization, and usage of knowledge inherent in every living organism [47,48] but manifests itself at various degrees [49]. Maturana [50] and Maturana and Varela [51,52] emphasized the universality of cognition and defined it as any effective behavior maintaining a state as a living system. Even here, we can identify different orders of cognition [53]. Higher-order cognitions are those in which metacognitive factors like control and monitoring are eminent [54] or defined more generally: thinking about thinking.

Viewing cognition as a continuum, we have reason to believe that humans have access to a wider range of these capabilities than any other currently known species on Earth [49]. For example, intentional reasoning, including its metacognitive processes, is most distinctly human [55]. The debate about whether cognition is a product of a convergent evolutionary trend [56,57] may be resolved by a continuous approach that recognizes that cognitive abilities may come in various forms and degrees, each differently adaptive in a given environment. Higher-order cognition is then constituted bottom-up by a patchwork of underlying basic mechanisms and processes [58,59]. In this sense, cognition in the universe may not be an all-or-nothing phenomenon but a gradualist one, with some mechanisms following a convergent trend.

4.2. (Self-)Definition of agency

Contrary to the seemingly ubiquitous presence of cognition among lifeforms, agency is something that can be ascribed by an observer. Maturana [50] goes so far as to state that every behavior may appear as action from the observer’s perspective. For our approach, agency may be understood as an agent’s ability to act purposefully and consciously upon and in a particular environment [60,61]. This is a fairly neutral perspective as we make little to no assumptions about how these actions emerge exactly.

Barandiaran et al. [61] have discussed the minimal requirements for agency. In their view, these requirements include a) distinction of the agent from its environment, b) the ability to manipulate this environment from within, and c) carrying out these processes in pursuit of certain norms or goals. The latter aspect constitutes the existence of a failure or success condition and its recognition by the agent. Note that the “adequacy” of the agents’ behavior is referring to individual norms and standards and may not be fully comprehensible from an observing perspective [50,51,61]. Furthermore, Barandiaran et al. [61] state that any conceptualization of agency must account for the ability of self-definition as individual by the agent. Without this self-definition, one would end up in an infinite regress of agency ascriptions. That is, an agent has to make the distinction between itself and the environment on its own. The function of this is that the agent must define a space of action in which to perform its action and which is different from its body. Only in this way, an agent can coordinate its actions spatiotemporally and in relation to his existence [61]. The agent is in no need to be defined by an external observer to carry out its actions. However, to constitute a reciprocal interaction, it is self-evident that an agent must be recognized as such by its interactional partner. This reciprocal relationship is the external ascription part of every agency definition. Thus, to constitute the interaction SETI is looking for, agency of extraterrestrials is also in the beholder’s eye. The agent, of course, has several strategies at its disposal to inform its social environment about its status as an agent. In the cosmological context, these strategies may include attention-seeking by technology. Here, we must keep in mind that these strategies may differ from the orthodox idea of contact by radio waves. Furthermore, technology may be recognized accidentally, meaning without the agent’s intention of notifying other observers about its status as agent.

Barandiaran et al.’s [61] approach is helpful to our conception of agency, as it shows the difficulties of identifying and describing this concept. The ascription of agency influences the behavior of the ascribing agent or observer. A study by Straub [62], in which she placed an android in an Austrian café, impressively showed this. Depending on the behavior exhibited by the robot, people changed their social interaction with it. What is more, behavior by observing humans changed when they realized that the robot could not fulfill what they expected from a social agent. This result emphasizes two crucial aspects of agency: First, the role of expectations in ascribing agency, and subsequently, the behavioral consequences if an entity fails to fulfill these expectations. In the latter case, observers may not be sure which behavior is appropriate or adjust their responses to the now changed status of the alleged agent. For example, participants in Straub’s study asked the android for permission to touch it, showing respect for its personal space and intimacy, but only if the robot demonstrated a high level of interactive capabilities, i.e., enhanced social agency ascription. In the conditions in which the android showed lower interaction ability, participants not only showed a greater willingness to explore the robot’s skin tactilely but even made attempts to smell it, a behavior inappropriate even in most human-human interactions.

4.3. Combining cognition and agency

The kind of agency SETI is searching for requires higher-order cognition. It seems reasonable to use the core components of human

agency as a tentative model here. Bandura [63], building on his preceding work [64,65], identified three core properties of human agency: forethought, self-reactiveness, and self-reflectiveness, i.e., the ability to plan one's future, regulate one's behavior, and the awareness of these capabilities. Bandura further notes that: "The metacognitive capability to reflect on oneself and the adequacy of one's capabilities, thoughts, and actions is the most distinctly human core property of agency" [63]. Anticipating a possible charge of anthropocentrism, we ask in what aspects extraterrestrial agency might differ from human agency concerning the functional level of the concept? Of course, the interesting question is if these capabilities have any minimum requirements that must be met to constitute meaningful contact between humans and extraterrestrials. Here, the self-defining aspect of agency [61] comes into play. In order to communicate, agents must enter a consensual domain of semantic descriptions [51]. These descriptions are always relational and recursive, eventually constituting the self [51]. This self-defined self is then regulating itself in relation to the semantic description it has made, for example, by formulating the sentence: "We are species XY and come in peace." The making of this statement is not only a form of deliberate action but also inherently and recursively refers to the agent who has produced them. Even more descriptive content such as "This is XY" implies the agent-based distinction between himself and the described entity. Furthermore, any language is temporally extended. There is no instantaneously sharing of information. In order to fulfill the coordination of actions, information by language must be transmitted and processed by communication partners. In this sense, a speaker must represent the consequences of his sentence and contemplate reactions to the answer he may or may not receive and the things already said. That is the fundamental action coordinating aspect of language [51]. Therefore, it seems very likely that some form of the general elements that constitute human agency must be present in order to communicate meaningfully with an extraterrestrial agent. This does not mean that extraterrestrials are bound to the particular human manifestation of these abilities but rather that these abilities are needed to communicate with us. To communicate with *each other*, extraterrestrials may rely on different capabilities not available to human beings.

Even if Straub [62] and Barandiaran et al. [61] propose a non-anthropocentric approach to agency, the problem is that we might not be able to avoid any comparison to humans. After all, SETI must consider human epistemological limits [66] and is therefore confounded with the human condition. Thus, in SETI, we must examine agency from a broad, general, and interstellar perspective, which must have the potential to account for the hypothetical capability of developing and using technology as well as the establishment of communication. The success of SETI depends on the compatibility between the capabilities and products of two agents, one of which - the human - is currently known, the other - the extraterrestrial - is unknown. If extraterrestrials produce agentic outcomes that are not perceivable by human beings, these actions will never allow for their identification. Such failure would not change the ontological status of the extraterrestrials and their abilities in terms of their existence but is a severe restriction in our ability to recognize the other as agents.

Overall, we do not argue that the cognitive processes leading to the agentic outcome are inevitably similar to the human example. However, given the spatiotemporal limitations of space, any first contact without the involvement of technology seems highly improbable, and technology builds on the premise of intention and reflexivity, i.e., agency [46, 67].

To produce technology, it is not mere behavior that is required, but behavior that is governed by thought and controlled and explained by the application of meaning. In other words, actions [46,68]. The explanatory aspect is critical and suggests that the agent must be aware of its behavior. Thus, an explanation is not restricted to an external observer. In the case of agency, the observer may be the agent himself who carefully monitors its behavior and identifies them as actions and himself as agent. Therefore, extraterrestrials must not only be able to

think (cognition) but also deliberately control (govern) their behavior with these thoughts to qualify as agents. Behavior primarily controlled by environmental forces or genetic instinct does not qualify as action.

Emphasizing the importance of the thoughts discussed here, we propose to use the term *extraterrestrial(s) (ET)* to refer to one or many extraterrestrial agents and not the commonly used term of extraterrestrial intelligence (ETI). Extraterrestrial defines the corresponding entity as capable of intentional behavior ergo agency [46]. However, we will still use acronyms like SETI or METI due to their general dissemination in the description of specific scientific projects.

4.4. Deducing cognition and agency through cosmic observations

Fig. 1 Shows the attribution process of agency, based on the observation of artificially produced phenomena. Observable phenomena of the universe are everything an observer can perceive, given his physiological and psychological constitution and technological capabilities. Artificial phenomena refer to phenomena that stand out against the "natural" background. We acknowledge the difficulties in assessing what is natural and what is artificial [39]. Admittedly, the argumentation here seems a little circular: artificial as something produced by an agent, and agents as somebody who produce artificial phenomena. The question is if we have any alternatives. SETI has to deal with an inverted attribution process [13]. Instead of using behavior to deduce thoughts and feelings, we make statements about hypothetical thoughts and feelings (cognition/agency), hoping to observe the corresponding behavior (artificial phenomena) and validate our hypothesis. On the one hand, this is owed to the fact that we have not directly observed any extraterrestrial behavior yet. On the other hand, observational processes in the universe are subjected to severe spatiotemporal limitations that complicate direct conclusions. As mentioned afore, agency is something ascribed by somebody, either by the agent himself or an observer. In terms of successful communication, the communication partners must identify each other as agents. Regardless of the criterion used here, intelligence or agency, our expectations prescribed in our cognitive schemata influence our search process [47]. However, the notion of agency and the linked ability to self-identify as agent partially decouples extraterrestrials and humans. To exaggerate, extraterrestrial intelligence depends on humans; extraterrestrial agents rely only on their ability to describe themselves as agents. However, the spatial description as "extraterrestrial" emphasizes that agents in the universe are always perceived in relation to the observing species, in our case *Homo sapiens* from the planet Earth. This relational nature of observation is undeniable and must be accounted for in every theoretical and practical consideration concerning SETI. Yet, agency in itself acknowledges that extraterrestrials are observers themselves, even without acting in an "intelligent" way. Turning one's gaze skyward and wondering if one is alone in the universe is a sign of agency and cognition, not intelligence.

Nevertheless, artificial phenomena may be distinguished from natural phenomena. If so, they have to be produced by somebody. Therefore, the presence of such phenomena allows conclusions about their origin and the factors that made the emergence of these phenomena possible in the first place. Note that the overlapping of known and artificial phenomena in Fig. 1 is highly dynamic and was created to reflect humanity's current level of knowledge, that also includes various hypotheses about the possible artificial origin of known phenomena, such as the famous "Wow-Signal" or the more recent interstellar object 1I/'Oumuamua [69,70].

Even if the ascription of agency and intelligence is made based on the same behavioral sample, the most significant difference between these concepts is in their evaluation: intelligence needs an external normative standard to be fully recognized. Within SETI, the human observer imposes this standard. Even though some authors [59,71] discussed intelligence in terms of cognitive complexity or flexibility, the question of the reference level of what qualifies as "intelligent" remains. On the contrary to this unclear external standard, agency refers to the ability to

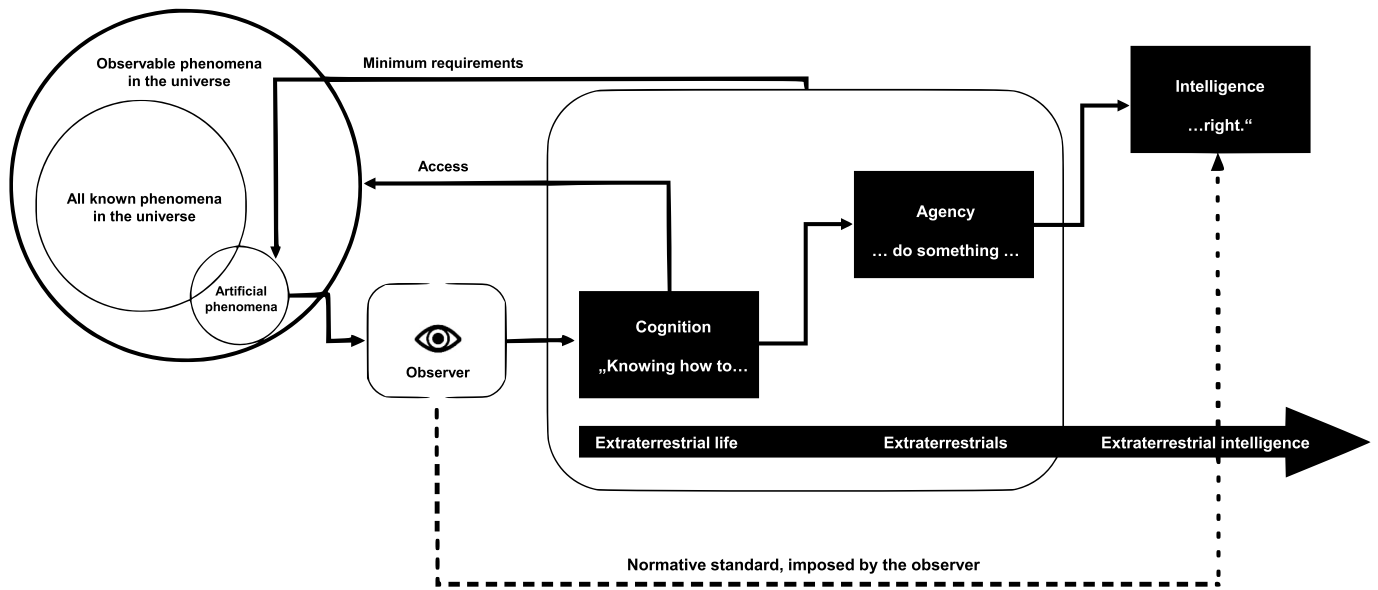


Fig. 1. Process of different ascriptions. Observers have only partial knowledge about the phenomena in the universe. Some of these phenomena can be artificially produced by other agents. Here, cognition and agency are the minimum requirements to produce an artificial phenomenon. Humanity currently has no certain knowledge about the existence of artificial phenomena but has identified some phenomena that are under debate to be such. Once an observer recognizes a phenomenon categorized as artificial, he or she can make several inferences about its constituting conditions. In a comprehensive term, cognition constitutes the possibility of gaining knowledge about the phenomenon of the universe. As cognition is inherent to any form of life, the demarcation line between extraterrestrial life and extraterrestrials is agency.

do something for a reason without a statement of adequacy outside of the agent’s reference frame. Intelligence, very broadly seen as the ability to solve problems successfully, is always referential to certain norms imposed by the environment, other agents, or oneself. It is about *doing something* in a way that is recognizable as qualifying for the label “intelligence” by someone.

This becomes all the more problematic when, as in interstellar communication, information is available only sparsely and with a time lag. Even if agency is also related to successful goal accomplishment [61], this concerns the internal goals of the agent, which do not have to constitute an “intelligent” solution to a problem. We must acknowledge the idiosyncratic character of problems, goals, and solutions, as well as our incapability of recognizing them as such. While there may be some similarities, such as in self-perpetuation [72], the different solutions for similar purposes may not lend themselves to a sharp demarcation of what is an “intelligent” solution in the eyes of the observer. Searching for behavior that human observers can clearly categorize as “intelligent” solution to a known problem may result in a narrow-minded focus on “intelligence-as-we-know-it.” Of course, doing something for a reason can sometimes lead to doing the right thing, but also consider the opposite. Drinking a bottle of bleach is generally not considered very smart. Nevertheless, performing the action allows identification as an agent. The realization of the purpose comprises many intermediate steps, and not all of them must be completed effectively for the ascription of agency. One will also be characterized as agent if the performance of the action is interrupted. It is essential here that the agent itself is aware of its actions and the constituting mental processes. Drinking bleach requires all of the aspects of human agency mentioned by Bandura [63]: An agent, once he has distinguished between himself and the environment, must regulate its sensorimotoric contingencies to achieve a goal located in the future. Of course, one could argue that if the goal is to die painfully, then drinking bleach can be considered very smart, but that is just another example of the very subjective evaluation of what qualifies as intelligence. Attribution of intelligence needs a referential frame, currently not available to us within the cosmic context. Agency is based on the deliberate manipulation of the environment guided by the agent’s internal standard and does not require general goal fulfillment.

Hence, agency is a more presumption sparse approach to SETI. However, to identify deliberate transformations of the environment, we must increase our understanding of the observable phenomena in the universe and its origins.

4.5. The true SETI desiderata

All technosignatures that SETI hopes to find presuppose technology and thus a creating agent. Even if any ascription is made post facto and even if the initial motive for the environmental transformation was not establishing a first contact, this fact holds. Even considerations of hidden, silently observing, and currently unknown extraterrestrial civilizations [73,74] or their aggressive, predatory, and equally unknown counterparts [75–77], build on the premise that the related species will act purposefully in concordance with their goals and therefore qualifies as an agent, albeit an unidentifiable one in the former scenario. The fear or hope of evoking another agent’s attention is grounded on the notion that this agent is capable of recognizing the attention-seeking agent and its actions [62]. Thus, the general scientific representation of extraterrestrials within SETI is the representation of extraterrestrial agents. Nearly all of the scientific scenarios include planning, overseeing, and executing thoughts. If extraterrestrials decide (agency) to engage in space exploration, they must acquire, organize, and use the knowledge of doing so (cognition) and eventually deliberately plan their efforts (higher-order cognition). Hence, we can identify (higher-order) cognition and agency as the true desiderata of any SETI project.

This argument does not dispute the role of technosignatures in detecting these higher-order cognitive agents. The thoughts presented here are intended more as a careful examination of what *exactly* SETI is looking for. Cognition and agency are conditions of possibility for technology. Ivanov et al. [78] recently proposed a classification framework of extraterrestrial civilizations based on the energy available and the ability of environment interaction. Such a classification inherently acknowledges the technology constituting role of agency, even without directly mentioning this concept.

Furthermore, Dunér [71] discussed the role of socio-cognitive abilities in the emergence of technology, emphasizing the role of

intersubjectivity. While questions about the social nature of extraterrestrials are highly speculative, we may conclude that to coordinate certain actions to achieve a level of social organization one may need a sophisticated level of cognition and agency. Questions regarding the co-evolution of these phenomena remain an interesting topic. Lastly, Dunér refers to several theories about human cognition, such as the extended mind hypothesis [79]. While the extension of cognition to the surrounding environment seems *prima facie* universally helpful for developing and using technology, we argue for a more fundamental approach to extraterrestrial cognition and agency. A more detailed examination of the nature of human cognition may then be done on this solid groundwork.

One may criticize the identification of cognition and agency as the true SETI desiderata, an insight irrelevant for the general search, but consider an analogy from the history of psychology. Early behaviorism declared mental processes to be a “Black Box.” Behaviorism did not deny the existence of mental processes but showed little to no interest in things not directly observable. This led to logical positivism, where theories had to be entirely defined in terms of directly observable phenomena [80]. Applying such a line of thought to SETI would mean a theoretical stop sign, just after detecting any technosignature. As only this particular trace of technology is observable, researchers may deduce the fact that there has to be someone who produced it but cannot make any further assumptions about the mental processes of these mysterious extraterrestrials. This is too restrictive. Instead of stopping, we should keep driving, trying to explore the street beyond the stop sign. In light of an interdisciplinary SETI approach, we want to emphasize the importance of combining the physical search for technosignatures with the necessary psychological and philosophical frameworks. This will enhance our understanding not only of SETI but also the human perspective on the universe and its alleged inhabitants. We acknowledge the empirical boundaries of this argument. Yet, just because we currently have no empirical access to certain aspects does not render them automatically unimportant. The SETI community has already acknowledged the difficulties concerning the notion of intelligence [38]. Although a pragmatic solution may be appropriate here for conducting the general search, it leaves theoretical gaps that we hope to fill with the thoughts presented here.

Furthermore, any theoretical considerations become at least partially empirical verifiable in case of a first contact. From this moment on, the availability of a suitable set of theories is enormously important [2,81]. In this sense, the thoughts presented here are also meant as preparation for the debate following any first contact. Examining the implicit presumptions and their theoretical boundaries is vital to understand the psychological foundation of human SETI efforts and eventually increase their chance of success.

4.6. False positives and negatives

Note that the agentic products SETI is looking for do not necessarily have to originate from biological lifeforms. Depending on the amount of transmitted information, distinguishing between a biological or non-biological contact partner would be very hard, and some authors [2,8,82,83] have discussed the possibility of widespread postbiological entities across the universe. Moreover, Barandiaran et al. [61] noted that life is sufficient under their model of minimal agency but not necessary for the qualification as agent.

Furthermore, Raup [15] discussed an exceptional case to the notion of agency. He described a hypothetical non-sentient, radio waves emitting lifeform, the products of which could be mistaken for artificial radio signals. On the one hand, this emphasizes the external ascription process of agency. On the other hand, it also demonstrates SETI’s dependency on this ability to establish communication and that an alleged technosignature is just one part of the picture. While some degree of cognition would be present in any form of extraterrestrial life, any ascription of agency can result in false positives and false negatives and a

misled evaluation of communication potential. Humans may be seduced to think that the behavior of Raup’s life forms qualifies as agency. However, if the lifeform cannot explain why it does emit these radio waves or is unable to interrupt it on purpose, this behavior is not the product of agency. Not every behavior of an agent, of course, qualifies as action, but to do so, it must mean something to the lifeform in the sense that: “It requires doing something because it is thought to be a means to a desired end. [...] So there is a difference between being caused by an event that means M and being explained by the fact that it means M” [68]. In Raup’s [15] example, this means acknowledging the difference between a genetic program that caused the emission of radio waves and the decision to build a radio telescope because this means being able to produce radio waves. Despite the admittedly difficult distinction between these cases and the additional physical limitations space imposes to any observer, a false positive does not change the fact that the idea of SETI is grounded on the notion that extraterrestrial lifeforms either engage in space exploration or create detectable technologies, behavior that requires cognition and agency. A false-positive diagnosis does not alter the existential status of the true-positive condition or the diagnostic process’s goal.

The reliability of any agency ascription depends on the contact scenario. Here, the most reliable scenario is also the most unlikely: a close-quarter contact. What may trouble people, including SETI enthusiasts, is that detecting a technosignature, depending on the “ambiguity” [43] of this particular phenomenon, may provide no definitive and immediate answer about the factual existence of an extraterrestrial agent. The general process here would be that any anomaly, conceivably as artificially produced, grants evidence to the alternative hypothesis about the existence of extraterrestrial agents. The null hypothesis would be that the same phenomenon originated without any agentic influence. It is then up to the scientific community to examine other possibilities and eliminate different explanations, including the alleged extraterrestrial origin if possible. Depending on this process and the contact scenario, our belief in the alternative hypothesis changes. Straub [62] empirically observed this general hypothesis testing in the different interaction patterns with the android. People approached it depending on its behavior and adapted to its reactions. However, when their expectancies were not met, they rejected the idea that this artificial entity may be a fully-fledged social agent and treated it as a pure object. Straub [62] explained this with a transitional model of different stages of engagement in the interaction with social agents. Thus, the notion of agency depends on social setting and available information, not only in a human-robot or human-ET scenario but also in daily human-human interaction. However, while engagement between humans may be a matter of seconds, things in space do certainly take longer. Depending on the contact scenario, it may take more than a generation to test our hypothesis of the ascribed agency.

This testing relies profoundly on scientific methods and interdisciplinary efforts. Spending decades, if not centuries, on the falsification of a hypothesis may seem ridiculous from a psychological research point. These timeframes, however, are owed to the astronomical dimensions of space. Psychology cannot claim independence from these physical limitations. Overall, false positives and false negatives are real possibilities [2,15]. However, human failure to correctly identify an artificial phenomenon does not change the ontological status of this phenomenon. It may appear non-agentic to us, but considering the possibility that different extraterrestrials communicate with each other independently of humanity, this may be an human exclusive problem. Furthermore, considering the agentic self-identification [61], the ontological status of an agent and its actions is partially independent of an observer. Here, research addressing various technosignatures and the general limitations of our search process can produce valuable insights [41,43,66,84] to mitigate identification problems. Combining this approach with an interdisciplinary effort that also theorizes about concepts that are not yet directly observable can reduce the likelihood of false positives and negatives [39].

5. When does SETI succeed?

The identification of higher-order cognitive agents is the demarcation line between SETI and the astrobiological agenda. While the latter is searching for any instance of life, the former will only be considered completely successful if the discovered entity can engage in reciprocal communication. This is an unrecognized issue, as the declared target of SETI seems to be “intelligence” or “technology,” not communication. But even the famous Drake-Equation directly assesses the proportion of life engaging in communicative efforts [85]. Besides the obvious communication potential of a close-quarter scenario, contact by signals implies a sender-receiver connection. An extraterrestrial artifact in close proximity to Earth proves the general feasibility of extraterrestrial long-term space travel [2], and infrared signatures of cosmic megastructures or other technosignatures [6] would give humanity an approximate spatiotemporal cue and qualify this location as a target for following active SETI efforts. SETI would not differ from simple astrobiology if communication or its constitutive biological, psychological, and technological aspects were no essential factors. Hence, SETI research is not only concerned with how we can communicate [7,23,86] but also with our ability and means to understand extraterrestrials [87–91].

It seems very likely that most humans would interpret a first contact as an opportunity for communication. Pettinico [92] reported that 90% of surveyed Americans who believed in the existence of extraterrestrial life were open to responding to an interstellar message. Even though a cosmic dialog has obvious physical limitations, communication is not impossible. All of SETI’s means suggest at least a small probability of establishing two-way communication, even though it may never be realized. This includes not only the peaceful exchange of signals but also the qualification of Earth as a target for an interstellar conquest, a widely held fear within the Messaging Extraterrestrial Intelligence (METI) debate [76,93–95]. Hence, we must specify the aforementioned claim in the way that SETI is not primarily concerned about actual contact but rather the potential of establishing it, independent of its modalities and timeframe. The mesmerizing (or frightening) aspect of SETI is not the mere presence of other “intelligent” lifeforms in the universe but the potential to get to know each other. The human mind is restless and proficient in exploring alternative and counterfactual scenarios in the future and the past [96–99]. Once SETI has succeeded, the prospect of direct contact may be the annoying equivalent to that itchy spot that is impossible to scratch appropriately. The *what-if* will keep humanity and SETI researchers occupied, and relief may be only possible once we tried to establish contact, even though it may take several generations to get an answer. However, we must acknowledge that the relevance of any SETI detections depends on the distance between the alleged extraterrestrial and Earth [2,4].

6. Extraterrestrials as strangest stranger

Communication with extraterrestrials, apart from the problem of finding them, has certain requirements. As interaction partners, extraterrestrials are entirely blank to us [2]. They are the strangest strangers [“maximal Fremde” in German] [27,100,101]. This characterization is accompanied by an assumed non-human subject status, which entails the inadmissibility of anthropological attributions, but in principle, recognizes an opportunity for communication, albeit an uncertain one [27]. The strangest stranger is on the relative edge of our ability to communicate [27,100]. Therefore, at least five minimum requirements have to be met to ensure the hypothetical communication ability with the strangest stranger [27,100]:

- 1) Partial compatibility of sensory and communicational channels
- 2) Some kind of coherent thinking and decision instance
- 3) Rudimentary self-awareness
- 4) Intentional agency
- 5) A willingness to communicate

These characteristics are connected to either agency, cognition, or both, as shown in Table 1. Beyond these dimensions lies the absolute [schlechthin] stranger, who is not identifiable as a potential interaction partner [27].

We argue that this concept and its constitutive elements (i.e., cognition and agency) are much more useful for SETI than a vague definition of intelligence.

As strangeness is a relational category [27], our notion of the strangest stranger depends on the perceived similarity between humans and extraterrestrials. In the quest to identify the relevant categories of comparison, we have no choice but to start from our perspective. One could, of course, argue that we might think of two different kinds of extraterrestrials, each one with different characteristics, which then interact with each other, virtually eliminating humanity. This, however, brings us back to strangeness as a relational phenomenon. If someone imagines two different extraterrestrials, each one completely different not only from the other but also from humanity, the reference level of which we assess the perceived strangeness is still the human condition as it is this condition which virtually creates the strange entities in relation to itself. We cannot avoid the comparison. To paraphrase Spinoza and Hegel: Every determination of a property in terms of strangeness is at the same time a statement about humanity itself. In other words: “Built into the concept of otherness is the idea of relationship, the question other than what? In terms of the alien encounter that what is necessarily defined in human terms” [108]. However, the imagination of how extraterrestrials of different degrees of strangeness interact with each other is a thought-provoking approach, open for future research. Yet, these virtual extraterrestrials are still related to the human condition in

Table 1
Dimensions of the strangest stranger and their connection to either agency or cognition.

Dimension	Agency	Cognition
Partial compatibility of sensory and communicational channels	No immediate need, but sensory access to the world is necessary for any action upon and in it.	Communication must refer to shared entities, potentially describable for the communication partner. Cognition and perception of reality are constituted by sensory modalities [12,102–104].
Some kind of coherent thinking and decision instance	Executing actions.	Systems, such as nervous systems, process cognition enhance the possibility of interactions with the environment [51].
Rudimentary self-awareness	Learning about the effects of actions in the world and connecting it with its efficiency to achieve a species-specific sense of agency [105].	Self-knowledge and integration of action results.
Intentional agency	Nomen est omen.	Ability to plan, execute, and oversee agency outcomes. Humans do this through their executive functions [106] and their prefrontal cortex [107].
Willingness to communicate	Potential decision to engage in communication.	Recognizing others as potential partners of communication.

Note. Schetsche et al. [27] do not elaborate on what they understand as coherent thinking and decision instance. We see this aspect of the strangest stranger as an output generating system that allows for certain predictability not only for the strangest stranger itself but also for humans as their interactional partners.

some way. Even the concept of the strangest stranger is tailored to the minimum requirements of communication between *Homo sapiens* and other entities and thus not devoid of the human factor.

The hoped-for agent capable of higher cognition and communication that various SETI enterprises are searching for now has a different name: strangest stranger.

7. Working with anthropocentrism

To paraphrase Seneca: Humanity strives ad astra, and there is no easy way to achieve it. After all, evolution has not made us for space. Furthermore, it was unpredictable that it would only take approximately two and a half million years from the hand axe to leaving our planet. Therefore, our cognitive structures are not adapted towards an extra-terrestrial environment [71,91,102,109,110], and we are not used to thinking in astronomical scales [82]. This does not mean that our information processing does not work in environments like space, but our existing schemata might not be suitable there.

Engaging in SETI is a conscious decision made by cognitive agents. It is subjected to the same rules as our daily perception, with the significant difference that its scale is astronomical. Neisser [47] displayed one way to describe the human perception process, as seen in Fig. 2. The information provided by the environment is invariant. This information alters the internal schemata. These schemata, for their part, direct our perceptual exploration, which determines the type of information we can sample from the environment. A schema is conceivable as a cognitive map of the world and phenomena, stored inside our nervous system and modifiable by experience [47]. There are similarities to Maturana

and Varela's [51] ideas, who consider the internal structure of an organism as the reaction-determining factor instead of the perturbing external stimuli.

Mental images are not an act of perception but a derivate from it. Their function is anticipatory and agentic in preparing an organism for expected information [47]. This is a significant factor in our SETI aspirations. To be successful, a first contact has to be recognized. Signals or probes must be identified as artificial [2,9,45,111], and agents must be classified as such [112]. Both processes are dependent on our expectations of the qualifying behavior and the general context of observed phenomena [45,62,112]. Humans have the natural tendency of anthropomorphizing [113], especially in uncertain situations [114]. Space and its habitability are characterized by great uncertainty. In terms of cognitive agents, our single data point *Homo sapiens* with its ancestors forms our anticipatory mental images of other agents. Agentic self-, ergo anthropocentric knowledge is one determinant of anthropomorphism [114]. To adapt our schemata to the astronomical challenge we are facing, we must increase our knowledge, not only about us but also about other cognitive agents in the universe.

Schemata are modified by information [47]. Thus, we need to gather new information to alter our perspective deliberately. Fortunately, an intentional change of perspective is one favorable side effect of being an agent capable of higher-order cognition. Humans are already experiencing a fictional shift in perspective: Our cultural representation of extraterrestrials has already influenced our expectations of them and is likely to affect any first contact scenario [2,12,69]. Thus, we must accommodate our schemata about our place in the universe to the extension of potentially include other inhabitants. To do so, we must

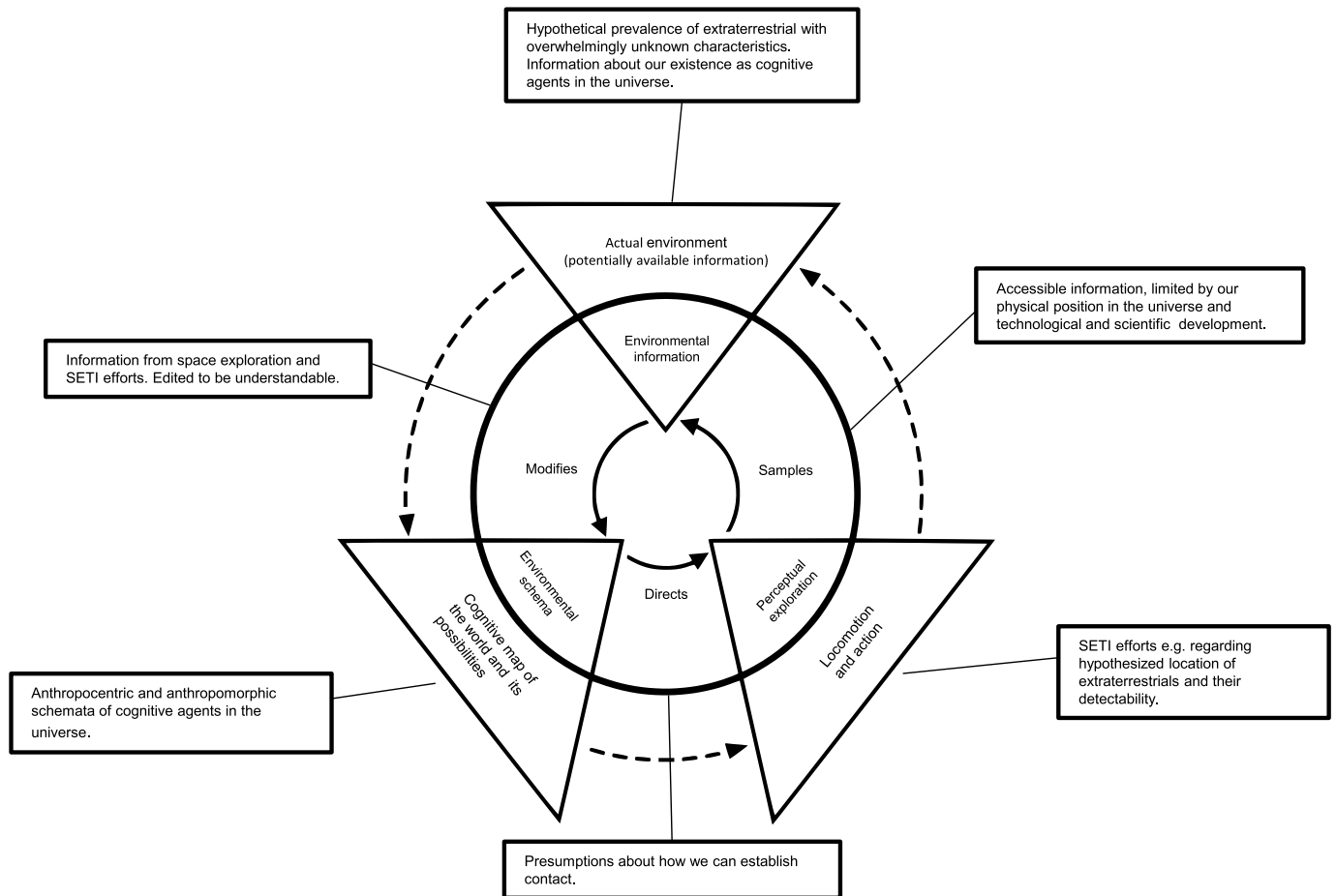


Fig. 2. Perceptual cycle by Neisser [47] applied to SETI. Information might be invariant, but our interpretation and expectations are not. Anthropocentrism and anthropomorphism are determining which information is sampled and influence our search process. Furthermore, sampled information, if not examined carefully, will consolidate inadmissible forms of anthropocentrism.

separate the pure fictitious from the scientific thinkable.

Furthermore, we must engage in an open debate about the factors that constitute the technosignatures SETI is looking for. The result of such a discussion could be a marginal but still consistent, increased chance of success for any SETI effort. In the same spirit, Baird [13] is utilizing an analogy to Piaget. Accordingly, we must dismiss the claim that any extraterrestrial will be just a “little human” and start questioning our anthropocentrism. However, our existence on Earth is a valuable point of extrapolation. It cannot be understood as a normative model for agents in the universe but instead as one possible configuration.

This paper, therefore, proposes a distinction between admissible and inadmissible anthropocentrism. While the latter unjustifiably declares humanity to be the galactic norm, the former tries to determine which characteristics of our existence are generalizable. This critical but comprehensive approach to anthropocentrism, provided by exopsychology, is a valuable tool for SETI, using scientific progress to alter existing schemata and eventually modify our search process. Closely related to this approach is the determination of the preventability of certain anthropocentric conclusions [2].

The human notion of intelligence is too anthropocentric. Even though influenced by our human thinking about it, cognition and agency are the more general and thus generalizable concepts. In this sense, they are an example of admissible anthropocentrism.

We do not argue that extraterrestrials predominantly resembled *Homo sapiens*. Instead, we call for a scientifically grounded debate on whether or not we can assume different degrees of similarity. Hövelmann [46], for example, noted that we might derive some data about the nature of extraterrestrials, such as that they are probably subject to the same constraints of nature as we are [89]. Thus, we may deduce broad motives for their behavior, such as exploration and exploitation behavior [115]. Such a classification is based on probably universal aspects of the planetary environment. Non equally distributed resources force organisms to adapt their behavior and carefully consider whether or not a resource should fully be exploited [115]. When it comes to more elaborated motivation, for example, in terms of interstellar conquest or beneficence [77,94], statements about the motives of extraterrestrials are nearly impossible. This is not a problem unique to the approach presented here but rather concerns SETI as a whole. On a very broad level, nonhuman-motivation and nonhuman-instrumental rationality may even stand in orthogonal relationships, although some universalities may be identifiable [72]. Yet, even though extraterrestrials invite us to wild speculations about their nature, their existence’s modalities are no blank check.

Another example of how planetary factors may influence the extraterrestrial condition is, for example, the fact that gravitation limits the size of organisms or at least heavily affects their physical condition [116–118]. This is a fact derived from our existence on Earth made by human scientists and narrows down any conception of extraterrestrials. Someone who thinks inadmissibly anthropocentric may assume that extraterrestrials possess the same physical attributes as *Homo sapiens* without further scientific justification. However, applying admissible anthropocentrism does acknowledge physical and biological boundaries to create a space of possibilities and then assesses these possibilities by their probability and similarity to humans. In the here presented conception of extraterrestrials as higher-order cognitive agents, we did not make any assumptions about the internal processes of alien cognition or the elaborated motives of the actions, but only about the necessity of them being present to establish contact.

Admissibility trades definitory sharpness for applicability. Due to the lack of empirical data other than the ones derived from Earth, this must be our starting point. Deciding whether a human trait is admissible demands a careful examination of its evolutionary function and behavioral, cognitive, motivational, and practical manifestation. Doing so, we must always consider alternatives in concordance with the laws of nature. Without direct observation, we will, of course, never be able to

make a specific statement, but we may be able to narrow down the aforementioned space of possibilities. Another sign of generalizability and thus admissible anthropocentrism is if the described characteristic is expected to be evolutionary beneficial in the particular environment. Such examinations are again fairly broad, offer various possibilities, and are unlikely to explain every aspect of the phenomenon.

To conclusively elucidate the distinction between admissible and inadmissible anthropocentrism, take, for example, interest in space exploration: Even if one does not see it as a universal adaptive trait among all instances of life in the universe, some conditions of possibility may be defined. Besides the necessity of cognition and agency, sensory access to the sky, respectively the stars, plays a significant role. Without such access, inhabitants of planets could not think about other inhabitants on other celestial bodies [24]. Such extraterrestrials would not engage in space exploration and would probably not be detectable given our current technological development. The admissible anthropocentric phenomenon here is *sensory access to the stars*. It is not limited to sensory organs, receptive to electromagnetic waves of 400–700 nm, but rather to any kind of perception of other celestial bodies. One step further, one could argue that, given the concept of convergent evolution, and universal laws of evolution [57,119–123], the development of a functionally equivalent structure of the eye becomes probable. As we continue to improve our understanding of the universe and life in general, we may be able to regain some of the definitory sharpness we sacrificed for admissibility.

Following probabilistic simulations of different configurations might enable us to approximate how extraterrestrials perceive the universe [124]. Thus, exopsychology, per the astrobiology and –physics findings, can hypothesize about possible configurations of extraterrestrials. Here, admissible anthropocentrism operates in the same relational borderline category as the strangest stranger. We may, of course, contemplate lifeforms incomprehensibly strange to us. While this is important for academic discourse and the maintenance of a broader perspective, practical considerations must acknowledge the principal possibility of communication and thus the, at least partial, compatibility of the extraterrestrial and human condition that is exemplarily represented in the concept of the strangest stranger. If we omit ourselves from the great contact equation, we simultaneously thwart any chance of success.

8. How can we benefit?

Even if SETI never succeeds, we may improve our understanding of ourselves and the universe [74,125]. Harrison [12] lists additional justifications for SETI, including advances in science and technology, educational beliefs, and a potentially positive effect on international relations. Here, psychology and especially exopsychology can play an important role. This may, for example, include research on the demands for understanding or creating a comprehensible interstellar message. The use of science and mathematics as means of communication has been a heavily disputed issue in SETI research in the past [86,89–91, 126–129]. Research in this area can also investigate which types of communication people are able to understand in the first place. One infamous anecdote being told is that SETI pioneer Frank Drake once send a self-made message containing 551 zeros and ones to fellow SETI researchers to decipher this alleged message from outer space. None of the test subjects were able to do so [130]. However, the general possibility of detectability regardless of the means is a SETI inherent axiom. Otherwise, it could never succeed. Hence, we must improve humanity’s capability of understanding technology, the universe, and any hypothetical messages and/or technology traversing it.

Moreover, SETI research has sparked intellectual and scientific debates. Take, for example, the idea that the evolutionary process on Earth represents any other planet due to the principle of convergent evolution. This is an argument most prominent brought forward by Morris [57, 120]. Some may accuse Morris of anthropocentrism. However, his arguments are founded on scientific methods and require that any

criticism follows this argumentative basis (for an evolutionary-based critique of some of Morris' ideas, see Ref. [131]). Reflexively rejecting any presumptions about extraterrestrials as anthropocentric because they refer in some way to humanity is just as short-sighted as seeing the conditions of our existence as normative *modus operandi* for any other agent in the universe.

Upscaling psychology to an interstellar level offers the opportunity for the ultimate test of its theories. If psychology is seriously interested in discerning human nature and the factors that make us the beings we are, it should not be afraid to contrast its object of study against outer space, its inhabitants, and the prevailing astronomical dimensions. Despite their usefulness on Earth, some theories will turn out to be non-generalizable and will therefore allow for an *ex negativo* description of the hypothetical extraterrestrial.

The principle of mediocrity is the theoretical foundation of an average similarity between extraterrestrials, humans, and their home planets. Accordingly, Earth and its inhabitants are not unique but prototypical [2,91]. Complemented with the assumption that nature's laws do not differ within the universe, an extrapolation based on Earth and its inhabitants might be permissible. Nonetheless, this does not rule out the possibility of significant dissimilarities. Being mediocre means that some entities will have higher or lower manifestations in the dimensions of comparison.

However, it is essential to remember that extraterrestrials might indeed have functionally equivalent structures. Still, in strong dependency on their environment, these structures do not necessarily have to be of the same physical condition as ours. Hence, it is essential to distinguish between function and anatomy [132]. Equating both variables is the path into the pitfall of inadmissible anthropocentric thinking.

9. A new perspective

We can only understand a living object's reality when we examine the relation to the surrounding world and objects [45]. Therefore, we must examine the hypothetical relationship of agents in the universe to the universe itself. While doing so, we must acknowledge that we cannot directly experience what it would be like to be an extraterrestrial [104]. Nevertheless, we might ask ourselves: What is it like to be a higher-order cognitive observer of the universe? This could be the connection between us and any extraterrestrial. To recognize other observers, we must examine if their perception of the universe is compatible with ours. A basic understanding of alien perception is critical for the success of SETI [124].

For what we seek is a glimpse of objectivity in our understanding and perception of, and knowledge about, the universe. Mitigating inadmissible anthropocentrism does not mean that we will achieve a complete objective image of reality. Our perception of reality is determined by our position as conscious observers [133]. Here, extraterrestrials provide the possibility to perceive ourselves through their perspective [44] and in relation to their hypothetical position. That is why the concept of the strangest stranger is so helpful and admissible in this context. It offers the possibility that we can communicate about this alien perspective. Nevertheless, there might be extraterrestrials who are absolute strangers to us. This status amounts to general unrecognizability and no chance of communication [27]. Qualifying as strangest strange is the minimum requirement for meaningful communication and our best and maybe only chance to catch a glimpse of objectivity.

Metaphorically speaking, we should apply the concept of object permanence also to extraterrestrials [16]. They might be there, even if we are not able to perceive them. The reference to the concept of object permanence acknowledges that some extraterrestrials might not be detectable today but have the general potential of recognition even if these strangest strangers are not developing the necessary technology. Changing to a more cosmocentric perspective, this also includes that different extraterrestrial civilizations can detect each other without

humanity even noticing it. On a less abstract level, object permanence also includes acknowledging that once extraterrestrials are present in our psychological reality (which they already are), they will not simply disappear but rather influence humanity in its relationship to the universe and itself, even if we do not actively think about them or may never detect them.

Wason [112] assumes that one part of being an agent is the ability to recognize other, even extraterrestrial agents. Here, exopsychology would be highly relevant in detecting and identifying cognitive agents across all conceivable contact scenarios while also investigating the factors that make these recognition capabilities possible in the first place. The thoughts presented are mainly concerned with the detection of an extraterrestrial technosignature. Of course, there is the possibility of encountering a close-quarter contact. However, given the current technological development of humanity, this would mean that extraterrestrials would have to come to us. In this case, we could identify them as higher-order cognitive agents and probably the strangest strangers. One may also think about a scenario where humans encounter a "primitive" alien species on a distant planet, not recognizing them as the strangest strangers or higher-order cognitive agents due to inadmissible anthropocentrism. This is undoubtedly a hypothesis worth exploring, as was done most famously in Stanislaw Lem's novel "Solaris" [9,134] and the general debate about the universal biological distribution of "life-as-we-know-it" [116].

The exopsychologist research agenda aims for the extension of our perspective. It emphasizes the need for a virtual-psychological change of perspective and sees humanity as just one possible manifestation of life. We must not forget that our observations are relational. By descriptions through language, observers generate distinctions relative to other observers and their perceived reality [51]. The terminus *extraterrestrial* itself contains a distinction. It does not only refer to our home planet but also creates a spatial, relational distinction. Imagine a human space colony on Mars. If a child were born there, it would strictly speaking qualify as an extraterrestrial. Furthermore, inhabitants of a faraway planet may be *extraterrestrial* to us. However, in an exopsychologist view, we are not the center of this characterization. From the perspective of the remote planet's inhabitants, we would be as *extraplanetary* to them as they are to us.

10. Conclusion

Extraterrestrials are already here on Earth. Anthropomorphized agents are a source of social influence [114,135]. We have seen this aspect of extraterrestrials in light of the hopes and fears expressed in the *Messaging Extraterrestrial Intelligence* (METI) debate [75,76,94,95,136]. Humanity is, therefore, already questioning its existence in relation to extraterrestrial observers.

We identified higher-order cognition and agency as the true SETI desiderata. How extraterrestrials perceive the universe is critical for their actions. Extending the idea of extraterrestrial agents, we elaborated on the link between perception, different forms of cognition, and action. Here, the human manifestation of agency functions as a non-normative point of reference, displaying how this ability *may* occur in the universe. To reach for the stars and other inhabitants, extraterrestrials must know about other celestial bodies and contemplate their habitability. This knowledge has to be acquired, organized, and used. A process we would describe as cognition.

Exopsychology aims for an accurate description of humanity's status in relation to other potential inhabitants of the universe. If we understand our spatiotemporal, cultural, technological, and psychological position in this relation, we should be able to identify inadmissible anthropocentric bias in our observation processes. Expanding our minds beyond an (inadmissible) anthropocentric perspective is necessary if we want to find extraterrestrials [124]. A byproduct of any SETI effort is always an improved self-understanding [12,125]. The inclusion of psychological theories and thinking into this process does enhance this

effect and increases the chance of success for SETI.

As Neisser [137] has noted: “Self-knowledge is inherent in the human condition, but self-centredness is not”. While self-knowledge in the form of admissible anthropocentrism can be an enlightening source in our thinking about extraterrestrials, we must demark its application from an overly and inadmissible form of anthropocentrism. We are not the normative standard for higher-order cognitive agents in the universe. Exopsychology will help humanity increase self-knowledge and self-understanding while also enhancing the understanding of the observable phenomena in the universe.

Exopsychology does not deal with the impossible but with the allegedly unthinkable. Despite the reasonably little chance of success and the giant space yet to be searched, humans are thrilled by the possibility of interstellar neighbors, even if these extraterrestrials may be incomprehensible to us. The universe, the final frontier; its phenomena and hypothetical inhabitants are both strange and mesmerizing. Albert Camus once wrote: “To a man devoid of blinders, there is no finer sight than that of the intelligence at grips with a reality that transcends it” [138]. In this sense, we must imagine the SETI-scientist as happy.

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