

# Anticipation in the Search for Technosignatures: a viewpoint

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The concept of “technosignatures” has been defined within the encompassing endeavor of searching for life beyond Earth as “evidence of some technology that modifies its environment in ways that are detectable”. This poster proposes the application of insights from the study of anticipation to the Search for Technosignatures, in order to proactively facilitate the development of this scientific field. Anticipation is the third level of Futures Studies that has been described as “a process through which the present is transformed, intervened in and ultimately governed in the name of the future”. This poster presents two ways in which the study of Anticipation in the Search for Technosignatures could be beneficial to its course.

## Introduction to Futures Studies

According to Bell [1], Futures Studies is a field of enquiry that involves systematic and explicit thinking about alternative futures, using specific theories, methods, and values. The goal of this field is to demystify the future, to make possibilities for the future more known, and to increase human control over the future. In essence, futures studies can help in preparing for the unpredictable. For Motti [2], human thinking about the future has evolved from prediction to forecast to foresight and eventually to anticipation and shaping the future. Similarly, Poli [3] distinguishes among three levels of Futures Studies.

The first level is forecasting, which is the properly predictive component of Futures Studies. Forecasting is often quantitative and uses predictive models to extrapolate or project the past into short or long term time horizons. This level assumes continuity of the structure of the system under study, as well as of the laws that govern it. The second level is foresight, which includes most of the traditional fields of Futures Studies. Foresight is often qualitative, non-predictive, and produces a variety of possible futures, usually through scenarios. This level includes and even focuses on discontinuities, aiming to challenge the mindset of decision makers by investigating either multiple possible and mutually incompatible futures in an exploratory manner, by working in a forward attitude from the present to the future, or normative ones, by working backwards from a selected future towards its necessary conditions in the present.

The third level is anticipation, which is based on the outcomes resulting from forecast and foresight in order to implement them into decisions and actions. Anticipation shares some of the features of foresight, i.e., it is non-predictive, qualitative, and focused on discontinuity, but also includes “futures literacy” and the acceptance of impredicativity and complexity. This level engages with reality in a way that considers not only what actually exists but also dispositions, habits, tendencies, and forces, all of which act like latents that may become actual, if proper triggering conditions are in place. The explicit practice of anticipation enables focused goal-oriented behavior which can improve sense-making, decision-making, strategy formulation, and societal resilience. A potential drawback is that it may give rise to the cognitive bias of inattentive blindness.

## Anticipation and Governance

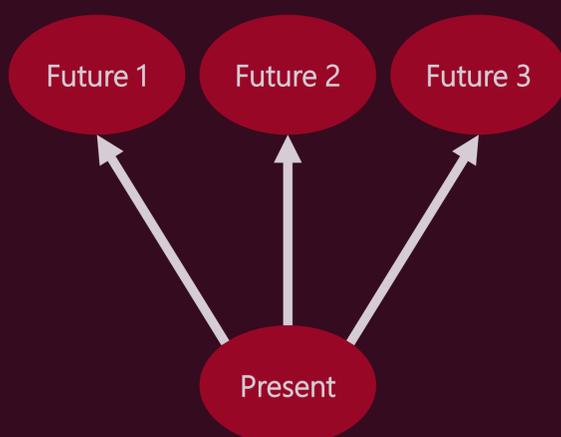
Alvial-Palavicino [4], drawing on the literature, has described anticipation as “a process through which the present is transformed, intervened in and ultimately governed in the name of the future”, which is “both a cognitive mechanism and a social process”. As a cognitive mechanism [5], anticipatory thinking -which is distinct from prediction- is the deliberate exploration and analysis of relevant alternative system states that can enable the imagining of a range of possible futures and the identification of indicators that could lead to these future states. Anticipatory thinking of the future can be either prospective branching, which examines the paths from the present towards future system states, or backcasting, which examines the paths from a particular future state towards the present. Both these forms of anticipatory thinking can be systematically supported by foresight methods which, as mentioned before, can be either exploratory or normative. As a social process [6], anticipation of futures is practiced by social actors because of their interest in controlling them, despite the impossibility of prediction, which frames anticipation as a form of governance with a normative character.

Anticipatory governance [7] can be defined as a new model of decision-making under high uncertainty which uses a wide range of possible futures to anticipate adaptation strategies, and then monitors change and uses these strategies to guide decision-making. Anticipatory governance has already been applied in emerging and contested fields of science, such as nanotechnology and biotechnology, and draws on an ensemble of three main capacities [8]: foresight, which is the capacity to explore multiple futures through diverse scenarios; engagement, which is the substantive public involvement in an exchange of ideas with traditional scientific actors; and integration, which refers to the merging of social and technoscientific research by means of co-developed processes of interchange that stimulate reflection. Political contest over anticipatory visions and interventions is intense. While practices of bringing the future into the present and shaping the present to anticipated futures can even take socio-material form and become integrated into everyday life, command over futures might also be used to establish immobilization to preserve immunity for the status quo of actors that have the required political power, as has been done with environmental futures in the past [9].

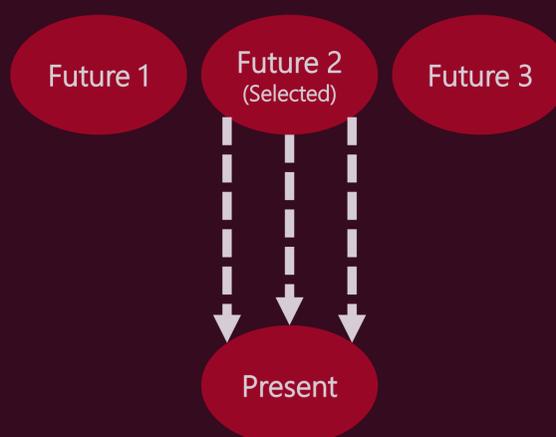
## Facilitating the Search for Technosignatures

Tarter [10] has defined the concept of “technosignatures” within the encompassing endeavor of searching for life beyond Earth as “evidence of some technology that modifies its environment in ways that are detectable”, in particular, evidence of “equivalents of some 21st century terrestrial technologies”. The discovery of technosignatures will thus permit the inference of “the existence, at least at some time, of intelligent technologists”. This poster proposes the application of insights from the study of anticipation to the Search for Technosignatures, in order to proactively facilitate the development of this scientific field. A more thorough investigation of this viewpoint will be conducted by the author in the course of his upcoming postdoctoral research project. Based on what was presented in the previous sections, there are at least two ways in which the study of Anticipation in the Search for Technosignatures could be beneficial to its course.

The first aspect is related to anticipatory thinking as a cognitive process. When thinking about the future, people can be affected by heuristics and biases [11]. Heuristics are mental shortcuts or simple rules that enable a person to engage with their surroundings in an efficient way. The use of heuristics often results in unconscious cognitive biases, which are systematic errors or deviations from norms or rationality in perception, memory, cognition, and judgment. Although useful in making efficient routine judgments, heuristics and biases are problematic in engaging with futures in a meaningful way. In the anticipation level of Futures Studies, these constrained patterns of contemplating the future are called “anticipatory assumptions”. The cognitive biases, heuristics, and anticipatory assumptions of the stakeholders involved in the Search for Technosignatures could have a significant impact on both the development of the field’s research agenda and on the imagined outcomes of a successful discovery. Thus, their study could prove beneficial. The second aspect is related to anticipatory governance as a social process. As mentioned before, this form of anticipation can utilize foresight to engage either with alternative futures or with a selected normative future. In particular, backcasting analysis [12] is an established method that can be applied on long-term complex issues in order to investigate how desirable futures can be attained. In the Search of Technosignatures, backcasting analysis could be used to first describe alternative futures of this field, then to determine the physical feasibility of a selected normative future, and finally to map the steps and measures that would be required to reach that point.



Exploring multiple futures  
(Prospective branching of anticipatory thinking)



Examining a particular normative future  
(Backcasting of anticipatory thinking)

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