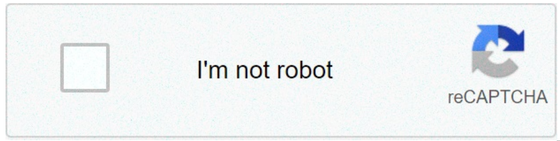

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We hypothesise that

DONATE [secure site, no need to create account] Skip to main content Download PDF Abstract: After it was proposed that life on Earth might descend from seeding by an earlier civilization, some authors noted that this alternative offers a testable aspect: the seeds could be supplied with a signature that might be found in extant organisms. In particular, it was suggested that the optimal location for such an artifact is the genetic code, as the least evolving part of cells. However, as the mainstream view goes, this scenario is too speculative and cannot be meaningfully tested because encoding/decoding a signature within the genetic code is ill-defined, so any retrieval attempt is doomed to guesswork. Here we refresh the seeded-Earth hypothesis and discuss the motivation for inserting a signature. We then show that "biological SETI" involves even weaker assumptions than traditional SETI and admits a well-defined methodological framework. After assessing the possibility in terms of molecular and evolutionary biology, we formalize the approach and, adopting the guideline of SETI that encoding/decoding should follow from first principles and be convention-free, develop a retrieval strategy. Applied to the canonical code, it reveals a nontrivial precision structure of interlocked systematic attributes. To assess this result in view of the initial assumption, we perform statistical, comparison, interdependence, and semiotic analyses. Statistical analysis reveals no causal connection to evolutionary models of the code, interdependence analysis precludes overinterpretation, and comparison analysis shows that known code variations lack any precision-logic structures, in agreement with these variations being post-seeding deviations from the canonical code. Finally, semiotic analysis shows that not only the found attributes are consistent with the initial assumption, but that they make perfect sense from SETI perspective, as they maintain some of the most universal codes of culture. From: Maxim Makukov [view email] [v1] Tue, 11 Jul 2017 17:39:26 UTC (563 KB) An hypothesis is a specific statement of prediction. It describes in concrete (rather than theoretical) terms what you expect will happen in your study. Not all studies have hypotheses. Sometimes a study is designed to be exploratory (see inductive research). There is no formal hypothesis, and perhaps the purpose of the study is to explore some area more thoroughly in order to develop some specific hypothesis or prediction that can be tested in future research. A single study may have one or many hypotheses.Actually, whenever I talk about an hypothesis, I am really thinking simultaneously about two hypotheses. Let’s say that you predict that there will be a relationship between two variables in your study. The way we would formally set up the hypothesis test is to formulate two hypothesis statements, one that describes your prediction and one that describes all the other possible outcomes with respect to the hypothesized relationship. Your prediction is that variable A and variable B will be related (you don’t care whether it’s a positive or negative relationship). Then the only other possible outcome would be that variable A and variable B are not related. Usually, we call the hypothesis that you support (your prediction) the alternative hypothesis, and we call the hypothesis that describes the remaining possible outcomes the null hypothesis. Sometimes we use a notation like HA or H1 to represent the alternative hypothesis or your prediction, and HO or H0 to represent the null case. You have to be careful here, though. In some studies, your prediction might very well be that there will be no difference or change. In this case, you are essentially trying to find support for the null hypothesis and you are opposed to the alternative.If your prediction specifies a direction, and the null therefore is the no difference prediction and the prediction of the opposite direction, we call this a one-tailed hypothesis. For instance, let’s imagine that you are investigating the effects of a new employee training program and that you believe one of the outcomes will be that there will be less employee absenteeism. Your two hypotheses might be stated something like this:The null hypothesis for this study is:HO: As a result of the XYZ company employee training program, there will either be no significant difference in employee absenteeism or there will be a significant increase.which is tested against the alternative hypothesis:HA: As a result of the XYZ company employee training program, there will be a significant decrease in employee absenteeism.In the figure on the left, we see this situation illustrated graphically. The alternative hypothesis – your prediction that the program will decrease absenteeism – is shown there. The null must account for the other two possible conditions: no difference, or an increase in absenteeism. The figure shows a hypothetical distribution of absenteeism differences. We can see that the term “one-tailed” refers to the tail of the distribution on the outcome variable.When your prediction does not specify a direction, we say you have a two-tailed hypothesis. For instance, let’s assume you are studying a new drug treatment for depression. The drug has gone through some initial animal trials, but has not yet been tested on humans. You believe (based on theory and the previous research) that the drug will have an effect, but you are not confident enough to hypothesize a direction and say the drug will reduce depression (after all, you’ve seen more than enough promising drug treatments come along that eventually were shown to have severe side effects that actually worsened symptoms). In this case, you might state the two hypotheses like this:The null hypothesis for this study is:HO: As a result of 300mg./day of the ABC drug, there will be no significant difference in depression.which is tested against the alternative hypothesis:HA: As a result of 300mg./day of the ABC drug, there will be a significant difference in depression.The figure on the right illustrates this two-tailed prediction for this case. Again, notice that the term “two-tailed” refers to the tails of the distribution for your outcome variable.The important thing to remember about stating hypotheses is that you formulate your prediction (directional or not), and then you formulate a second hypothesis that is mutually exclusive of the first and incorporates all possible alternative outcomes for that case. When your study analysis is completed, the idea is that you will have to choose between the two hypotheses. If your prediction was correct, then you would (usually) reject the null hypothesis and accept the alternative. If your original prediction was not supported in the data, then you will accept the null hypothesis and reject the alternative. The logic of hypothesis testing is based on these two basic principles:the formulation of two mutually exclusive hypothesis statements that, together, exhaust all possible outcomesthe testing of these so that one is necessarily accepted and the other rejectedOK, I know it’s a convoluted, awkward and formalistic way to ask research questions. But it encompasses a long tradition in statistics called the hypothetical-deductive model, and sometimes we just have to do things because they’re traditions. And anyway, if all of this hypothesis testing was easy enough so anybody could understand it, how do you think statisticians would stay employed? Proposed explanation for an observation, phenomenon, or scientific problem For the hypotheses of a theorem, see Theorem. For other uses, see Hypothesis (disambiguation). "Hypothetical" redirects here. For the 2001 progressive metal album, see Hypothetical (album). For the comedy TV show, see Hypothetical (TV series). The hypothesis of Andreas Cellarius, showing the planetary motions in eccentric and epicyclical orbits. A hypothesis (plural hypotheses) is a proposed explanation for a phenomenon. For a hypothesis to be a scientific hypothesis, the scientific method requires that one can test it. Scientists generally base scientific hypotheses on previous observations that cannot satisfactorily be explained with the available scientific theories. Even though the words "hypothesis" and "theory" are often used synonymously, a scientific hypothesis is not the same as a scientific theory. A working hypothesis is a provisionally accepted hypothesis proposed for further research,[1] in a process beginning with an educated guess or thought.[2] A different meaning of the term hypothesis is used in formal logic, to denote the antecedent of a proposition; thus in the proposition "If P, then Q", P denotes the hypothesis (or antecedent); Q can be called a consequent. P is the assumption in a (possibly counterfactual) What If question. The adjective hypothetical, meaning "having the nature of a hypothesis", or "being assumed to exist as an immediate consequence of a hypothesis", can refer to any of these meanings of the term "hypothesis". Uses In its ancient usage, hypothesis referred to a summary of the plot of a classical drama. The English word hypothesis comes from the ancient Greek word ὑπόθεσις hypothesis whose literal or etymological sense is "putting or placing under" and hence in extended use has many other meanings including "supposition".[1][3][4][5] In Plato's Meno (86e–87b), Socrates dissects virtue with a method used by mathematicians,[6] that of "investigating from a hypothesis."[7] In this sense, 'hypothesis' refers to a clever idea or to a convenient mathematical approach that simplifies cumbersome calculations.[8] Cardinal Bellarmine gave a famous example of this usage in the warning issued to Galileo in the early 17th century: that he must not treat the motion of the Earth as a reality, but merely as a hypothesis.[9] In common usage in the 21st century, a hypothesis refers to a provisional idea whose merit requires evaluation. For proper evaluation, the framer of a hypothesis needs to define specifics in operational terms. A hypothesis requires more work by the researcher in order to either confirm or disprove it. In due course, a confirmed hypothesis may become part of a theory or occasionally may grow to become a theory itself. Normally, scientific hypotheses have the form of a mathematical model.[10] Sometimes, but not always, one can also formulate them as existential statements, stating that some particular instance of the phenomenon under examination has some characteristic and causal explanations, which have the general form of universal statements, stating that every instance of the phenomenon has a particular characteristic. In entrepreneurial science, a hypothesis is used to formulate provisional ideas within a business setting. The formulated hypothesis is then evaluated where either the hypothesis is proven to be "true" or "false" through a verifiability- or falsifiability-oriented experiment.[11][12][13] Any useful hypothesis will enable predictions by reasoning (including deductive reasoning). It might predict the outcome of an experiment in a laboratory setting or the observation of a phenomenon in nature. The prediction may also invoke statistics and only talk about probabilities. Karl Popper, following others, has argued that a hypothesis must be falsifiable, and that one cannot regard a proposition or theory as scientific if it does not admit the possibility of being shown false. Other philosophers of science have rejected the criterion of falsifiability or supplemented it with other criteria, such as verifiability (e.g., verificationism) or coherence (e.g., confirmation holism). The scientific method involves experimentation, to test the ability of some hypothesis to adequately answer the question under investigation. In contrast, unfettered observation is not as likely to raise unexplained issues or open questions in science, as would the formulation of a crucial experiment to test the hypothesis. A thought experiment might also be used to test the hypothesis as well. In framing a hypothesis, the investigator must not currently know the outcome of a test or that it remains reasonably under continuing investigation. Only in such cases does the experiment, test or study potentially increase the probability of showing the truth of a hypothesis.[14]:pp17,49–50 If the researcher already knows the outcome, it counts as a "consequence" — and the researcher should have already considered this while formulating the hypothesis. If one cannot assess the predictions by observation or by experience, the hypothesis needs to be tested by others providing observations. For example, a new technology or theory might make the necessary experiments feasible. Scientific hypothesis People refer to a trial solution to a problem as a hypothesis, often called an "educated guess"[15][2] because it provides a suggested outcome based on the evidence. However, some scientists reject the term "educated guess" as incorrect. Experimenters may test and reject several hypotheses before solving the problem. According to Schick and Vaughn,[16] researchers weighing up alternative hypotheses may take into consideration: Testability (compare falsifiability as discussed above) Parsimony (as in the application of "Occam's razor", discouraging the postulation of excessive numbers of entities) Scope – the apparent application of the hypothesis to multiple cases of phenomena Fruitfulness – the prospect that a hypothesis may explain further phenomena in the future Conservatism – the degree of "fit" with existing recognized knowledge-systems. Working hypothesis Main article: Working hypothesis A working hypothesis is a hypothesis that is provisionally accepted as a basis for further research[17] in the hope that a tenable theory will be produced, even if the hypothesis ultimately fails.[18] Like all hypotheses, a working hypothesis is constructed as a statement of expectations, which can be linked to the exploratory research purpose in empirical investigation. Working hypotheses are often used as a conceptual framework in qualitative research.[19][20] The provisional nature of working hypotheses makes them useful as an organizing device in applied research. Here they act like a useful guide to address problems that are still in a formative phase.[21] In recent years, philosophers of science have tried to integrate the various approaches to evaluating hypotheses, and the scientific method in general, to form a more complete system that integrates the individual concerns of each approach. Notably, Imre Lakatos and Paul Feyerabend, Karl Popper's colleague and student, respectively, have produced novel attempts at such a synthesis. Hypotheses, concepts and measurement Concepts in Hempel's deductive-nomological model play a key role in the development and testing of hypotheses. Most formal hypotheses connect concepts by specifying the expected relationships between propositions. When a set of hypotheses are grouped together they become a type of conceptual framework. When a conceptual framework is complex and incorporates causality or explanation it is generally referred to as a theory. According to noted philosopher of science Carl Gustav Hempel "An adequate empirical interpretation turns a theoretical system into a testable theory: The hypothesis whose constituent terms have been interpreted become capable of test by reference to observable phenomena. Frequently the interpreted hypothesis will be derivative hypotheses of the theory; but their confirmation or disconfirmation by empirical data will then immediately strengthen or weaken also the primitive hypotheses from which they were derived."[22] Hempel provides a useful metaphor that describes the relationship between a conceptual framework and the framework as it is observed and perhaps tested (interpreted framework). "The whole system floats, as it were, above the plane of observation and is anchored to it by rules of interpretation. These might be viewed as strings which are not part of the network but link certain points of the latter with specific places in the plane of observation. By virtue of those interpretative connections, the network can function as a scientific theory."[23] Hypotheses with concepts anchored in the plane of observation are ready to be tested. In "actual scientific practice the process of framing a theoretical structure and of interpreting it are not always sharply separated, since the intended interpretation usually guides the construction of the theoretician."[24] It is, however, "possible and indeed desirable, for the purposes of logical clarification, to separate the two steps conceptually."[24] Statistical hypothesis testing Main article: Statistical hypothesis testing When a possible correlation or similar relation between phenomena is investigated, such as whether a proposed remedy is effective in treating a disease, the hypothesis that a relation exists cannot be examined the same way one might examine a proposed new law of nature. In such an investigation, if the tested remedy shows no effect in a few cases, these do not necessarily falsify the hypothesis. Instead, statistical tests are used to determine how likely it is that the overall effect would be observed if the hypothesized relation does not exist. If that likelihood is sufficiently small (e.g., less than 1%), the existence of a relation may be assumed. Otherwise, any observed effect may be due to pure chance. In statistical hypothesis testing, two hypotheses are compared. These are called the null hypothesis and the alternative hypothesis. The null hypothesis is the hypothesis that states that there is no relation between the phenomena whose relation is under investigation, or at least not of the form given by the alternative hypothesis. The alternative hypothesis, as the name suggests, is the alternative to the null hypothesis: it states that there is some kind of relation. The alternative hypothesis may take several forms, depending on the nature of the hypothesized relation; in particular, it can be two-sided (for example: there is some effect, in a yet unknown direction) or one-sided (the direction of the hypothesized relation, positive or negative, is fixed in advance).[25] Conventional significance levels for testing hypotheses (acceptable probabilities of wrongly rejecting a true null hypothesis) are .10, .05, and .01. The significance level for deciding whether the null hypothesis is rejected and the alternative hypothesis is accepted must be determined in advance, before the observations are collected or inspected. If these criteria are determined later, when the data to be tested are already known, the test is invalid.[26] The above procedure is actually dependent on the number of the participants (units or sample size) that are included in the study. For instance, to avoid having the sample size be too small to reject a null hypothesis, it is recommended that one specify a sufficient sample size from the beginning. It is advisable to define a small, medium and large effect size for each of a number of important statistical tests which are used to test the hypotheses.[27] Honours Mount Hypothesis in Antarctica is named in appreciation of the role of hypothesis in scientific research. See also Wikisource has the text of the 1911 Encyclopædia Britannica article Hypothesis . Axiom Bold hypothesis Case study Conjecture Explanandum Hypothesis theory – a research area in cognitive psychology Hypothetical question Logical positivism Operationalization Philosophiae Naturalis Principia Mathematica – for Newton's position on hypotheses Reductionism Research design Sociology of scientific knowledge Theorem Thesis statement References ^ a b Hilborn, Ray; Mangel, Marc (1997). The ecological detective: confronting models with data. 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