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See Appendix EPATI – The Existential Patents
See Appendix EPAT2 – Existential Patents Quick Summary
See Appendix TECH – Technology Progress

“Imagine Knut decides to take a sip of coffee from the mug next to his right hand. He does not even have to think about how to do this. This is not because the situation itself is trivial (a robot capable of recognising the mug, deciding whether it is full, then grabbing it and moving it to Knut’s mouth would be a highly complex machine) but because in the context of all possible situations it is so trivial that it no longer is a problem our consciousness needs to be bothered with.”

– Wiki e-book: [Cognitive Psychology and Cognitive Neuroscience, Problem Solving from an Evolutionary Perspective](#) (2011) ¹

Triviality: Within GGDM, ‘looking’ is non-trivial. This is probably not, and cannot be, true of the universe in general. Trivialness probably depends on consciousness.

- ✓ For example, I have grown very tired of always ending up in the wrong universe, the one where for each opportunity, in any situation or task, out of all of the possibilities, I end up in the universe where the petty, annoying and utterly stupid little thing always goes wrong, just for the purpose of annoying me. It’s truly amazing how consistently trivialness happens in our daily lives.

“Reverse engineering has its origins in the analysis of hardware for commercial or military advantage. However, the reverse engineering process, as such, is not concerned with creating a copy or changing the artifact in some way; it is only an analysis in order to deduce design features from products with little or no additional knowledge about the procedures involved in their original production.”

– from Wikipedia article, “Reverse Engineering,” captured October 23, 2019

Reverse Engineering: Thus, in reverse engineering, we are not trying to create an exact duplicate of Damascus Steel or an A7V tank from WWI – except perhaps to demonstrate that our analysis is correct – but rather to discover the features, abilities, and knowledge behind the design and construction. In the case of artifacts, whether alien or historical, it may be impossible or undesirable to produce an exact copy of the artifact.²

- ✓ This is an example of how Wikipedia quotes are used in GGDM; this quote helped frame the reverse engineering rules in the game design. That is, Reverse Engineering in GGDM will not allow a position to duplicate another position’s Patent or make copies without having the Patent. When the Allies captured German A7V tanks in 1918, they examined them, but not for the purpose of making copies.
- ✓ In 1976, Viktor Belenko defected to the West from the Soviet Union by flying his MiG-25 Foxbat and landing in Hokodate, Japan. The combat jet was disassembled, fully examined and tested, then returned to the Soviet Union in crates aboard a freighter and Japan presented a bill to the Soviet Union for damage to the airfield, crating and transport. The MiG-25 was an aircraft whose purpose and abilities were largely unknown to the West; it turned out to be a high-altitude interceptor not a fighter-bomber as originally believed (it had some kick, but not much punch!). The West was not trying to make their own copies of the MiG-25, but rather to make

training simulators of the MiG-25 and it is not likely that the West obtained any technology from the MiG-25 that they did not already have, the MiG-25 was borderline obsolete by the time it entered service.³

- De-conjunction Junction: Activation of the Technology Power for the purpose of Reverse Engineering is an attempt to find out how an alien technology works so that it can be used or adapted to the position's technology. The Technology Power Activation costs only a Scene at the location to be examined, no Acts are used, perhaps representing plausible deniability.⁴
 - ✓ If the junk is floating in system space, the Scene must be on the star, if not, then it must be on the planet location.

Deconstructing an alien technology requires two basic parts: The opportunity to view or have the alien technology for study, and second, the not inconsequential task of figuring out what it does and how it works.

- ✓ The 'opportunity' may also come as a result of successful Special Operations, *infra*, e.g., the insane Operation Wildhorn III, July 25, 1944 to steal V-2 rocket parts. During the Cold War, in 1988 the US stole a crashed Soviet Mi-25 Hind-D helicopter located in Chad, and the Soviets tried to snatch an American F-86 Sabre in 1951.

The latter difficulty includes, but is not limited to, different basis for the technology, alien writing and counting systems, possible differences in Eras (Would a medieval person be able to reverse engineer a telephone? Even if they had one?), the fact that the object may be part of a system and have no standalone function, that the object may be inconsequential, and not the least – the fact that it's alien.⁵

- ✓ For example, a computer keyboard is a wonderful artifact – I have many, most of them don't work (cat barfed on one, tea cup spilled on another...). The keyboard is useless without being attached to a computer, and my laptop is useless now because of a dead keyboard. Without our language and counting systems, and the concept of writing – e.g., consider a Japanese keyboard, we know what a keyboard is and does, but without the proper computers and knowledge of Japanese language, it's useless to have one. Maybe an archaeologist will find my house and a trove of dead keyboards.
 - ✓ For example, that the object may be a toy – some alien brat left its favorite toy behind and its parents had to endure the long flight with bratty pouting and whining in the backseat all the way home to Betelgeuse.
 - ✓ Not to mention schematic and mapping systems. We were told in military school that we would not be able to use Soviet maps, not only because of the different alphabet, but also because their longitude zero runs through Moscow instead of Greenwich. In the last couple of years, the full and stunning extent of the Soviet military mapping obsession has been revealed and discussed in second tier media in the West.
- Roman Numerals Again: The Roman numerals were an additive system and we understand them because they were preserved and continued some use after the introduction of the positional notation Hindu-Arabic numeral system. What if they were alien, or if Roman culture, like the Hittites, had been erased from history, and we had no cross references, no clues that they were numbers?

- ✓ “Much of the world, including Europe, also lacked an efficient numbering system such as that developed in the Hindu and Arabic cultures. (Try long division, for example, using Roman numerals.)” – Jon Davidson, “What is Calculus,” Southern State Community College (Ohio), undated article.

- See also discussion of Roman Numerals in Symbols & Abstractions, 1 Beginnings, p. 29, and EN 8, p. 33, *supra*.

Any numeral system – whether tally or place notation – has a base cycle, for example, in the current world, the cycle is 10, the numbers run from 1 to 10, and then after 10, the next number is $(10 + 1 =) 11$ through to 20, and so on. If a species only had 8 digits, their counting system might cycle in eights (octal), that is, 0-7 and the next number after 7 would still be 11, but there would be no 8, 9 or 10, 18, 19 or 20 and so on. And the development of zero in our *place notation* counting was a 500 year process; zero was originally nothing and had no symbol or at least, no mathematical operation. Zero is necessary for development of computers, but in all cases it is likely a late development added to an already existing numeral system.⁶

- ✓ In Episode 1 of the Japanese language (with English subtitles) tiaga drama Yae’s Sukara (2013), the master of the ‘artillery’ school in Edo in about 1853, rather than being concerned about ‘shooting cannons,’ instead stressed learning to read Dutch so that they could learn ‘Western arithmetic, science, military and medicine’ with the goal that Japan could build anything the Westerners could if they understood how. Thus, the key to figuring out an alien technology is as much likely in figuring out their language (especially if they left the manuals behind) than in understanding the basis of the technology; the Stargate series cheated on this issue because the aliens were using scripts known from ancient Earth (more precisely, that they had introduced to ancient Earth) to which some modern concepts were added, such as the numeral zero.
- Alien Artifact: When the Technology Power is activated for the purpose of Reverse Engineering the Scene must be at the location of the proposed Reverse Engineering attempt. The position’s Regular Turn Actions must describe in sufficient detail the specific alien physical object or colony and the level of contact with the target alien object or colony. Finally, the Action must describe the objective (or ‘sub-purpose’) of the Reverse Engineering as either Xeno-archeology, Alien Patent or Alien Stardrive.
 - ✓ Alien Stardrive objective requires possession of a reasonably intact alien starship (e.g., ‘flying saucer’), and is a slightly different procedure described separately below.
 - ✓ For the purposes of Reverse Engineering in GGDM, Xeno-archeology is not limited to ‘dead worlds’ or ancient civilizations; it broadly encompasses physical examination of all alien technologies, including on current ‘living worlds’ controlled by the position.

Previously colonized worlds can count as colonies for Reverse Engineering purposes; for example, see designated Special Planets which are former **alien colonies**, Resources from Special Planets, 2 Taxation & Census, p. 307, *supra*.

- ✓ There are a limited number of Reverse Engineering opportunities at each site or for each artifact (*ut infra*), and thus, the position players should be cognizant and choose

carefully for their needs, does the position need Research Pieces or a connections between Applications? Or is Era Progression and as shiny new Stardrive Patent more important?

- ✓ The card game Race for the Galaxy features prominently cards relating to discovery of alien ships and worlds with ruins (especially the Alien Rosetta Stone world), and the emergent “six drop” (a player term) development card called the Alien Tech Institute. In the Babylon 5 universe, there is an Earth-government related xeno-archeology corporation, Interplanetary Expeditions, which is in the business of mining alien technology for profit. Their slogan is “Exploring the past to make a better future,” though in another view, they are opportunistic scavengers of dead worlds. Within the framework of GGDM, it is likely possible to create Colleges, Institutes and/or Corporations relating to reverse engineering alien technology.
 - Organizations are *individual effectiveness multipliers*. Had Raemer Schreiber, Enrico Fermi, or Robert Oppenheimer been soldiers on the front lines – a man with a gun among thousands – they would not have invented the atomic bomb and nuclear power. The resources and commitment of the U.S. government at war placed them together at Los Alamos.
- Champollion: The starting point to resolve all Reverse Engineering activations of the Technology Power is a judgment by the Concierge – quantified in a number from 1 to 9 – of the ‘Quality of the Contact’ with the proposed alien object or colony. A value of ‘1’ represents very weak contact – such as a fleeting glimpse of a UFO – while a value of ‘9’ represents the best quality of contact, such as possession of an undamaged major alien artifact at a urbanized colony, or a colony on a planet containing the remains of a previous alien civilization. Other factors may, at the judgment of the Concierge, include whether or not First Contact has been made with the (former) alien owners (in some cases, they are extinct in the playing area), length of contact, whether **alien colonies** have been Conquered, Converted or Naturalized, and whether Diplomatic Spaces or Shared Meanings exist with the alien originators. Establishing a Specialized Colony for that purpose at the location of a dead/abandoned **alien colony** is a major effort by the position, and Colleges may also be considered. Reverse Engineered alien technology may also be important or even critical to the story of the game.

The position will not be informed ahead of time (and players should not ask) what the Concierge might consider the Quality of Contact for any situation or what factors may be considered; there will be no pre-discussion or arrangements or prejudgment opinions issued.

 - ✓ One example of the problems merging human and alien technologies into a working system is the television show, Star Trek: Deep Space Nine. Chief Engineer O’Brien comments on it several times during the show.
 - ✓ The Quality of Contact judgment by the Concierge is extremely important to all Reverse Engineering attempts. It should not be treated randomly, the Concierge should not abdicate their responsibility to a die roll when one is not dictated by the rules.
- Tourist Attraction: The attractions of Reverse Engineering alien technology ranges from the possibility of a cheap tech boost from someone else’s research to necessity when confronted with possibly superior alien military technology (in the real world, it is called Technical Intelligence, or TechInt, a prominent feature of the Cold War). Either way, it costs RPs. The position’s Turn Actions must include, as with regular Research attempts, a number of RPs

committed to the Reverse Engineering attempt, which will be immediately subtracted from the position's Treasury (this amount will not be modified as in regular Research attempts). Note that with a cost of *no Acts and one Scene*, Reverse Engineering attempts will normally be processed before Actions costing just one Act (see Appendix PAT2).

- ✓ The first two Spitfires owned by the predecessor to the Israeli Air Force were assembled from junk – leftover parts from the British Royal Air Force and parts salvaged from downed Royal Egyptian Air Force Spitfires. They were test flown in July and October 1948 and entered service. The intriguing possibility of reassembling and using alien vehicles is not directly addressed in Reverse Engineering (it would be very difficult, considering they are of alien origin, not like Spitfires). But if this were desired in the game, the Concierge could substitute receipt of an alien ship for normal results of Reverse Engineering plus some risk of loss on the first flight.
 - ✓ The best technical intelligence agency in the world is Jane's Information Group (aka, "Jane's") whose books were frequently referenced in my intelligence section during field training exercises, instead of the embark box full of dusty military field manuals that we had to bring along for show: We had an embark box full of technical manuals and a backpack full of Jane's. And a lot of pogeey bait.
- Alien Prometheus: The essence of reverse engineering is the engineering, not the technology, though some relationship of understanding must exist between the two. Technology Power activations in GGDM encompass technology and engineering as a whole process.

Reverse Engineering attempts for the purpose of 'Xeno-archeology' seek to gain Research Pieces, which are placed on the Public Space, and may sometimes result instead in a new Application placed on the Matrix (i.e. a Development). These attempts are resolved like normal Research Attempts (see 2 Technology, p. 702 *et seq.*, *supra*) with the following differences:

- ✓ No Research Area is chosen for Reverse Engineering attempts, if the attempt is successful, the Research Area is determined randomly (or by Concierge judgment).
- ✓ The *base chance* of success is 5% x the Quality of Contact modifier determined by the Concierge, which produces a base chance range of between 5% and 45%.
- ✓ The RPs committed to the Reverse Engineering attempt are divided by four instead of three, and the attempt is overfunded if the second die roll is less than (rather than less than or equal to) the RPs divided by four. Otherwise, it is underfunded; there is a greater chance of underfunding in Reverse Engineering attempts than normal research.
- ✓ The chance of success of a Reverse Engineering attempt is the base chance plus or minus the over- or under-funding percentage, just like a normal Research Attempt.

Finally, for each successful Reverse Engineering attempt for the purpose of Xeno-archeology, there is a chance equal to the Quality of Contact assigned by the Concierge that a Development will be received on the Matrix instead of a Research Piece on the Public Space. This creates an 'exponential' effect for the Quality of Contact assigned by the Concierge, as it both influences the chances of success and the chances of obtaining an alien Application instead and careful judgment should be exercised. The Application will be received when the research is fully paid, in cases of underfunding and insufficient RPs in the Treasury. The Application received will be either one listed on the Patent of the alien item being examined, or

randomly determined (e.g., for an abandoned alien world) and it will be placed in a randomly determined open location on the Matrix but not connected (see Patent Prosecution, 3 Patents, p. 747, *infra*). The Concierge can also substitute judgment based on what is being examined.

- ✓ The question of a Reverse Engineering attempt is not so much whether, given enough time (considering the time represented by a GGDM Regular Turn) they can ‘figure it out’ but rather, whether or not there is anything useful to be gleaned from what is being examined? Returning to Damascus Steel for example (or even Greek Fire), the curiosity is mostly historical; ‘rediscovery’ will likely not add much to our current technology as our current technology is vastly superior overall to ancient technology.
 - ✓ Reverse Engineering attempts, by their nature, provide many opportunities for creative Concierge use of Interventions. As I am sure you can imagine... Terminator 2 (1991) is the result of reverse engineering future technology leftover from the first movie and competing time-travelling interventions, but the whole franchise was rather careless about temporal paradoxes. Who needs intellectual stuff like temporal paradoxes when you have Schwarzenegger?
 - ✓ [Interview] “Someone who assembled the weapon – it might have been Schreiber, I don’t recall – remembered that when the whole thing was supposedly finished, he noticed that some of the wires were reversed and stayed up all night reversing them back the way they were supposed to be or the thing might not have worked at all. And it was General Groves’ horror that the bomb might not work, the material would land on the ground and the Japanese would sweep it all up and use it to make a bomb themselves, not a very likely scenario, but General Groves worried a lot about making sure these things actually worked when and how they were supposed to work.” – Richard Rhodes (author of The Making of the Atomic Bomb (1986)), The Half-Life of Genius: Physicist Raemer Schreiber (2018).
- Itsappe Who Stole Fire: Prometheus stole fire from the Titans to give to man (Ancient Greek tale), Itsappe (coyote in the Shoshone tale) stole fire from the humans for the animals.⁷

Reverse Engineering with the objective of ‘Alien Patent,’ if successful, will result in one random connection being established on the Matrix between two Applications are adjacent on the Matrix and not currently connected. There does not have to be an actual alien Patent.

- ✓ It’s sort of like, ‘Gee, I didn’t know the safety match tip and the friction strip on the match pack were connected!’⁸☺

The mirroring requirements plus the chances of success make ‘Alien Patent’ a long shot, but an established connection can be very beneficial in terms of several potential future Patent Prosecutions (see 3 Patents, p. 747, *infra*) and Era progression (see 1 Eras, p. 759, *infra*). The process does not directly lead to copying of or obtaining the Alien Patent.

- ✓ A Reverse Engineering attempt for the purpose of Alien Patent costs 1 RP.
- ✓ The chance of success of the Reverse Engineering attempt is equal to the Quality of Contact expressed as a percentage, that is, from 1% to 9%.

If successful, a connection will be established between two Applications currently on the Matrix as described above. If there are multiple possible connections, one will be chosen randomly (meaning there is likely little reason for the Concierge to exercise judgment on this).

- ✓ The business card read, “Wile E. Coyote, Super Genius. Have brain. Will travel.”

“Lazar said that his job was to help with the reverse engineering of one of nine flying saucers, which he alleged were extraterrestrial in origin. Lazar claims one of the flying saucers, the one he coined the ‘Sport Model,’ was manufactured out of a metallic substance similar in appearance and touch to stainless steel. In a subsequent interview that November, Lazar appeared unmasked and under his own name.

Lazar claimed that the propulsion of the studied vehicle was fueled by the chemical element with atomic number 115, or ‘E115’ (which in the 1980s was presumed to exist but had not yet been artificially created; it was first synthesized in 2003 and later named moscovium). Lazar explained that the propulsion system relied on a stable isotope of E115, which he explained generates a gravity wave that allowed the vehicle to fly and to evade visual detection by bending light around it. No stable isotopes of moscovium have yet been synthesized; all have proven extremely radioactive, decaying in a few hundred milliseconds.”

– from Wikipedia article, “Bob Lazar,” captured October 23, 2019

Flying Saucers: Stardrive Patents are different from regular Patents in GGDM, as will be explained in the Stardrive sections, *infra*. If the Reverse Engineering purpose is ‘Alien Stardrive’ – one of which must be present e.g., from a crashed or captured alien ship, and the reverse engineering attempt is successful on the same Regular Turn as an attempt is made to prosecute a new Stardrive Patent, the chance of success of the latter is increased by 5-15%. That is, rather than possibly receiving a Research Piece (or Application) or a connection between Applications on the Matrix, Reverse Engineering of the Alien Stardrive may result in improvement of a chance to successfully develop a new Stardrive on the same Regular Turn.

- ✓ Norman Spinrad’s Second Starfaring Age (The Void Captain’s Tale (1983), Child of Fortune (1985)) was kicked off by the reverse engineering of the alien Jump Circuit from abandoned colonies of We Who Have Gone Before.

As described in Event Horizon, 1 Eras, p. 760, *infra*, development of a new Stardrive is critical to advancement out of the 1st Era, so this could be very important to the position. To obtain this possible effect of Reverse Engineering an alien stardrive requires two activations of the Technology Power on the same Regular Turn, and the Reverse Engineering attempt will resolve first.

- ✓ This effect cannot be obtained if 1) the ship being examined had a Generic Stardrive (GSD, see 2 Stardrive, p. 791, *infra*) and 2) the position attempting the Reverse Engineering already has the Generic Stardrive (GSD) Existential Patent. In these cases, the Reverse Engineering attempt will be converted to Xeno-archeology and resolved accordingly (as the position may not know in advance what sort of Stardrive was on the ship being examined, and this is a risk), and will have no effect on Stardrive Patent prosecution.
- ✓ This process does not allow improvements in Ship Speed of the Generic Stardrive (or any other Stardrive) through Continuous Operational Technology (COT) Patents (see 2 Patents, p. 740, *infra*), it only applies to prosecution of a new Stardrive Patent as described in Stardrive Patent Prosecution, 2 Stardrive, p. 796, *infra*.

- E115: The chance of success in Reverse Engineering an Alien Stardrive is the Quality of Contact (QOC) number determined by the Concierge plus the Current Era of the position.

This means that the range of probabilities is from 2% to 11% (QOC 1-9% plus 1-2% for 1st or 2nd Era, min 2%, max 11%); it is unlikely unless the 4th Era is opened in the game (optional), that a 3rd Era position will attempt to Reverse Engineer an Alien Stardrive.

- ✓ The percentages range from a 1st Era position looking at a totally smashed alien ship trying to figure out how it goes (2%) to a 2nd Era position examining an intact alien ship (11%).

The attempt also costs 3 RPs from the Treasury.

- ✓ This, like many other Power Activations in GGDM is a risk-cost-benefit evaluation. For the cost of a Technology Power Activation, a Scene and 3 RPs, the position has a 2-11% chance of getting a one-time bonus, usable on the same Regular Turn that it also tries to prosecute a new Stardrive Patent. But success could significantly alter the development trajectory of the position and possibly the game!⁹

Upon a successful Reverse Engineering of an Alien Stardrive, the bonus of 5-15% to concurrent Stardrive Patent Prosecution on the same Regular Turn is randomly determined and applied. The position does not need to know the bonus received, only that they successfully Reverse Engineered the Alien Stardrive. Each type (that is, the type of Stardrive on the ship, each ship can have only one type) of Alien Stardrive may only be Reverse Engineered once.

- ✓ As an aside, a Minor Race (pre-1st Era) would have a 1-9% chance of figuring out the flying saucers they captured, if the government can surreptitiously budget (over say, 50 years or a century) the 3 RPs without the taxpayers noticing.
- Alien Tourist Trap: It is suggested that each major alien object or general location (i.e. Special Planet) may be the subject of a limited number of Reverse Engineering attempts by a single position. That is, a position should not be able to ‘milk’ or ‘mine’ one find for the entire game; the find should be investigated and *then civilization moves on*, whether or not anything was gained from the investigation. Any continuing research at the site is subsumed under normal Research and Development rules described in 2 Technology generally, *supra*, without specific reference to xeno-archeology. How many attempts are allowed for each site or object is at the judgment of the Concierge, but an entire dead/abandoned alien planetary civilization should not merit more than three Reverse Engineering attempts (in one to three consecutive Regular Turns), perhaps one of each objective (i.e. Xeno-archeology, Alien Patent, Alien Stardrive) while a single crashed alien ship should get only one attempt of any type.
 - ✓ The Concierge, through use of an Intervention, *may* change the initially set Quality of Contact modifier on the second and third Reverse Engineering attempts at the same location; e.g., the researchers may do damage through carelessness or lack of understanding, thereby reducing the chances of success, or they may improve chances through diligent, careful, considered analysis. This should be done for story purposes and the Concierge should prudently avoid doing it to solely ‘level up’ ‘reward’ or ‘punish’ a position; it could also be handled completely randomly by a computer assistant, though that sort of defeats the purpose of having a human Concierge and disregards the possible effects of Colleges and positional commitment to technology.

- ✓ Reverse Engineering attempts could be made at the location of Conquered **alien colonies** or **alien colonies** of other Native Population Types in the game that have recently been abandoned or obliterated. This very much affects the Concierge judgment of quality of the contact (the scale of 1-9, *ut supra*); a Conquered Colony, intact, will rate high on the scale, whereas, there might not be much left to find if the subject colony has been largely obliterated before surrender or being forcibly Balkanized.¹⁰
 - See also Xenobiology discussion, 1 Information, p. 1333, *infra*.
- ✓ Reverse Engineering should not be confused with scavenging, e.g., the main lead characters at the beginning of the TV series *Defiance* (2013-2015) were scavengers looking to make it rich quick in a mostly lawless wasteland. However, if the participants like, scavengers could be the source of alien junk at a location to be used in Reverse Engineering attempts. Scavengers could have a major effect on the game even.
- ✓ There is a *blurry continuum* from scavenging to intelligence to reverse engineering, e.g., Project Azorian attempting to recover Soviet submarine K-129 in 1974, to which Howard Hughes lent plausible deniability (see 3 Special Operations, p. 1314, *infra*).

“Man the maker looks at his world and says ‘So who made this then?’ Who made this? – you can see why it’s a treacherous question. Early man thinks, ‘Well, because there’s only one sort of being I know about who makes things, whoever made all this must therefore be a much bigger, much more powerful and necessarily invisible, one of me and because I tend to be the strong one who does all the stuff, he’s probably male.’ And so we have the idea of a god. Then, because when we make things we do it with the intention of doing something with them, early man asks himself, ‘If he made it, what did he make it for?’ Now the real trap springs, because early man is thinking, ‘This world fits me very well. Here are all these things that support me and feed me and look after me; yes, this world fits me nicely’ and he reaches the inescapable conclusion that whoever made it, made it for him.”

– Douglas Adams, “Is there an Artificial God?” speech at Digital Biota 2, Cambridge U.K., September 1998 (transcript and audio recording of the more than one hour speech are available free at <http://www.biota.org/people/douglasadams/>)

Children & Puddles: This is probably how children see the world, and how my cats – if they ever wondered why – would think of their heated cat houses and food dishes. What Mr. Adams is speaking about is a simple acceptance of existence. Like a cat or child. But the child grows up, and the cat doesn’t.

- ✓ See also In Our Puddle, 1 Entropy, pp. 231-232, *supra*, for Douglas Adams’ ‘puddle’ story.
- ✓ See further Mythopoeic Thinking discussion, 1 Temporal Technology, p. 809, *infra*.

[Interview] *“The discovery of nuclear fission was like the discovery of fire. It was the first major form of energy that does not depend upon, ultimately, the sun.”*

– Richard Rhodes (author of *The Making of the Atomic Bomb* (1986)), *The Half-Life of Genius: Physicist Raemer Schreiber* (2018)

The Secret of Fire: There was a debate in the latter half of the 20th Century about when human ancestors (not necessarily beings we would call human) discovered or gained the controlled use of fire. This is not an issue as simple as it sounds, for there is a difference between having controlled use of fire obtained and preserved from natural sources, and the ability to make a fire.

The one fact that was clear throughout was that human ancestors had the ability to keep and control fire for far longer than they had the ability to make fire – our ancestors probably obtained fire first from lightning strikes on trees and other burnable materials, or from carrying burnable materials up to volcanic vents. Fire was so important that the story of how humans obtained fire was embedded in every religion from the time that creation myths began; many Native American myths describe a wolf bringing fire down from the heavens or a volcano as a gift to humans.

The secret of fire is this: That human ancestors had fire – and overcame the animal’s instinctive fear of fire – for a long enough time that it profoundly affected our evolution. Some estimates place the advent of controlled use of fire back as far as 750,000 years ago, based on evidence found in caves at Zhoudoukian (i.e. The Peking Man, *Homo erectus pekinensis*). Most scholarly analysis accepts that human ancestors had control of fire – if not the ability to make fire – at least 400,000 years ago.

- ✓ One can imagine back around 1 million B.C.E. a persecuted weird doomsday cult that wore body covering and insisted on cooking all foods, and who predicted the demise of all who didn’t follow their way...

The benefits of the controlled use of fire are easily extolled in their obviousness; they include warmth, light, protection from predators and winter, the ability to expand to new living areas, pottery, heat-bending wood and hardening wooden spear points.

- ✓ “Evidence for life in caves is abundant, and Mousterians must have occupied them extensively. Windbreaks of poles and skin were probably erected at the cave mouth for protection against the weather. Fire is in general use by this time of course, and no doubt used for cooking, for warmth, and for keeping dangerous animals at bay.” – Jurmain, Nelson & Turnbaugh, Understanding Physical Anthropology and Archeology, 3rd Ed., 1987, p. 437.

Fire light probably was a major contributing factor to the rise of storytelling (e.g., cave paintings), legends, early religion, and mysticism. Fire was the first god that humans could touch.

- ✓ “We mentioned earlier Peking Man’s practice of cutting away the base of a human skull to remove the brain. Deep in the Guattari Cave, sixty miles south of Rome, Neanderthals performed a similar ritual. Explorers found a human skull – the right side crushed and the foramen magnum area cut out – in the center of a circle of stones. Near the circle were several piles of deer, cattle, and pig bones. Apparently, the man had been killed (sacrificed?) outside the cave, by a smashing blow to the right side of his head. His head was taken into the cave and placed within the circle of bones. What is the meaning of this remarkable activity? For the first time in human history, we find people who are concerned with more than the material aspects of life. Deliberately burying a corpse and depositing objects that belonged to him alongside his body reflects attitudes and values different from the ordinary. Death had meaning, perhaps mystical, something unknown, and Neanderthals recognized that they had to come to terms with what they didn’t understand.” – *Id.*, pp. 439-440.

- **Raw Meat:** But most importantly, fire led to cooked food. Cooking food makes it softer and of course, safer, as it kills many harmful microbes that might have devastated early population groups. Softer food is easier to chew and to digest, and this in turn, meant that the muscles that control the jaw, which are attached to the top of the skull, decreased in size. This decrease in the size of the chewing muscles may have resulted in a larger cranial space. This change was so pervasive over a period of half a million years – how many people do you know who have an appetite for unprocessed raw meat?

- ✓ “By the Middle Pleistocene times in Java, *H. erectus* had changed, but not a great deal. A slight increase occurred in the height of the vault and the diastema and projecting canine had disappeared. The small brain continues in the Trinil (Sangiran) 2, 3, 10, 12, and 17 specimens, which are all remarkably similar. There seems to have been little evolutionary change in the Middle Pleistocene until the upper levels of the Kubah Beds are reached. Here, a recent significant find, Sangiran 17, estimated at about 500,000 years, represents a decided break in the similarity of Javanese Middle Pleistocene erectus forms.

Although this almost complete skull retains the basic morphological pattern of Java erectus, it is longer, broader and higher. The dental arch is remarkably similar to *H. sapiens*, and the forehead is higher than any other Javanese *H. erectus* of the Middle Pleistocene. These modifications of skull size are reflected in the cranial capacity of Sangiran 17, which measures 1,023 cm³. We do not presently know what processes might have occurred in the short time representing 30 feet of strata separating Sangiran 12 (900 cm³) from Sangiran 17 (1,029 cm³) that could have produced this increase in cranial capacity.” *Id.*, p. 383.

No, humans are not able generally to consume raw meats – our digestive system and psychology have changed so much from the evolutionary impact of controlled fire, that conscious effort is required to eat *unprocessed* raw meats (you would not dine with the lions and wolves) – and many humans don’t seem to prefer to consume even raw vegetables or to a lesser degree, raw fruits (though of course, we can and do). Warm food is reassuring and relaxing, it is a vital part of our psychology, the need to eat warm, cooked food, once a day.

- ✓ Not even Paleo-diet promoters hawk eating raw meat (but hawks do!).

- **Testosterone Bubble:** At a much later point in human evolution, approximately 150,000 to 50,000 years ago, there was a marked decrease in the testosterone levels of male populations over a wide range of ethnicities. This may have – is theorized to have – resulted in less violence, more cooperative behavior, and less distraction. The timing of the decrease coincides with most of the intellectual and cultural advances associated with late prehistoric humans.

- ✓ “Humans went through a major development 50,000 years ago, when the species, which first developed 150,000 years earlier, started to develop tools and art started to flourish. Testosterone levels in humans was beginning to moderate down to modern concentrations around the same time, according to a new study.

Study was undertaken of 1,400 modern and ancient skulls, which led to the understanding of decreasing testosterone levels. Among these were 13 skulls more than 80,000 years old, along with 41 specimens aged between 10,000 and 38,000 years, and 1,367 modern skulls, representing 30 ethnic backgrounds. Researchers believe

that lower levels of the male hormone may have led to a greater degree of understanding between people, reducing violence, allowing arts and toolmaking to become more advanced.

‘The modern human behaviors of technological innovation, making art and rapid cultural exchange probably came at the same time that we developed a more cooperative temperament,’ Robert Cieri, from the University of Utah and lead author of the study, said.

Decreasing testosterone levels were noticeable through the changes to the shape of human skulls from the period. Thick eyebrow ridges receded, as heads became rounder.” – James Maynard, “New Study Links Lower Testosterone Levels to the March of Civilization,” *Tech Times*, August 12, 2015.

- ✓ “Testosterone levels can also affect social interactions of our primate relatives, according to researchers. Male chimpanzees experience a large increase in testosterone levels during puberty, while concentrations among bonobos is small. When chimps become stressed, their bodies release additional testosterone, while cortisol, a hormone related to stress, floods the bloodstream of bonobos. Social interactions between chimpanzees are much more prone to violence than similar incidents between bonobos. Brow ridges are also much more pronounced in chimps than they are in the mellower species.” *Id.*

We have now reached a point where some men need testosterone-boosting treatments.

“Biology is more like history than it is like physics. You have to know the past to understand the present. There is no predictive theory of biology, nor is there for history. The reason is the same: Both subjects are still too complicated for us.” – Carl Sagan, Cosmos, Episode 2

Backdoor Evolution: Carl Sagan shows that empiricism *does not equate* to predictive ability.

There was no anthropology class in my STEM-oriented high school (we had a planetarium and a two story greenhouse inside the school), and no courses in psychology or any of the social sciences. On the latter, “World Cultures” was about as far as they got when they should have been teaching intro criminology. In the United States, at least, anthropology (of any kind) has been considered a college subject as no local school board would risk the wrath of the righteous right in funding a course in anthropology (or anything approaching evolution, even zoology).

This represents a major gap in our public education that probably has not changed, with consequences for civilization. In fact, evolution was not even discussed; rather, the teaching of evolution was back-doored in – as it was in so many places – through the teaching of biology by progression through the phyla of the animal kingdom. Many authors have pointed that modern biology or life sciences cannot be taught *sans* evolution. Further, to ‘disprove’ the ‘theory’ of evolution would require the destruction of the whole of modern science, as every branch of science has contributed over the last 150 or more years, to the developments in our understanding of life and evolution on Earth.

But what truly becomes interesting is when the controversial textbook Of Pandas and People (1989, 1993) is introduced into the conversation. In *Kitzmiller v. Dover Area School District*, 400 F. Supp. 2d 707 (M.D. Pa. 2005), the Court determined that the book was simply a reedited

creation science book where some terms were substituted for ‘creator’ to avoid claims that the book was creationist. Thus, the court deduced that the intent behind *Of Pandas and People* and the introduction as a required textbook in the Dover Area School District was an attempt to backdoor the teaching of ‘creation science’ in public schools, which had previously been rejected in *McLean v. Arkansas Board of Education*, 529 F. Supp. 1255 (E.D. Ark. 1982) and *Edwards v. Aguillard*, 482 U.S. 578 (1987). The *Kitzmiller* Court concluded thus:

- ✓ “Those who disagree with our holding will likely mark it as the product of an activist judge. If so, they will have erred as this is manifestly not an activist Court. Rather, this case came to us as the result of the activism of an ill-informed faction on a school board, aided by a national public interest law firm eager to find a constitutional test case on ID [intelligent design], who in combination drove the Board to adopt an imprudent and ultimately unconstitutional policy. The breathtaking inanity of the Board’s decision is evident when considered against the factual backdrop which has now been fully revealed through this trial. The students, parents, and teachers of the Dover Area School District deserved better than to be dragged into this legal maelstrom, with its resulting utter waste of monetary and personal resources.”

But there have been no court cases of which I am aware – after *Tennessee vs. Scopes* – regarding the backdoor teaching of evolution via high school biology (or sometimes called life sciences) classes. Defendant *Scopes* lost technically, but the real loser was Fundamentalism, and the real winners were the Modernist. In matters of pure fact, as in cases before the Court where establishing *fact* is paramount, science clearly has the upper hand over religion, which is why it is utter fallacy for religion and creationist to fight in Court battles, especially ones with no jury.

There is an interesting dynamic playing out, corollary to the Empirical Mythology discussion in 1 Technology, p. 691, *supra*: Science has been very careful not to cross over into the reserve regions of religion – except that it hasn’t stopped science-fiction writers from regularly going there – but religion has ham-handedly attempted to invade the factual regions of science on many occasions. It is worth reading again:

- ✓ “Science and religion ask different questions about different things. *Where religion addresses ontology, science is concerned with ontic description.* Indeed, it is what Orthodox theologian David Bentley Hart calls their ‘austere abdication of metaphysical pretensions’ that enables the sciences to do their work.” – Michael Robbins, “Atheists Used to Take the Idea of God Seriously. That’s Why They Mattered.” *Slate Magazine*, July 8, 2014 (emphasis added).

“People never stop to think about these basic facts when they watch wars and cop shows on the television. People take too much for granted. Each time a gun is fired the whole history of engineering comes into play. Of politics, too: war, assassination, revolution, terror. Guns aren’t just history’s props and agents: they’re history itself, spinning alternate futures in their chamber, hurling the present from their barrel, casting aside the empty shells of the past.”

– Tom McCarthy, *Remainder* (2005)

Endnotes.

¹ Citation: Cognitive Psychology and Cognitive Neuroscience – Problem Solving from an Evolutionary Perspective, by AkumAPRIME, Anwinkle, Aschoeke, et al. (14 contributors, 52 anonymous edits), at <https://en.wikibooks.org/w/index.php?oldid=2064115>, published in PDF book form at <http://www.saylor.org/site/wp-content/uploads/2011/05/Problem-solving-from-an-evolutionary-perspective.pdf> (Saylor Academy).

² Citation: “Imitation is the sincerest form of flattery that mediocrity can pay to greatness.” – Oscar Wilde.

³ Commentary: I read Belenko’s co-authored (with John Barron) autobiography, *MiG Pilot* (1980) sometime around 1985. Some Marine who barrowed the book in the late 1980s drew a moustache and goatee with a pen on Belenko’s cover image. Because that’s what they did to books in high school, and most first-enlistment military service members are high school kids with guns.

⁴ Commentary: “Conjunction junction what’s your function?” – Schoolhouse Rock, “Conjunction Junction” (1973).

- ✓ I am a bit raffish. That much should be clear by now. What the heck does Schoolhouse Rock have to do with reverse engineering alien technologies? But if you think about it long enough ...

⁵ Commentary: There are lots of conjecture and conspiracy theories on this point in the UFO community. Does the government have a UFO, bodies, or other alien artifacts stowed somewhere down Extraterrestrial Highway (Nevada SR 375)? Have they made any progress in figuring out the technology? Remember pushing the lever forward is reverse. Hollywood loves UFO conspiracy theories (e.g., Independence Day, Close Encounters).

⁶ Citation: I highly recommend viewing the April 18, 2020, Up and Atom YouTube video “Why We Might Use Different Numbers in the Future,” which clearly explains what always seems like a complicated subject of numbering systems. The video references books by Isaac Asimov on the advantages of different base numbering systems.

⁷ Commentary: Native American tales still have some charm, whereas Ancient Greek tales have always seemed to have been told by a bunch of drunk old men.

- ✓ Though I could not find it, I remember a native tale about a coyote who carried a burning twig in its mouth down from a volcano to give man fire.

⁸ Citation: “The first known use of matches was in 577 during the siege of a town in northern China. Women in the town used sticks coated with a mixture of chemicals to start fires for cooking and heating, thus allowing them to conserve their limited fuel by putting the fires out between uses. The details of this technique were subsequently lost to history. It was not until 1826 that John Walker of England invented the first friction matches. Walker’s matches were ignited by drawing the heads through a folded piece of paper coated with ground glass. He began selling them in 1827, but they were difficult to light and were not a success.” – Chris Cavette, “Match,” How Things are Made (<http://www.madehow.com/Volume-3/Match.html>), undated article.

⁹ Commentary: In the universe of the Andromeda television series, the Vedrans invented slipstream drive and conquered the worlds of their galaxy, forming an empire, using their exclusive control of the means of FTL travel. The Kalderan race was attacked by the Vedran Empire, but they later captured a Vedran starship and reverse engineered the slipstream drive. With slipstream drive, the Kalderans built a fleet of starships that were able to strike back against the Vedrans and only eventually succumbed due to the vast size and resources of the Vedran Empire compared to the much smaller area controlled by the Kalderan Commune (see discussion of Minor Races, 4 Diplomacy *infra*). Eventually the Vedrans, like the Romans, understood that they could not control such a large empire (three galaxies) indefinitely, and the Vedran Empire morphed into the more democratic Systems Commonwealth. Knowledge of the slipstream drive thereafter spread to all technological species, either through membership in the Commonwealth, or because the Kalderans gave the technology to everyone to encourage galactic revolts.

¹⁰ Commentary & Citation: For example, the Russians gained the knowledge and ability to produce tungsten steel when they took over the Krupp Works in Magdeburg during the post-WWII occupation (source, Wikipedia article, “Krupp,” July 20, 2018). Tungsten steel, which Germany had been manufacturing since before WWI, was the material key to the superiority of German armor and weapons. *This implies that the Russians did not have tungsten steel armor during WWII.* This is an example of how a technology could be captured with a colony, at the judgment of the Concierge; no reverse engineering was required.

- ✓ England had only one tungsten mine in 1912, and it was owned by the Germans and England was getting 90% of its tungsten from German companies before WWI (Greig Watson, “World War One: Tungsten ‘the armour plate of conflict’” BBC News, June 6, 2014). During WWII, the allies bombed tungsten mines controlled by Germany along with other mines that provided nickel and molybdenum to harden steel, by 1943, the quality of new German armaments declined due to shortages – tungsten was also used in armor-piercing tank shells which drained the supply (the Soviets also used tungsten rounds, e.g., the T-34 fired them).