Smooth seas do not make good sailors

Georgina Parry April 2014

Asimov: ***In the same way democracy can not survive overpopulation human dignity can not survive overpopulation, convenience and decency can not survive overpopulation. As you put more people into the world the value of life not only declines but it disappears. It doesn't matter if someone dies, the more people there are the less one matters.*** [1]

There is no need for alarm clocks as all are woken by the gentle artificial sunrise, as the lighting is gradually restored to the habitat areas. Optional birdsong, relayed live from the 'Wildlife' zones, plays during the breakfast hours.

Grace makes her own late breakfast with the ingredients her mother has left by the blender. Spiralina, chlorella, coconut milk, coconut oil, avocado. One fat metabolism activating, micro-nutrient packed, tasty, antioxidant rich, green, smoothie! She takes it to her private room. Then logs herself into school. Her friends avatars are already at their desks. The screen switches to the 'whiteboard'.

The first law of sustainability.
Population growth and or growth in the consumption of resources can not be sustained.

She wonders, fleetingly, why it is there every morning. It is said that the world's population within the sanctuaries is stable at 5 billion with 0% growth. Disease, famine and war were left behind. Those with the calling to dedicate themselves to the life of warriors patrol the surface, keeping away criminals, terrorists and debris that pose a threat to the ventilation shafts and logistics portals. They collect weather data from the surface weather stations and carry out repairs on the apparatus when needed. They also escort culture and technology exchange missions between sanctuaries.
There are so many ways to serve mankind other than procreation. Those with the calling to be parents must apply for suitability examination and training. They give up a lot of benefits and freedom when making that choice of dedication. Besides, everyone can share in the lives of the sanctuary's children with regular updates on the 'C.F. (Child and Family) zone' channel. For some, watching their lives is like watching their own family. But most people are fulfilled, and feel significant and valued without children.
Grace remembers seeing the Affirmation on the entrance to C.F.

Every child a wanted child
Every child a healthy child
Every child loved and nurtured
Every child educated and socialized
Every child a blessing to our sanctuary

She had memorized it because it made her feel warm, appreciated.
New screen:
"*The greatest shortcoming of the human race is our inability to understand the exponential function."*
Dr. Albert A Bartlett

Yes that one is familiar, the lesson of the bacteria in a jar.

From the knowledge hub
"Bacteria grow by division so that 1 bacterium becomes 2, the 2 divide to give 4, the 4 divide to give 8, etc. Consider a hypothetical strain of bacteria for which this division time is 1 minute. ….One bacterium is put in a bottle at 11:00 a.m. and it is observed that the bottle is full of bacteria at 12:00 noon. Dr. Albert A Bartlett When was the bottle ***half-full?*** *Answer:* ***11:59 a.m.!***
How long can the bacterial growth continue if the total space resources are quadrupled? [I.e. three new bottles are found.] Answer: "Quadrupling the resource extends the life of the resource by only two doubling times! **[*Just two minutes*]**. *When consumption grows exponentially,* ***enormous*** *increases in resources are*

consumed in a very short time!" Dr. Albert A Bartlett [2]

These are important lessons that mankind had to learn and every child in the global sanctuaries education programme learns.
That example brings to mind the symbiont microorganisms used to defend the sanctuaries from disease. Antibiotics are mostly obsolete, as are disinfection and sterilization. Disease is avoided by maintaining healthy bodies, inside and out, and by having a healthy living symbiont environment. Cleansing is carried out with mild cleansers containing encapsulated beneficial microbes, such as Lactobacilus species. These symbionts compete with pathogens, preventing their proliferation.

New Screen:
There is no wealth but life. He who buys what he does not need steals from himself.

She has seen this affirmation before, at the start of the history class last term. She recalls being told that growth of consumption and production used to be a measure of success. How silly that was. Now even infants begin to learn about the exponential function, to understand that limits can not be exceed. At first they think being allowed to take more and more jelly beans out of the box is a good thing but when the box is empty they gradually begin to understand.

It's like this everyday. It's called social affirmation. Everyone in the sanctuaries shares this belief system, knowledge of the mistakes of the past, and of the sacrifices of the future problem solvers who made the survival of so many possible. Some had been leaders, some scientists, some philanthropists and some just visionaries who could see what needed doing but needed others to make it happen. What they had in common was they had opened their eyes and heeded the change in the weather. Each region of the Earth had its own challenges and there was not one solution to suit all. The future problem solvers pooled their knowledge, expertise, research and development, and ideas. Their Motto was **"Adapt to survive".**

New screen:
The human species is the ultimate generalist, we learn, we adapt, we survive.

Yes we do, she thought. When she had been younger she had worried about the unwritten future and what would happen to the thousands of sanctuaries scattered across the globe. Her mother listened to her concerns and then said "*Smooth seas do not make good sailors.*" Grace now knew it as one of the affirmations. Her mother patiently explained that it meant. "Whatever happens we will learn from it and be better able to deal with similar problems in the future. We are becoming good sailors, Grace." She smiled. There is no shame in being wrong so long as we learn. People can even choose to alter their dedication if they have a new calling, though most are permanently sterilized by the age of 25.

Grace is looking forward to Bioengineering today. They have had several weeks to work on the behavior programming and testing of their virtual 3D models. The designs are being presented for the first time. She is hopeful that her design will do well in the upcoming trials. The prize is to have the design 3D printed and presented to the people of habitat 2739 in the community Knowledge Hub. From there the design specification will be shared with the sanctuary's Central Knowledge Hub and could be accessed by other sanctuaries looking for a solution.
It certainly meets the specification. It must solve a problem, and it must be a survivor. Useless designs or ones that break easily will be eliminated early. She has designed a planting aid that could work in the gardens or 'Wildlife' zones. It is based upon a hunting spider morphology. Its spider like legs dig a hole in the ground, then it will lay a seed, like an egg, before carefully covering it with the good earth. It will work all day or night with its lightweight energy efficient design. It is tough too, with chitin and keratin components and soft, self healing polymer hydraulic arteries.
This bioengineering project has been a labor of love. She has nurtured and modified its virtual form into its final solution. It is a survivor, she is sure of it. Her confidence comes from long experience of design and programming life like forms and behaviors. As a toddler she had learned to use BAMZOOKi [3]. An old, old game but considered of educational value for pre-schoolers. Also, like all kids, she learned to read and learned to code at the same time. Collaboration on virtual habitat projects is a recess activity for the older children, when Kids Zone and Greenspace trips are not scheduled. The younger ones are nearly always

given free play exercise in Greenspace. The older children's virtual selves, their avatars, can explore and play in the virtual worlds of their own creation, which may contain as much or as little magic as they wish to include. Sometimes it's pure escapism, sometimes testing realism. Either way it exercises their minds in play.

Passive tunnel ventilation solution of prairie dogs. Application: Reducing the need for active ventilation or mechanical air conditioning of a subterranean network.

Bernoulli's principle can be regarded as a statement of the conservation of energy principle for flowing fluids. The qualitative behavior that is usually labeled with the term "Bernoulli effect" is the lowering of fluid pressure in regions where the flow velocity is increased. Bernoulli's principle applies to various types of fluid flow.[4]

Action of Bernoulli effect on the rim crater burrow design of the black tailed prairie dog
When air flows across a surface the velocity gradient gives a potential source of work. …The burrow of the black-tailed prairie-dog would be an extraordinarily large respiratory dead-space if diffusion alone were relied upon. Diffusion appears inadequate for sufficient gas exchange. The burrow is built for wind-induced ventilation. Typically it has two openings at opposite ends and mounds surrounding these, of two forms, one form on each entrance. [5]
Entrances are of 3 kinds. Some have no mound . Others have a wide, round, unstructured mound (given the name dome crater), or a high mound, shaped like a volcano, with clearly visible rim, (given the name rim crater). If a tunnel has a low dome crater and a higher rim crater a breeze blowing across the ground will cause air to enter the lower dome crater and exit the higher rim crater.[11]Mounds with sharp rims are more effective exits for air than mounds with rounded tops. In black tailed prairie dog colonies the shape differences are correlated with the differences in height. [6],[7]

The prairie dogs look cute, thinks Grace. Do they have prairie dogs in this sanctuary? She will ask the Knowledge Hub at the end of this lesson.
As many species as possible have been spared but many now exist only as records in the Knowledge Hubs, or in some cases as preserved genetic material. Plants and animals that have medicinal, companionship, bio-mimicry or bioengineering relationships to mankind have a special place of respect in the hearts and minds of the people. Each has been scrutinized for direct uses or adaptations that could be useful 'in the unwritten future'. Their images are displayed on the walls of the Knowledge Hub, together with the tree of life to which all Earth life belongs, as a mark of respect. The human population could not survive alone and these are fellow survivors, on the same journey, sharing the same key of life, the same genetic cypher.
New screen:
Desert snails-survivors [7]

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New Screen:
Revision of Gills
Centrifugal air extraction Current application, auxiliary air supply for sub-aquatic sanctuaries, and submarines.
The separation of dissolved air from the water can be achieved by applying low pressure. Henry's Law states that, the amount of gas dissolve-able in a liquid is proportional to the pressure on the liquid. Reducing pressure causes dissolved gas to be released. Achieved by using a centrifuge causing lower pressure in the center from where the air supply is collected. Developed by LikeAFish Technologies [8]

Oxygen diffusion extraction
What are the human metabolic parameters that made nano-material diffusion extraction of oxygen problematic? Include metabolic O_2 requirements, toxicity of CO_2 and excess O_2, and the solutions to these problems in your discussion.[9],[10]

Gills, grown according to nature's specification, with external placental interface are a great adaptation for the sub-aquatic sanctuaries. The sea floor was colonized when it was realized that sea level rise could not be halted or held back. The sub-aquatic sanctuary dwellers are not confined now. They can swim unhindered in the ocean, and in the aquaculture ponds and aquatic 'Wildlife' habitats. It makes salvaging resources and history from the submerged cities a much more pleasant dedication. So cool, thinks Grace. She hopes one day to be accepted for a cultural exchange expedition.

The affirmation had become: ***Adapt to the environment. Do not cause more problems than you solve." (Bend like the willow.)*** Some people like to wear willow tree emblems a reminder of their strength without resistance to change, though others prefer the tree of life symbol, which is a reflection of their culture of bio-mimicry[11] and respect for life.
Back in history people had been saying: ***Adapt the environment to survive***, but it was decided that geo -engineering projects were too dangerous because of the unknown, undesirable consequences that might occur. [12]Restoring the African grasslands and other areas of desertification has been a success though. Regenerating some habitat suitable for surface living and slowing CO_2 rise. Where once overgrazing had been blamed for desertification, a future problem solver, *Allan Savory*, realized it was insufficient beneficial trampling and manuring of the land that was the real culprit. Large roving herds of animals encourage plant growth with stabilizing root structure. When trampled into the ground, this plant material locks in the carbon. Savory had said *"We must use livestock, bunched in very large moving herds, mimicking the way they used to roam when wild, or as they were herded in our agricultural past."*[13]
It had taken time for the project to gain momentum. People had first to accept the paradoxical wisdom.

Recess * * * *

After shared recess, real or virtual play, the rest of the day is for personal research and study or creativity. Grace is building her own textures library. She likes to play the textures collection as a screen saver. Watching them slowly morph into each other as her mind relaxes and zones out. The project has approval from her parents and mentors. Stress reduction is seen as activity worthy of dedication time. It increases resistance to disease and improves mental and social well being. For the same reason some of the children choose to spend time with companion animals.[14]

On the family's habitat screen is written -

Diversity aids survival, do not let the book be destroyed to save the page

That's a historic affirmation. It had been necessary to prevent mass migrations, to protect civilizations and preserve unique and valuable cultures. At a time when the whole World was facing its own problems there had had to be global co-operation. To build sanctuaries to protect the lives of the helpless hordes, preserve the civilization that lay in the path of their migration, preserve the diversity of humanity and to live up to what it means to be human.

The 3D printing revolution [15] allowed rapid construction of temporary sanctuaries, which could then be extended and improved with a safe population. Some would choose the dedication to sanctuary design or dedication to construction. The production of new materials had also been a great help. Starting with the first self healing concretes [16] and Self-healing polymeric materials [17],[18]but progressing to living materials, often chosen for their properties of self healing and strength. Bones with artificial supply of nutrients and oxygen. Living self healing echinoderm based skins, or chitin exoskeleton for biospheres. Organic forms of seed pods and plankton are preferred as dwellings [19] and work spaces. They make the artificial environment beautiful and seemingly natural. Humans are becoming symbiotic residents of living man made hosts. The life of the sanctuary depends upon its ecosystem of inhabitants and the inhabitants depend upon the sanctuary's survival.

Not everyone embraced the idea of living in the sanctuaries. Some stayed outside. They said they were waiting for God. Grace had asked her mother what that meant. She replied with the story of the drowning man. "Three ships came by but the drowning man sent each of them away. When the man died and met his God he asked, "why didn't you save me." His God replied, "I sent three ships." They had a certainty in their

minds that couldn't be shaken. We're not prisoners, Grace, we choose this life. Those that want to leave often choose to serve the sanctuary with the dedication of warriors. But it is a very tough life. Most people wouldn't be able to survive out there. Without the sanctuaries programme mankind would have been facing an evolutionary bottle neck. That means nearly everyone dies and the few survivors become the progenitors of the new hominid species. Who knows if we would even recognize them as men, Grace?"[20]

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The news-Weather patterns shifting again.

The weather has been temperamental for a long time. Long-term weather forecasting is difficult because it shows "sensitive dependence on initial conditions." Still called the butterfly effect here (Even though the reports from the sanctuary's warriors are that no butterflies have been seen on the surface for a long time!) It makes planning expeditions difficult.

From the Knowledge Hub
The Lorenz Strange Attractor was discovered while Edward Lorenz was trying to create a model of the atmospheric dynamics of planet Earth, in the 1960's He used a shortened version of the Navier-Stokes equations. The Navier–Stokes equations describe the motion of fluid substances. These equations are found by applying Newton's second law to fluid motion, assuming that the stress in the fluid is the sum of a pressure term and a diffusing viscous term (proportional to the gradient of velocity) which describes viscous flow. The Navier–Stokes equations, in full and simplified forms help with the design, study,modeling and analysis of many things involving flow of liquids or gasses. [21]
The non-linear dynamic system used for Lorenz' model illustrates cyclic long term behavior revealing ***a hidden order.*** [22]

Grace reasons that people must have once thought that, because small initial alterations to a linear system lead to small changes, so as long as the climate inputs were kept small, everything was fine. That's how a set of completely deterministic equations behave. The inputs have not been small though. (It may have been the additional methane released by the melting ice sheets and permafrost.)[23],[24] *And* the equations are nonlinear. Nonlinear systems may demonstrate amazingly complex 'chaotic' behavior. The entire Earth climate and weather system is chaotic.[25]

This sanctuary might one day be buried under ice. The scientists say it's to do with shifting of the ocean currents [26]. Grace isn't afraid. It's a completely self sufficient biosphere now containing many different ecosystems that are needed for sustainability. The inhabitants can live under the ice, burrowing up into it if needs be. Or the sanctuary could be put into hibernation. There has been a lot of research into hibernation and aestivation of animal species [27],[28] as part of the Global, future migrations research and development policy. Not only are the dormant states well understood, they are used as therapeutic measures. Careful control of body temperature can lower a person into a dormant hypothermic state, useful for traumatic injuries and surgery.[29] Fever therapy and aestavation therapy are used for curing infections and for cancer treatment.[30] Both of those kinds of disease are thankfully very rare nowadays. It is thought that is because of the compulsory sleep regime and optimal vitamin D levels[31] within the population, obtained through diet as there is insufficient exposure to natural sunlight via the solar tubes. Sanctuary 2739 might even be chosen for the first migration into space. Nowadays it is unthinkable that people would go out alone into space. As unthinkable as chopping off an arm, throwing it away and expecting it to survive. It can't because it's part of a greater whole, just like mankind belongs with the tree of life. The sanctuary's biosphere has been self sufficient and sustainable for at least 10 years. It can survive and support human life independent of any outside assistance. Sometimes Grace hopes 2739 will be chosen, "we *are* ready now", she tells herself.

Everyone loves the artificial night. After a long tiring day at their dedication they let their bodies bathe in the natural melatonin. It has built up in their bodies gradually as the wavelengths of the lighting are centrally reduced from blue to red. It is called sunset and is said to mimic the change in wavelengths of light on the surface with which human metabolism evolved.

From the Knowledge Hub

Near sunrise and sunset, the natural light approaches nearly tangent to the Earth's surface. The light's path through the atmosphere is so long that much of the blue and green light is scattered out, making the clouds the sun illuminates appear red. [32]

Mammalian eyes are not just a part of the sensory system that produces images Additionally the mammalian eye detects changes in light irradiance leading to non-image forming light responses. Synchronization of the circadian rhythm's clock is one non-image forming, irradiance dependent response [33]

Exposure to light at night has been correlated to several types of cancer, diabetes, heart disease, and obesity. Exposure to light suppresses the secretion of melatonin, and lower melatonin levels are considered the link with cancer. Researchers have also linked short sleep to increased risk for depression and cardiovascular disease. Researchers who shifted the timing of the circadian rhythms of their subjects found that their blood sugar levels increased, giving a pre-diabetic state, and decreased levels of leptin, the hormone that makes people feel full after eating. [34]

Any light of can suppress the secretion of melatonin, but blue light is the worst culprit. Different wavelengths of light were compared for melatonin suppression and phase shifting of the salivary melatonin rhythm. The shorter wavelengths of 470, 497, and 525 nm showed the greatest melatonin suppression, 65% to 81%. [35]

Sleep is compulsory as a population health measure. The Culture and Entertainment Zone closes before sunset and people return to their own habitats. EM devices are centrally shut down so there are no distractions. People sleep better than they ever did on the surface, and are healthier as a result.

Once upon a time it was thought that all llife was within a space-time continuum, where past and future were the same and everything that would happen was already written into its fabric. Many clever men (and women) agreed, though it made some people uncertain and uncomfortable. The clever men would show the mathematics and win the argument. Then it was found that it was a trick of the light. The answer had been written on a web site called FQXi [36]. The image mankind call 'the present' has been written in the light but the material future has not been built. Now it is the mission of people like Grace, and the human species, to build a future. Success will be measured by the contentment, health, altruism, high culture, and creativity of its people. As a species, Homo sapiens sapiens are hackers of nature's solutions presented by the tree of life, that has evolved over millions of years. It could not be clearer if there was "**How to survive"** in big bold letters written on every surviving life form. Life provides lessons on, for example how chemistry and physics are harnessed efficiently. The solutions are applied to solve humanity's problems, or stored for future use. Many life forms, having 'sailed rough seas', have lessons to teach. Together the humans are becoming 'sailors' who can survive what ever nature's temper. Mankind is no longer *as* vulnerable, having developed a way of living, learned form the book of knowledge, written in the genetics, morphology, anatomy, physiology, metabolism, biochemistry, biophysics, behavior and ecology of life. A truly sustainable, versatile and adaptable way of life that is ready to be transplanted to other hostile worlds. The time and work it has taken to nurture and develop a human culture based upon sustainability, symbiosis, bio-mimicry, and respect for life has been preparation for the mission to propagate the tree of Earth life; so that even if all life on Earth is destroyed, G=C,C=G,A=T,T=A lives on.

Carl Sagan:**"*A blade of grass is a commonplace on Earth; it would be a miracle on Mars. Our descendants on Mars will know the value of a patch of green. And if a blade of grass is priceless, what is the value of a human being?*"**[37]

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