

Appendix

Common Critiques of the Idea of Human Space Settlement

Modern critiques proposing that humanity should not attempt to settle space (e.g. Billings 2018, ‘Colonizing other planets is a bad idea’) frequently use a small set of emotional or putatively moral arguments against the idea; I have addressed each of these ideas directly and at length in my 2012 semi-popular-science book *Emigrating Beyond Earth: Human Adaptation and Space Colonization* and articles published in *Spaceflight* and *Scientific American Mind*. On the one hand, I do not often engage in this debate as I find its most commonly-cited arguments to be poorly-formulated from the start. On the other, it is important, when one has the luxury of some possibility of cultural influence, to make the genuine case for space settlement. On the third hand, it does not seem to me that a culture that needs to be convinced to do something as difficult and dangerous as attempting space settlement will ever achieve that goal, it will have to be carried out by people willing to take large personal risks for a larger-than-the-individual goal of safeguarding the better of humanity. Such people are not likely to be influenced by critics who suggest that for whatever reason, humans should not attempt to settle space. Such critics will of course not do so and will remain on Earth.

To these ends in this appendix I provide a direct critique of a recent article that uses all the most common arguments that humanity should not attempt to settle space.

“Should a species like ours spread itself to other planetary environments that can be exploited for human gain?” This question uses the ‘trigger’ word *exploited* in an inflammatory way, even if inadvertently. Exploitation simply means the use of something, and all species, plant and animal, use resources in maintaining the processes of living systems. Also, ‘human gain’ is here suggested as something distasteful or otherwise negative, while I argue, throughout this book and other writings, that space settlement should be considered a responsible act of species- and civilization-insurance. If humanity and civilization are not considered worthy of preservation, we have a fundamental difference of opinion.

“Should humans seek to exploit and/or colonize space? If so, how should this be done?” These are vast questions, some of which I address in this book and my other writings advocating for space settlement. In particular in this book and *Emigrating Beyond Earth* I have made significant efforts to cast human space settlement in an evolutionary context and as a net moral good.

“Is it possible that humankind is evolving into ‘a terrible new species,’ one more destructive than ever before?” It is entirely possible that this is so, and entirely possible that it is not so. The context of the question suggests that the author feels it is the case, but that is an assumption not verified. Any human culture and any technology may be deployed for good or ill.

Would it be ethical to enable people with enough money to buy a ticket to leave our troubled Earth behind? The cost of space access is currently high, but it is being reduced; the expense of voyaging to Mars, or building, for example, Lagrangian-point colonies, will be quite high for some time. The act of departing the troubled Earth is here cast as irresponsible, but may conversely be seen as responsible, as I argue above, as there is no guarantee that Earth civilization will not collapse to the great loss of humanity’s many moral goods. The distribution of wealth on Earth will always be an Earthly problem that should not be exacerbated by small numbers of people voyaging beyond Earth.

Would it be ethical for government(s) to subsidize such an enterprise? This is possibly a fair critique and a good argument for private space settlement efforts. I agree that governments should operate first to protect and ensure a safe and fulfilling life for their constituents.

What are the ethics of giving the rich yet another advantage over the poor? If the advantage implied here is the advantage of having a safer and more tolerable life in some habitat beyond Earth, it is not clear how that would occur at the expense of the poor if space settlement were privately funded.

Does this American image of the Wild West extended to off-Earth locations justify cowboy colonization of other planets? In my discussions with serious space-settlement planners I do not encounter a cowboy mentality. Rather I find people interested in self-sustaining settlements that would be among the ‘greenest’ of all humans settlements because resources would be precious and all processes would be eminently designed for efficiency. I have only encountered the negative visions of the ‘Wild West’ approach in dystopian fictions, including many depicted by Hollywood.

Does belief in American exceptionalism provide sufficient justification for off-Earth colonization? The conception of settlement beyond Earth originated in the historical period with the Russian Tsiolkovski, and many space agencies—including the Japanese, Canadian, Chinese, Indian, Russian, British, American and European—all express an interest in humanity living beyond Earth. The conception that this idea is entirely American is insular and ignores these many other serious considerations of humanity-beyond-Earth.

Is this near three-centuries-old version of manifest destiny propelling the present generation to colonize other planets? (and) If so, does manifest destiny provide sufficient justification? The conception of space settlement as ‘Manifest

Destiny' is rooted in outdated concepts of the 1950s, when space settlement was expressed largely as the ultimate conquest of Nature. I detect no such conception in modern and serious space-settlement planners. The modern conception considers space settlement as a project that would better our understanding of ourselves Nature, through living in exposure to that wider Nature.

Is this near three-centuries-old version of progress propelling the present generation to colonize other planets? (and) If so, does progress provide sufficient justification? As in the prior question, this sentiment of an ancient conception of inevitable progress is outdated and I do not detect it in serious space-settlement plans or discussions.

In other words, is the project or policy going to provide a return on the national investment, if we define 'return' to be the economically sustainable human habitation of space? As in my previous book on this topic, *Emigrating Beyond Earth*, I do not argue that space settlement must provide an economic return on a federal investment, although any investment made at the federal level would be a contribution to the larger project of species- and civilization-insurance.

How much do we actually know about how people's religious beliefs intersect with their thinking about space colonization? I think we know little about this, but am unclear on how 'peoples' (generally) religious beliefs would be affected by space settlement. People of many religious faiths have expressed an interest in space settlement and I see no reason that they would not themselves participate in space settlement. I would no more accept a given religion's opposition to space settlement as a reason to curtail it than I would accept a given religion's opposition to prevent other action by private individuals who have different religious views.

That said, the results of this survey, for those who place weight on such things, do not provide any credible evidence that the U.S. citizenry is in favor of the human colonization of space. The author then should be satisfied that space settlement will not receive federal funding or be attempted. I agree that if the citizenry are not interested in a given project, they should not be compelled by the federal government to take it up. At the same time, individuals pursuing their own course of action should be allowed to carry it out if it does not impinge on the rights of other citizens. Private space settlement, I argue, is in this position.

While Elon Musk may claim that his plan to take people to Mars will be privately financed, it must be noted that Musk built his space business on direct and indirect government subsidies and that government contracts now constitute more than \$1 billion of his company's annual revenue. It is disingenuous to imply that the federal government is promoting space settlement by supporting Musk's company with technology development and space-services contracts. The federal government is focused in these contracts on lowering the cost of space access, with an almost exclusive focus on access to Low Earth Orbit. Certainly the federal government is not actively promoting space settlement, and NASA has no office of space settlement, with their mission explicitly described as exploration.

Index

A

Acclimatizations, 43, 213
Active teaching, 157
Adaptation, 8, 275, 277
Adaptation by first-to third-generation space emigrants, 226
Adaptive Domains of Human Culture, 286
Adaptive domains of humanity, 272
Adaptive options, 322
Adaptive planning models, 347
Adaptive potential, 163
Adolescence, 75
Ageing, 67
Agriculture, 319
Allee Effect, 111
Alleles, 102
Analogue studies, 344
Analytic mode of thought, 299
Animal postnatal movement, 200
Anthropocentric, 25
Anthropology, 4, 7
Archaeology, 231
Arrival, 213
Artificial intelligence, 190
Arts, 181
Assimilation, 213
Associative mode of thought, 299

B

Bainbridge, W.S., 343
Barnett, Homer G., 185
Behavioral adaptations, 272
Behavioral development, 59
Beyond Earth, 4
Biocultural adaptation, 4

Biological evolution, 7
Biological sex, 172
Biomimicry, 220, 326
Bodily decoration, 176
Bordieu, Pierre, 214
Brown, Donald, 283
Bruno, Giordano, 1

C

Cellular cytoskeleton, 42
Censorship, 162
Census population, 113
Childhood, 75
Childhood Health Promotion, 78
City, 316
Clinal variation, 216
Closed populations, 133
'Closed-system' spacecraft, 30
Communal religions, 175
Connectome, 55
Conurbation, 317
Course of life stages, 178
Creativity, 299
Critical period' in development, 53
Critiques of the idea of human space settlement, 357
Cults, 175
Cultural selection, 104
Cultural maladaptation, 162
Cultural reaction norm, 163
Cultural regulation of biological evolution, 188
Cultural selective environment, 158
Cultural transition, 306
Cultural universals, 165
Culture, 7, 156

D

Default mode network, 55
 Demes, 94
 Demography, 124
 Development, 53
 Dialects, 167
 Dispersal, 199
 Distributions of animal life across geographies, 201
 Drift, 105
 Dunbar Number, 139
 Durham, W.H., 182, 282

E

Ecclesiastic, 175
 Economy, 314
 Effective Population, 112
 Effects of radiation with dose, 79
 Egalitarian, 311
 Embryogenesis, 52
 Emic, 272
 Emigrating Beyond Earth, 231
 Emigration, 199
 Encephalized, 55
 Enculturation, 306
 Epigenetics, 213
 Episodic consciousness, 190
 Establishment, 216
 Ethics, 170
 Ethnogenesis, 184
 ETHNOPOP, 133
 Etic, 272
 Eugenics, 142
 Evolutionary computing, 340
 Evolutionary contingencies, 32
 Evolutionary paradigm for space settlement, 345
 Evolutionary transitions, 14
 Exoanthropology, 11
 Exposure scheduling, 65
 Extrasomatic means of adaptation, 8
 Extraterrestrial, 4
 Extraterrestrial anthropology, 11

F

Family, 313
 Family structure, 177
 Fertilization, 50
 First-cousin marriage, 107
 Fixation of new variety, 217
 Flight physiology, 41

Food Preferences, 180
 Food pyramids for three modern culture groups and speculative beyond-earth settlement types, 298
 Foodways, 180
 Founder Effect, 108
 Functional development, 56
 Future-in-Space Working Group Telecon, 64

G

Gabora, Liane, 190
 Gardner-O’Kearny, William, 135
 Gastrulation, 50
 Gender, 172
 Generations, 100
 Genetic diversity, 100
 Genetic in-migration, 102
 Genetic screening, 143
 Genetic testing, 143
 Genotype, 7
 Gerathewohl, Siegfried J., 11
 Gesture, 168
 Godwin, Francis, 1
 Grammar, 167

H

Habitation beyond Earth, 6
 Hamlets, 316
 Hein, Andreas, 131
 HERITAGE, 135
 Heterozygosity, 105
 Heterozygotic decay, 109
 Hina, 1
 Hologenome, 7
 Homeobox genes, 221
 Homeostasis, 213
 Hominins, 20
 Homo, 4
 Horticulture, 319
 HOX gene family, 41
 Hox genes, 221
 Human adaptation to microgravity, 279
 Human biological adaptive tools, 282
 Human dispersal distance, 16
 Human global dispersal, 198
 Human material cultural universals, 336
 Human research roadmap, 80
 Humans-in-space, 6
 Human vocalized language, 168
 Hypergravity, 42

I

Implantation, 50
 Incest taboos, 179
 Independent colonies, 27
 Independent dwelling, 316
 Infancy, 75
 Infrastructure conditions superstructure, 283
 Innovation, 321
 Instinctual physical actions, 42
 Interplanetary medium, 4
 In vitro gametogenesis, 71

J

Justice, 172

K

Kinship, 309
 Kinship-based descent, 310

L

Lagrangian points, 4
 Language, 166, 288
 Life expectancy, 68
 Linton, Ralph, 308
 Longue duree, 25, 183
 Low Earth Orbit, 4

M

Major dimensions of religious traditions, 306
 Malina, Frank J., 301
 Management of property, 172
 Marin, Frédéric, 131
 Mason Lab, 189
 MATLAB, 135
 Mechanisms of culture change, 183
 Megacity, 317
 Memes, 8
 Microgravity, 42
 Migration, 101, 199
 Migration syndrome, 219
 Minimum Viable Population, 113
 Model of human space emigration, 221
 Monotheistic, 175
 Moore, John, 133
 Moral codes, 302
 Moral philosophy, 170
 Moran, Emilio F., 282
 Movement, 211
 Mufwene, Salikoko S., 292
 Multiagent simulation, 341
 Multigenerational communities, 63

Murdock, George P., 276
 Mutagenesis, 60
 Mutation, 100

N

Natal dispersal distance, 17
 Natural, 104
 New routines of life, 214
 Niche construction, 278

O

Olympian, 175
 On the Origin of Species, 10
 Oogenesis, 47
 Open populations, 132
 Ovarian follicle atresia, 83

P

Passive shielding materials, 63
 Phenotype, 7, 43
 Phenotypic plasticity, 58
 Philosophies of adaptive human space settlement, 349
 Polytheistic, 175
 Pool of options, 185
 Population genetics, 95
 Postreproductive adulthood, 81
 Power, 311
 Preadaptation, 210
 Prenatal, 72
 Preparation, 202
 Proliferation, 216
 Propaganda, 162
 Proxemics, 211
 Punctuated equilibrium, 128

R

Radiation, 60
 Radiation sources, 62
 Radiation therapies, 65
 Range expansion, 199
 Ranked, 311
 Rappaport, Roy, 305
 Reaction norm, 22
 Recommendations are the following specific to radiation hazards, 63
 Reference species, 41
 Reproductive adulthood, 79
 Reproductive behavior, 179
 Reproductive isolation, 127
 Resilience, 321

S

SCHELL, 346
Selection, 104
Selective environments, 198
Self-selecting group, 210
Settlement, 213
Settlement pattern, 315
Shamanic, 175
SHELL, 345
Skylab, 301
Slavery, 312
Social engineering, 193
Social roles, 172
Space, 4
Space anthropology, 11
Space colonization, 6
Spaceflight, 39
Space settlement, 6
Speciation, 127
Species, 127
Spermatogenesis, 45
Stages of human emigration beyond earth, 201
Stages of human life, 25
Subsistence mode, 319
Summerford, Steve, 141
Supernatural, 173

T

Terrestrially-tethered settlements, 27
Thesesus, 205
Timescale for formalized educational change, 218
Timescales for genetic change, 99
Tools for adaptive space settlement planning, 324
Towns, 316
Tsiolkovski, Konstantin, 2

U

Ultimate sacred postulates, 182

V

Variation, 60
Villages, 316
Vocabulary, 293
Vocabulary change, 294

W

Worldship, 130
Wright, Sewall, 112