

Astrosociology and Its Subfields: A Preliminary Guide for Students Who Wish to Pursue the Field

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The movement toward an astrosociological curriculum has slowly made headway since the incorporation of the Astrosociology Research Institute (ARI) in May 2008. Much of the effort during the first two or three years involved the continued articulation of the definition and relevance of the field, which still continues to some extent, but the shift in orientation for ARI has begun to move toward the implementation of educational programs and the execution of astrosociological research. ARI's *Astrosociology in the Classroom* program exists to develop courses that cover the various astrosociological subfields, including its first objective of creating an *Introduction to Astrosociology* course for undergraduate students. The focus of astrosociology centers on the human dimension of space exploration, settlement, and other related activities; that is, how the human element interacts with space. This interaction between space and society/humankind, known as *astrosocial phenomena* – and defined as social, cultural, and behavioral patterns related to outer space – is the focus of astrosociology. As a multidisciplinary field, it includes the social and behavioral sciences, the humanities, and the arts. The importance of astrosociology lies in the fact that it epitomizes the underrepresented half of the entire body of knowledge needed to understand and sustain the potential of an increasingly strong relationship between humankind and space, with the other half consisting of the STEM fields and disciplines. The intent of this essay is to provide potential astrosociology students with a survey of the important subfields so they can make informed decisions about whether to pursue the field during its early stages within academia. Potential students should be aware that they would become important shapers of astrosociology just by their very study of astrosociological issues.

I. Introduction

STUDENTS of astrosociology represent the future, as they will comprise the backbone of the movement to create a coherent and organized academic field (Pass, 2009) to fill the void that should have consisted of the social-scientific approach toward understanding the relationship between space and society (Pass, 2006a; Pass, 2006b). A major assumption that underlies the very notion of an astrosociology academic field centers on the argument that, in fact, it is needed based on the dearth of social science and humanities disciplines and fields that touch on outer space that existed before 2004² with the posting of the first part of the astrosociology Inaugural Essay (Pass, 2004). This trend continues even today despite the existence of astrosociology. “The contribution that the social sciences and the humanities have been allowed to make to space studies and actual space endeavors to date is very slight” (Dator 2012). A huge unrealized potential exists, but it needs fulfillment.

To be fair, individuals worked on such topics long before then, but they did not do so as part of any dedicated subfield or subdiscipline. Frankly, most of them worked in relative obscurity from the views of those comprising the mainstream portions of their disciplines and fields. Nevertheless, they have indirectly provided the foundation of astrosociology through their tireless and inspired efforts (Pass, 2008:881). Thus, social scientists are no strangers to the study of space issues. However, a more comprehensive and organized approach was needed in the past. Little

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² The field of astrosociology was founded by the author in 2004. The reasoning for doing so was based on the argument that no dedicated, coherent effort existed to provide education and research regarding outer space from a perspective that includes the social and behavioral sciences, humanities, and the arts. As of the writing of this paper, things have changed too slowly among the aforementioned disciplines and fields, which remains a challenge, though the space community has begun to take astrosociology much more seriously.

collaboration among social scientists was possible without the recognized structure of a formal field that we see today in astrosociology. Therefore, a major effort is underway to unite as many social science and humanities scholars interested in space issues as possible – along with the effort to recruit interested students – so that progress can occur and their contributions can benefit the space community.

This paper devotes considerable discussion to the Astrosociology Research Institute (ARI) throughout. This particular organization exists for the sole purpose of developing astrosociology and facilitating the carrying out of astrosociological education and research. Fulfilling ARI's mission involves implementing courses at various educational levels as well as recruiting (1) students, (2) professionals in the social sciences, (3) collaborators from the physical and natural sciences, and (4) supporters of all types to help fund the effort. Participation and assistance from a variety sources are necessary due to the nature of the problem involved; that is, the fact that the very fields and disciplines required to develop astrosociology do not recognize the subject matter as accepted subfields. This general statement refers to the gatekeepers and mainstream constituencies of these fields and disciplines. Despite this reality, a growing number of social scientists and humanities scholars – and their students – are beginning to focus on astrosociological-type issues in increasing numbers.

This paper represents a continuation of the effort to push toward instituting astrosociology as an academic field. The major subfields discussed along with research questions require attention. These questions were long ignored in the past by social scientists, but it is ARI's mission as a nonprofit organization to develop the field so that a truly holistic view of human spaceflight and related areas of study become commonplace among all space scientists, students, and the public. This essay represents a first comprehensive look at the astrosociology subfields so that students of all stripes can familiarize themselves with some of the core issues involved.

II. Astrosociology Definition and Relevance

Before proceeding further, it is important to reexamine briefly the definition and relevance of astrosociology as a foundation for discussions to follow. Astrosociology is defined as the scientific study of *astrosocial phenomena*, which consist of social, cultural, and behavioral patterns related to outer space.³ It is a multidisciplinary perspective field meaning that it includes the social and behavioral sciences, the humanities, and the arts insofar as involving those scientists and scholars from these perspectives who study space issues. The astrosociological perspective focuses on the relationship between space and society, or how astrosocial phenomena affect human beings and their societal structures both on Earth and beyond. It also involves how human beings in space interact with those on Earth.

Moreover, there is a strong connection to the STEM fields and disciplines (i.e., science, technology, engineering, and mathematics) that represent the major categories of traditional subject areas within the space community. Collaboration is a major part of ARI's approach. A truly holistic view of space issues can only come about when the scientists and scholars from the two branches of science collaborate in a formal and meaningful manner (Pass, 2008). Otherwise, the status quo will continue in which a significant number of scientists within the physical and natural sciences have a strong interest in space issues while the great majority of social scientists continue to ignore them while a relative handful pursue space issues on their own.

The relevance of astrosociology lies in the absence of space issues the social sciences and humanities covered in the past, subject matters it now focuses on directly. Moreover, the likely future of humanity's destiny most probably involves living in environments beyond Earth's atmosphere. Therefore, the impact of astrosocial phenomena should increase as the twenty-first century unfolds.

Unless humanity is knocked back to the Stone Age by some massively destructive event, or social problems become overwhelmingly disruptive, it is apparent that the relevance of astrosocial phenomena will increase in the future. Human [societies] will incorporate, benefit, and become more dependent on the space sciences and space exploration technologies (Pass, 2004b:28).

The growing importance and influence of science and technology in contemporary societies encompasses a strong interaction between space and society, and thus astrosociology will become more relevant as time passes. The involvement of the human dimension also demands the significant input of the social sciences and humanities, which should become more important in collaboration with the physical and natural sciences.

Future human spaceflight and space exploration – the latter of which is broadly defined here as venturing into space to accumulate knowledge and garner other benefits, both tangible and intangible, via human presence or robotic spacecraft – will involve more people and more sophisticated equipment. Human spaceflight, exploration, settlement, and resource exploitation involve *human beings*. Thus, it is clear that astrosocial phenomena affect

³ For a brief, though comprehensive discussion, see the ARI website's home page: <http://www.astrosociology.org>.

individuals, cultures, subcultures, social groups, institutions, and actually all terrestrial social structures. In the future, space migration will involve transformative social change on Earth's societies and their various constituent elements in addition to new human experiences that occur in space ecosystems.

The fact is that astrosocial phenomena have affected human cultures and individuals for the full extent of recorded human history, and even long before that, yet we know very little about the consequences of this in terms of how they have helped to shape human perception, thought, and future aspirations. Humanity did not need to venture into space to feel the effects of space phenomena or question its place in the cosmos. Astrosocial phenomena had affected human beings, their cultures and societies, long before the Soviet probe called Sputnik 1 became the first human-made satellite in 1957 or Yuri Gagarin became the first human being to orbit our planet in 1961. Despite this reality, the social sciences, humanities, and the arts did not follow along with physical and natural sciences in the serious study of the relationship between humanity and outer space, even when the era of human spaceflight began. In 2004, the author founded astrosociology – and much too late by the way – to fill the gap of an academic field dedicated to the study of outer space from a social-scientific perspective so that a single recognizable astrosociological focus and related literature could contribute to the STEM-based research already common within the space community.

III. The Astrosociology Research Institute (ARI)

The establishment of ARI in 2008 brought in the other half of the scientific disciplines and fields into the space age. The other branch of science consists of the social and behavioral sciences, the humanities, and the arts (Pass, 2008). Why is this important? Based on the relevance of astrosociology described earlier, and the lack of response to a social-science orientation over the course of the space age, it seemed important to this author to create astrosociology first in 2004 and thereafter ARI once the momentum for developing the field became adequate.

ARI exists in order to facilitate the development of astrosociology by providing and encouraging education and research from a social science perspective. ARI's primary mission is to develop the field of astrosociology as an academic field that attracts social and behavioral scientists, and most importantly, students from whom the space community has received relatively little input in the past. The mission is focused around attracting individuals, organizations, and other entities to assist in the field's development at a rather precarious point even today. This effort is extremely important, as its failure may well resort to falling back into a social reality in which the social sciences and humanities remain isolated from space education and research in a number of fundamentally social-scientific areas. Moreover, existing fields such as space history, space law, and astrobiology will not receive the benefit of input from social scientists. This would leave holes in the attempt to create a holistic approach that could potentially include all types of scientists and scholars from both branches of science in educational, theoretical, and research efforts.

A. ARI Education and Research

Education is the hallmark of any academic field. The ARI flagship program in this area is called "Astrosociology in the Classroom" and it serves as nexus for all types of efforts aimed at moving astrosociology into the lectures and curricula of educational organizations. "Besides attracting established professionals, a vital part of ARI's overall strategy involves attracting students to study astrosociology and inspiring them to later embrace the field as practicing social scientists – that is, as astrosociologists" (*Astrosociological Insights*, 2013)⁴. When it comes to space issues of all types, one can attribute the missing voices to the social and behavioral sciences, the humanities, and the arts. Astrosociology education through its very identity creates a rally point to which those left out of the conversation about space issues can come together.

Astrosociological research is the one area that currently requires the most attention, though in relation to education, because it has received the least attention. The reasoning has been that it was first essential to place the field of astrosociology into a position of acceptance by a significant segment of the space community and, to some extent, by the social science community. Both have to work together to bring the astrosociological subfields more prominently into the mainstream of space education and research.

Efforts to move astrosociology from a position of doubt, particularly among sociologists and other social scientists, to a respectable academic field took approximately from its inception in 2004 to nearly three years following the establishment of ARI in 2008. Since then, ARI has moved to add significant advisors and supporters to its cause making its mission easier to accomplish. Several events have supported the mission. Examples include a special astrosociology issue of *Astropolitics* in 2011, the establishment of the *Astrosociological Insights* newsletter

⁴ See the ARI newsletter, *Astrosociological Insights*: http://www.astrosociology.org/vlibrary.html#VL_Newsletter.

in 2012, and the announcement of *The Journal of Astrosociology* in 2013 with the initial Call for Manuscripts.⁵ These efforts, along with a planned astrosociology reader tentatively entitled *Launching Astrosociology* demonstrate great strides in advancing ARI's mission.

IV. Survey of Major Astrosociological Subfields

The major subfields of astrosociology include some familiar subject areas and some that are not quite so familiar to most readers of this paper. The subfield list below is not exhaustive by any means. It is only a representative demonstration of the types of subjects that could be included in an Introduction to Astrosociology course, which would essentially consist of a survey of the major subfields, or dedicated courses that would focus only on one or a few subfields. Additionally, it is quite possible – and even expected – that new subfields will arise as astrosociology educational efforts occur in the future as astrosociology develops. In contrast, some existing fields may not evolve into strictly astrosociological subfields, which will require interdisciplinary education and research.

For example, astrosociology covers familiar subject matters, but the focus is to bring the traditions of disciplines such as sociology, anthropology, history, and political science into the conversation so that a broader viewpoint may be established. Again, this is the multidisciplinary orientation of the astrosociological approach. Additionally, the social sciences possess long histories in which many theories and research findings will prove applicable to existing concerns. This sort of collaboration is important not only between the branches of science, but also within each branch – including the social science branch.

Each subsection below includes a brief description and discussion along with at least three research questions related to the astrosociological subfield. Each topic includes very limited references (and even none for some topics) as a starting point for students to investigate that general subject matter to enhance his or her knowledge. The point of this exercise is to expose interested students to astrosociological subfields as an introduction, as they are vital to the ongoing development of astrosociology as an academic field.

The purposes here are to (1) familiarize the potential student of the existence of these subfields, (2) allow him or her to determine if they provoke an interest in the subject matter, and (3) excite the student enough to pursue astrosociological education and research at some level of intensity. Regarding the third purpose, the student may only think about familiar issues from a more astrosociological perspective, may write a paper or thesis about issues involving an astrosociology subfield, or even become involved in shaping the future of astrosociology in some way. It can run the gamut from mild curiosity to the pursuit of astrosociology as a professional career. Neither extreme is possible, however, without at least a brief familiarity with the topic involved. The major subfields listed in one place serves to familiarize the reader with the scope of astrosociology.

A. Working on the Definition of Astrosociology

One area that deserves ongoing attention involves the evolution of astrosociology's development into the future. The definition of astrosociology is quite important to its present orientation and even more so for its future development (Pass, Hearsey, Caroti, 2010). The definition presented earlier in this essay is a first attempt that came with the founding of astrosociology, but it certainly should become more advanced over time.

- 1) Is the current definition adequate?
- 2) Is the current definition clear enough?
- 3) How can the current definition be improved?

Research questions in this area focus investigations into increasing the precision and clarity of the definition of astrosociology. To some this may not seem important, but it is vital for focusing education and research into one particular direction or another. While an astrosociologist may not concentrate on this issue exclusively, every astrosociologist should think about it from time to time while teaching and conducting research.

B. Astrosociology Education

Astrosociology educators focus on teaching others about astrosociological issues, whether they are young students or seasoned professionals. Those wishing to become astrosociologists themselves would be most interested in these astrosociological subfields directly. Those from other social sciences or the other branch of science who include space issues in their courses may also wish to incorporate astrosocial phenomena into their existing courses

⁵ For further discussions about the various ARI projects and programs currently implemented, see the ARI Projects page: <http://www.astrosociology.org/ariprojects.html>. See details regarding the Special Issue on Astrosociology in the journal *Astropolitics* in the Virtual Library: <http://www.astrosociology.org/vlibrary.html#VL>. More information about *The Journal of Astrosociology* can be found here: <http://www.astrosociology.org/joa.html>.

or research efforts. The latter would also benefit from this introduction to astrosociological subfields, especially if they are not aware of astrosociology's existence.

- 1) What are the best ways to get astrosociology in the classroom?
- 2) What types of astrosociological materials will various types of professors and instructors want for their existing courses, and which professors and teachers will be willing to incorporate astrosociology materials into their existing classes?
- 3) Which existing colleges and universities will be open to implementing astrosociology programs and courses on a formal basis?

The future of astrosociology education remains undetermined, so taking any steps – whether large or small – will reflect desired progress. Thus, a wide-ranging approach to getting astrosociology into the classroom should result in overall growth that takes a number of different directions and reveals itself in many guises. The establishment of astrosociology education depends heavily on the assistance of established professors, chairs, administrators, and others in existing academic schools at various levels.

One thing seems clear, however. Social science students are interested in outer space and many would be willing to take astrosociology courses. This author conducted a survey in the past among sociology students in an Introduction to Sociology course. (See Pass, 2007b for a full description of the study). Space can enhance learning in social science classrooms just as effectively as in natural or physical science classrooms. Astrosociology education is important because humankind must learn more about its relationship with astrosocial phenomena, as they will most likely increasingly affect the course of humankind's future.

C. Theoretical Astrosociology

Here, the focus is on matters concerning how astrosocial phenomena affect the human condition. As usual utilizing the scientific method, theory informs or suggests areas for research in order to prove or falsify theories or parts of them. The issues involved here include all of the astrosociological subfields as expressed in these research questions, though only a few research questions exist in this subsection as examples. A good example involves how folk beliefs that are entirely unfounded scientifically can strongly affect how people assess the space program (Pop, 2011). Cultural forces can influence human behavior despite objective evidence that refutes the bases of strongly held folk beliefs, which trigger behaviors nevertheless.

- 1) How will an increasing presence of human beings in space affect terrestrial societies?
- 2) Can commercial companies sustain their programs without assistance from public space agencies in the future? That is, how successful will the purely private aerospace industry become in the future?
- 3) Will the militarization of space put strains on international cooperation missions, or even put an end to them?
- 4) Will nations form alliances based on traditional structures, or will new alliances emerge?

Theoretical astrosociology seeks to explain how astrosocial phenomena affect humanity at all levels of analysis, and more broadly focuses on the reciprocal relationship between space and society.

What will astrosociological theory reveal about humanity's connections to space? What new ideas will emerge when a new generation of astrosociologists put their minds to asking new questions? The future is wide open for theoretical astrosociology because very little research has taken place in the past.

D. Applied Astrosociology

This subfield takes a “hands-on” or practical approach. The practical side of astrosociology focuses on how space assets affect contemporary society as well as how they may do so in the future. Working together with physical and natural scientists, applied astrosociologists investigate past and present influences. They may also collaborate to plan for future applications of space assets for new benefits. Solving or, more practically, mitigating social problems represents an important area of research and practical involvement by applied astrosociologists (Pass, 2006c). The potential solution to space-related problems also comes into play and may well result in social benefits in the form of spinoffs and technology transfers.

- 1) How can we use surveillance satellites (remote sensing) more effectively to improve social problems?
- 2) Improved planetary defense infrastructure will prove extremely costly if implemented on even a moderate scale, so how can poorer nations be protected even while they cannot afford to contribute nearly as much to the overall global effort?
- 3) What can applied astrosociologists bring to the table in the planning of space missions to make them more successful from a social interaction perspective?

Many practical issues will arise that require technical and scientific solutions. However, we will find that an increasing number of these issues will also require input from astrosociologists who take the impact of astrosocial phenomena into account.

E. Astrosociological Research

Astrosociology researchers do not focus on purposeful applications of astrosocial phenomena, as do applied astrosociologists, even though their efforts may result in others using their findings to tackle practical problems and issues. Instead, they conduct scientific investigations to determine if theoretical hypotheses from others or themselves can be verified utilizing the scientific method by taking advantage of the interplay between theory and research. Astrosociological research is vitally important for the development of astrosociology.

- 1) At what point will the lack of resources such as oil and fresh water reach a tipping point at which space resources become feasible enough to pursue?
- 2) What new scientific or technological breakthroughs will transform human spaceflight, exploration, and even settlement?
- 3) How will various social environments within space habitats affect the social interaction among inhabitants in different ways? That is, how does space architecture affect social interaction?

Researchers will act blindly without the input from theory just as theory will remain unverifiable without the input from research efforts. Like any field, astrosociology must rely on the interaction between the two. Astrosociological research focuses on the human dimension of space issues, which currently does not receive nearly enough attention given the significant impact of astrosocial phenomena. There is much to discover from an astrosociological perspective, and the social sciences have a long way to go to catch up with the other branch of science in areas involving space and humanity's relationship with it.

F. Medical Astrosociology

This subfield is vitally important because traditional space medicine, which focuses on biomedical issues, cannot fully explain the best course to take when practicing medicine in all circumstances due to social and medical interactive complications, including ethical dilemmas (Pass, 2007a; Pass, 2007b). Subfields such as medical sociology and medical anthropology focus on similar issues in terrestrial societies. Medical astrosociology will do the same, though with a focus on how astrosocial phenomena influence the practice of space medicine and related issues. Research indicates that in terrestrial societies, there are cultural differences even when trying to determine definitions of health and illness. Additionally, social forces affect how medical institutions operate and how they prioritize medical care among different segments of the population.

- 1) What considerations come into play when resources are running out and the need for them increases? Are priorities based on some form of social hierarchy or on some other criteria?
- 2) If pregnancy in a particular space environment potentially threatens the viability of the newborn's survival, how is an acceptable level of risk determined? Moreover, by whom?
- 3) How much genetic and mechanical engineering of settlers in a space ecosystem is acceptable in order to improve survivability on a long-term basis?

Thus, social and cultural factors greatly affect medical decisions whether on Earth or within space habitats. Within the latter social environments, the influence of astrosocial phenomena will likely complicate things much more than on Earth. It is important to determine how the practice of terrestrial medicine and extraterrestrial medicine differ, as well as how the former can inform the latter.

G. Planetary Defense

This literature is well established from physical science perspectives. On the other hand, the social-scientific literature is, by comparison, nearly nonexistent. Detecting and defending against cosmic objects headed for Earth may prove ineffective at one point or another, and thus societal leaders should think about how to respond to failed detection scenarios and defense attempts (Pass, 2006c). The experience and knowledge of social scientists in matters dealing with emergency and disaster response scenarios, and related areas, would be vitally needed as advisors in such circumstances. Before such a situation may occur, however, it is extremely helpful to conduct thought experiments and apply relevant previous research findings to such exercises.

- 1) How can local, state, and national resources best prepare for a large comet or asteroid strike?
- 2) Should societies protect their material culture such as art, music, literature, and recreational heritage to some extent? How much protection in bunkers, for example, is practical or desirable?
- 3) How should various nations coordinate their efforts when a cosmic body is due to strike the planet?
- 4) If one particular nation is at greatest risk, how should the others react even when not directly affected?

Astrosociologists can play a big part in providing greater input into these types of issues. It is not simply a matter of designing and building technical equipment to detect and defend against cosmic bodies heading for an Earth impact. The general area of planetary defense involves decision-making regarding many issues such as those associated with the research questions above. Additionally, public fear may result in panic-based harmful behavior.

H. SETI, Astrobiology, and Astrosociology

Interestingly, SETI (Harrison, 1997) and astrobiology (Harrison and Connell, 1999) represent areas in which sociologists and other social scientists have contributed significantly. The problem remains that they have not done so in an organized way under the umbrella of a single field such as astrosociology. Many publications in this area exist for the student to explore, which are oriented toward both of the branches of sciences, and interdisciplinary orientations as well (for example, see Dick, 2013 and Harrison, 2011).

- 1) If life exists elsewhere in the galaxy, why have they not communicated with us (Fermi Paradox)?
- 2) Could we understand a message from an extraterrestrial civilization?
- 3) How will various religious groups react when microbial life is discovered elsewhere in the solar system?
- 4) If an alien civilization is detected far away in space, how will it affect daily social life?
- 5) What will happen if an alien spacecraft heads for Earth? How would this scenario play out?

Astrobiologists are finding more and more evidence of organic compounds and potential life-creating processes in space. Astrosociologists should be alert to how this increasing evidence is affecting societies and individuals. Additionally, SETI researchers are predicting the detection of intelligent signals or other indicators within the next twenty years. The implications involved are staggering and thus require ongoing research.

I. Space Law and Space Policy

These two general subject areas are already well established as well. So what can astrosociology contribute? More social scientists and humanities scholars could focus on these types of issues so that the study of social and cultural implications opens up to the entire social science community as well as the space community. An expansion of inclusion beyond space researchers currently involved can provide added insights from perspectives perhaps not included. Additionally, an increase in the sheer volume of participants would theoretically help, especially including those who take an astrosociological perspective in their approaches.

The involvement of social scientists in the study of criminal law and delinquency is rather common. However, the study of issues related to space law that involve astrosocial phenomena is much more limited, though not nonexistent (Pass, Hearsey, Caroti, 2011:12). The questions in this subsection reflect the basis for an important area of research. Space policy involves decision-making that shapes space exploration efforts of a given nation, and even joint projects among nations such as the International Space Station (ISS). It also involves the goals and objectives of space programs and projects. For example, the balance between the peaceful versus military purposes of space remains a volatile issue within nations as well as a dedicated concern of the United Nations at the international level.

- 1) What elements of terrestrial legal systems will be replicated in space? Why?
- 2) How will law develop in isolated space ecosystems of the future? What issues are involved?
- 3) How will space law affect policy and the ability to create commercial projects on cosmic bodies?
- 4) How will social change affect various elements of global space governance at various levels of analysis such as the international level and among institutions within individual societies?

These types of questions related to space law and space policy have social and cultural implications that would benefit from an even greater level of interdisciplinary interaction than we see today.

J. Space History

This subject area is well established by space historians (for example, see McCurdy, 2011; Launius, 1994). However, collaboration with other types of social scientists, as well as humanities scholars, can provide additional insights. It is probably safe to say that many of the astrosocial phenomena that have shaped space exploration and related areas remain unknown or scarcely addressed. Many social and cultural forces conspire to shape human behavior in all social arenas. They include politics, economics, religion, and law.

- 1) How did the Cold War aftermath provide the social forces driving space exploration today in various nations?
- 2) How does larger culture affect the national space programs, and what subcultures and countercultures disfavor space exploration? How have these forces played out over time?
- 3) Will history repeat itself vis-à-vis space exploration? In what ways?

There is no question about the importance of space history. It would be beneficial to increase the participation among a greater variety of theorists and researchers from the social science branch of science. Indeed, fledgling astrosociologists could make important contributions to a well-researched area of theory and research.

K. Space Economics / Political Economy

Important questions surround how socioeconomic forces impact on space exploration, space research, and spaceflight. Economic considerations are essential. For example, is the space program of the United States worth the

money expended? (For example of this type of discussion, see Foust, 2007). Space issues involving economic considerations within and among terrestrial societies regarding space exploration are vitally important. In the future, such considerations will involve both economic analyses within space settlements and among societies from around the solar system, assuming that human space migration occurs as predicted by many.

- 1) How will commercialization within the aerospace industry affect the efforts of public space agencies?
- 2) Will humanity create a space economy throughout our solar system? When? What form will it take?
- 3) Is it better to spend money on Earth to try to solve existing social problems before worrying about space exploration or even research?

Economic considerations largely determine practical matters, and putting many ideas about space missions and efforts into practice tends to be quite expensive. How much will economic constraints limit space exploration efforts? The priorities of a nation must include space exploration in the mix, so politicians must decide how much funding they each deserve, which results in the hierarchy in which space expenditures fall toward the bottom of the list based on arguably misinformed subjective assessments.

L. Space Societies (Beyond Earth's Atmosphere)

How do social structures in space environments establish themselves as ecosystems? This subfield includes organized human social groups of all population sizes (including crews, micro-societies, mini-societies, communities, and eventually entire societies; and perhaps even extraterrestrial nation-states). An important concept here is the fact that population size affects social group dynamics and human behavior. Population growth results in more complex social systems. The concept of the space society is important to consider, as it will probably become the subject of very real social structures (Hearsey and Pass, 2012).

- 1) What contributions can astrosociologists make in planning long-duration and permanent settlements?
- 2) What types of social-structural elements can officials make to allow for rapid population growth and the resulting social and cultural transformative changes that they create?
- 3) How do various space environments affect the characteristics of ecosystems that arise within them?

Space settlements may not occur until decades from now. However, humanity would benefit by taking them seriously today. The complexities involve technological and physical scientific issues, of course. However, human ecosystems in space, or anywhere else for that matter, involve social and cultural forces – or astrosocial phenomena – that require attention in order to ensure that the human dimension receives its fair share of consideration. The fact that the two branches of science must interact to achieve a holistic understanding of space issues means that concentrating only on the physical matters is inadequate, as the social environment is just as important to survival and sustainability.

M. Terrestrial Spacefaring Societies

Spacefaring societies will reside on planet Earth. This conceptualization is a theoretical social construction that possesses certain characteristics. It represents a transformative model that develops from the space-capable societies witnessed today. (For a discussion, see Pass and Harrison, 2007). Today, the most advanced societies are space capable and thus rather primitive compared to what will occur as they move closer toward the theoretical ideal of a space society along the spacefaring continuum.

- 1) What will spacefaring societies look like and why?
- 2) How does the growing impact of astrosocial phenomena contribute to the social and cultural change found in various terrestrial societies?
- 3) What are some of the events and social forces that can derail movement toward the spacefaring ideal?
- 4) How far along is any given society along the spacefaring continuum as measured by major mileposts (that is, events, accomplishments, and new social conditions or social/cultural characteristics)?

When thinking about space settlements and migration into our solar system and beyond, it is important to remember that interactions with outer space will affect societies on Earth as well. When one considers how societies differ since the advent of the space age, it is clear that the impact of astrosocial phenomena have contributed significantly to the social conditions of contemporary societies. One can examine the achievements in space and determine how they relate to advancements in societies.

N. Science Fiction and Astrosociology

Astrosocial phenomena encompass both science and science fiction when they relate to space. There is a two-way relationship between them. This means that science influences science fiction, but also that science fiction influences science (or at least it may provide a direction for future research). Science fiction also examines the human condition in the midst of imaginary social conditions that, when done well, provides insights about humanity

and its (social and cultural) milieu (Caroti, 2009). Science fiction literature can be inspirational, frightening, and educational in the form of warnings about the human condition.

- 1) How can scientists of all types best take advantage of predictions from science fiction literature?
- 2) Relatedly, what criteria should they use to attempt to mimic fictional science and technology?
- 3) Do science fiction authors make good futurists?

Considerations related to science fiction represent an excellent example of how the humanities can contribute to astrosociological theory and research. The imaginations of science fiction authors can inspire new ideas that physical scientists may not foresee themselves. Moreover, they can lead social scientists to examine areas related to astrosocial phenomena that they may not consider otherwise.

O. Collaborative Astrosociology

By its very definition, astrosociology is a multidisciplinary social science. However, this model is not adequate to understand the true effects of astrosocial phenomena. Collaborative astrosociologists purposely integrate ideas from the natural and physical sciences into their efforts. Moreover, they encourage, and work with, natural and physical scientists to develop synergistic ideas and theoretical models, and then test them together in joint scientific investigations that represent a holistic approach.

- 1) How can collaboration between the two branches of science be formalized?
- 2) What can the astrosociological perspective and literature contribute to ongoing physical and natural science studies and experiments?
- 3) What types of synergistic outcomes may be possible through purposeful collaborative efforts between fields and disciplines within each of the two scientific branches?

Collaboration between the two branches of science is essential for long-term sustainable space exploration in order to maximize knowledge, of course, but also to take advantage of favorable astrosocial phenomena that may arise. The latter is not possible without a proper understanding of the social and cultural forces that exist and change over the course of time. Collaboration, when formalized, can become a powerful approach that currently remains largely underutilized.

P. Interplanetary Relations

When human social groups leave Earth on long duration or permanent space excursions, how will they interact with those left behind? Family members and friends represent one dimension. However, what about allegiances to authorities and commitments to nations? Historically, groups that left behind their homes and countries have opted in many cases to forge new identities and commitments.

- 1) Will crews in long-duration missions begin to take commands from Earth less seriously?
- 2) How will interplanetary relations affect terrestrial societies that paid for the original missions of space settlers?
- 3) Will separate nations on other cosmic bodies be friendly or prone to conflict? If the latter, what types of social and cultural forces could produce such an outcome?

Interplanetary relations deserve serious attention even today. International relations and other types of similar research can provide important insights into these types of matters that will eventually play themselves out. The important thing to remember is that societies separated by outer space will have to interact in order to survive and prosper, and thus economic and political issues – among others – will become the subjects of astrosociological theory and research.

Q. Astrosociological Subfields – Some Final Thoughts

As one can see, even this (probable) incomplete list of subfields is quite extensive and covers many interrelated subject areas. Nevertheless, these very brief discussions and research questions, in fact, do provide the potential student with much to think about. Many subfields have received very little attention by social scientists, so students pursuing them would become pioneers in the field of astrosociology. It is something for students drawn to the combination of the social sciences and outer space to consider. A single student could easily carve out an entire career by focusing on only one aspect of one of the subfields discussed above.

V. Conclusion

The essential proposition of this essay is that a successful future in space for humanity cannot occur without the fields and disciplines included within the field of astrosociology. The human dimension of spaceflight and space exploration (in the broadest sense) demands that the missing void requires fulfillment by social and behavioral

scientists, humanities professors and scholars, artists, and most importantly, students of these disciplines and fields. This author created astrosociology to add an undervalued and underrepresented perspective to the study of space phenomena that impact societies, social groups, social institutions, social groups, cultures, subcultures, countercultures, and individuals – that is, astrosocial phenomena. These phenomena have affected human beings and cultures long before humanity understood cosmic phenomena from a truly scientific perspective. Thus, the founding of astrosociology is long, long, long, . . . overdue. Moreover, there must be a formal and serious collaboration put into place between the two branches of science that can contribute to the furtherance of understanding, and taking advantage of, humanity's relationship with space phenomena.

The best method to develop astrosociology into a truly academic field is, of course, to place it before students interested in the relationship between outer space and society. Only the next generation of astrosociologists can expand the influence of this field into academia, the public sphere, and into places of influence in public and private organizations. Only students can make the continued development of astrosociology sustainable into the future. To make this possible, however, these students must be educated about astrosocial phenomena so that they can in turn teach others and conduct meaningful astrosociological research.

Finally, it is extremely important to be quite blunt about the reality potential astrosociologists-in-training face. The current climate in which astrosociology develops is difficult. While officers and supporters of ARI, in fact, are working on curricula and other efforts to place astrosociology in the classroom, the road ahead involves creating the social infrastructure as well as the course content. Nevertheless, it promises to be an exciting future and we invite interested individuals and organizations to join our effort.

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