



SYSTEMS PROCESSES THEORY (SPT) AND SUSTAINABILITY:

I. APPLICATIONS OF AGING/ SENESECE AS A SYSTEMS PROCESS TO SUSTAINABLE CONSTRUCTION METHODS



Introduction

Buildings affect the local and global environments through a series of interconnected human activities and natural processes. As a society's economic status improves, its demand for architectural resources such as land, buildings or building products, energy, and other resources will increase. This in turn increases the combined impact of architecture on the global ecosystem, which is made up of inorganic elements, living organisms, and humans. The goal of sustainable design to find architectural solutions that guarantee the coexistence and welfare of these three essential groups.

Sustainable building development is a very large system in which there are many complex relations among the population, resources and the environment. Therefore the system science model is a useful tool to analyze sustainable development system on population, resources and environment.

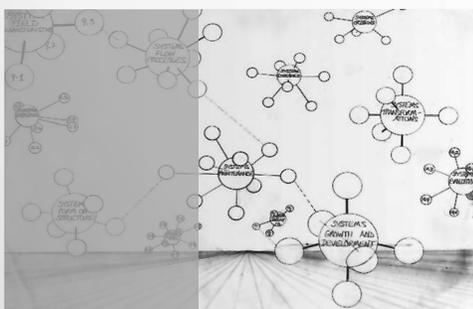
System Science and Sustainability

The term "aging" refers to the biological process of growing older in a lethal sense, also referred to as "senescence".

Entropy is a measure of order and disorder. If let be, aging systems go instinctively from youthful, low entropy and order to old, high entropy and disorder.

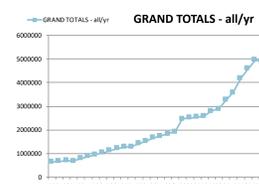
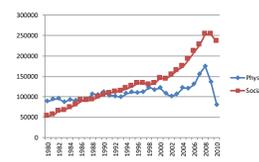
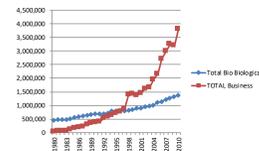
System's Process Theory

- Interdependence and Interconnections within the organization, between the organization and the environment
- In this course we have learned that there are many competing systems theories,
- There is a need for integration, at Cal Poly we choose to integrate by focusing on systems processes,
- Systems are a set of interrelated parts that turn inputs into outputs through processing, we consider about a 100 systems processes
- Then we connect them together by linkage propositions shown as lines in the diagrams
- Linkage Propositions explain how the many systems processes influence each other to create long-term complex systems.



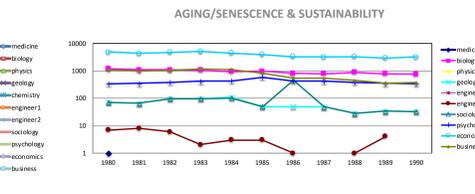
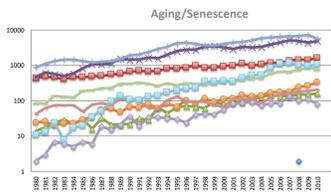
- There are also hundreds of linkage propositions, but both systems processes and linkage propositions fall into a much smaller number of ontological or related classes.

Trends in Literature



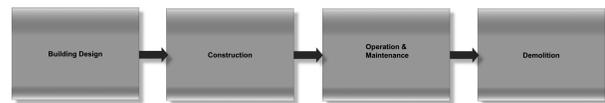
- Limited to two largest domains i.e. "living systems" and "business/industry" to promote discrimination of trends in smaller domains (note high numbers on X axis).
- A continual increase in lit of bio domain is noticeable; a jump in target lit searches usually indicates division from baseline
- Exploding increase in "business domain" beyond 2002
- Limited to the two lowest article activity domains i.e. "physical systems" and "social systems" to better allow discrimination of trends in smaller domains.
- A continual increase in lit of bio domain is noticeable; a jump in target lit searches usually indicates division from baseline
- Exploding increase in "business domain" beyond 2002
- Note that physical sciences only represented by geology pending obtaining data on total articles in chemistry, astronomy, and physics databases which may account for virtual flatline growth of total lit in physical sciences until mid-current-decade; so any jumps in target lit searches show significant increases in interest in key systems process(es)
- The fall for most recent two years is to be discarded as the irregularity of databases

- a Grand Total of 68 million articles were searched across eleven key databases
- Average per year searches ranged from about 1 to 6 million per year
- Trends across the totals show arithmetic increases up to roughly 2002 and then an exponential increase pattern



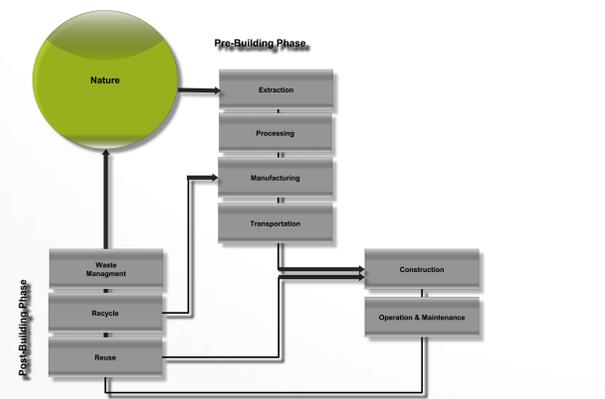
- Exact search term: "aging" and "senescence" not limited by "scholarly journals" or "reviews"
- The total articles for "aging" and "senescence" from 1980-2010 across all databases was 240,931
- The total articles for "aging" and "senescence" and "sustainability" from 1980-2010 across all databases was 68,201
- There was an upswing in articles in engineering in 1997
- There was also an upswing in geology records in 1997 and again in 2007, yet a decline in 2009 for some reason
- Sociology records varied across all years
- The medical database only had two records in 2008

System Models



The conventional building life cycle

The conventional model of the building life cycle is a linear process containing of four major phases: design, construction, operation and maintenance and demolition. The obvious shortcoming of this model is its linear form, which makes it act independent from nature. Another problem with this model is that it does not address environmental issues associated with the obtaining and manufacturing of building materials or waste management.



The sustainable building life cycle

- The life cycle design (LCD) is a "cradle-to-cradle" approach acknowledging environmental consequences of the entire life cycle of architectural resource. LCD is based on the notion that change of form in material does not put an end to its worth. the life cycle of a building can be categorized into three phases: pre-building, building, and post-building. These phases are connected, and the boundaries between them are not obvious. Studying the building processes in each phase offers a better understanding of how a building's design, construction, operation, and disposal affect the larger ecosystem.

Application

What is sustainability?

According to The World Commission on Environment and Development, "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

How does that relate to Aging in Place? In terms of buildings, Aging in Place is about updating and maintaining the building in order to extend it's life. This can be achieved by making the right choices, starting at the pre-design stage.

Looking back in time, our ancestors built their homes with what materials they had available and developed strategies for dealing with the climate in a passive way. Why are we not looking at these tested methods of building sustainably instead of always trying to pursue new ideas? All we have to do is rediscover and update them for a modern setting.

By studying the two systems through life cycle design and energy flow, I will be able to create a conceptual framework that can guide us how to design more sustainable buildings.

ISSS-INCOSE Collaboration

- The International Council on Systems Engineering and the International Society for the Systems Science have formally agreed to cooperate in exploring and developing systems science as a knowledge base for both fields. Representatives from both organizations have met in Canada, Arizona, and England to plan these joint efforts.
- The Systems Science Working Group (SSWG) has identified four or five official projects. Two of these focus on SPT and Systems Pathology, which are also SIGs of the ISSS.
- This poster is an example of one of these strategies of the joint SPT projects to enable several graduate students in systems science, systems engineering, or related new fields to share their extensive literature survey on the large number of systems processes.
- By cooperating on search and analysis of the diverse literature and especially by integrating, preserving, and making available their individual products, all thesis writers benefit as does the practicing fields of systems engineering, etc.

Conclusions

- Since subjects surrounding death and dying are not developed concepts of systems science, finding the right terminology was a rigorous process.
- The Challenge for this project was the limited data available on "Aging" or "Senescence" as a systems science that would also relate to construction and sustainable development.
- A more specific search, including terms such as "building" or "sustainable development" seemed to be more effective in getting the more desirable results.
- The goal is to create an Odum diagram of energy flow for the two types of construction methods. By the end of my thesis project I will have a third diagram that can act as a conceptual guide for sustainability in architecture.