**Leslie White: Presentation**

Background Info:

- 1900-1975
- Born in Salida, Colorado
- After his parents divorced when he was 5, he and his two siblings moved with his father into a farm near Greeley, Kansas
    - There, they had no indoor plumbing, running water or electricity
    - But, they had a fine view of the advent Halley's comet
        - then White developed an interest for astronomy
        - He intended to major in physics in Louisiana State
- HOWEVER, when the US entered WWI, White joined the Navy
    - it was here that his primary focus turned to issues of human behaviour
- In his new quest to understand "why peoples behave the way they do" he later enrolled in Louisiana State University as a student of psychology and sociology
    - he moved on to Columbia university where he received his M.A. a year later
- He never took a single course under Boas, even though they were there at the same time.
- He studied under Alexander Goldenweiser (a former student of Boas)
    - White learned Boasian methodologies and developed the characteristic emphasis on ethnology and antipathy for cultural evolutionism.
    - However, in later years White would grow to become a critic of Boas, bashing his ideology at every opportunity,
        - This was detrimental to his career and perhaps even the development of his own original ideas.

Energy

- Everything is the universe may be described in terms of energy.
- *Second Law of Thermodynamics* – the universe is breaking down structurally and running down dynamically → it is moving in the direction of lesser degrees of order.
- Animate organisms are able to move in a direction opposite to that specified by the law of entropy because they are able to draw upon free energy outside themselves and incorporate it within their own systems.

    - All living beings are dependent on energy derived from the sun
        - sun → plants → animals
- The life process, in its maintenance of in the individual organism is not merely a matter of capturing quantities of energy and of incorporating them within living systems to take the place of like quantities that have been expended during the process of living. In an adult organism, the energy content is constant. One calorie is worth as much as the other (they're all equal), therefore an exchange would bring no advantage.
- **What sustains life and makes possible its evolutionary development?**
    - White references Schrodinger.
    - According to Schrodinger:
        - The withdrawal of negative entropy from its environment
        - **negative entropy** → creation of orderliness
            - Schrodinger: "what an organism feeds upon is negative entropy…sucks the orderliness from its environment…after utilizing it they return it in very much degraded form…"
    - The process of life can be described in terms of energy, also. A living organism is a structure through which energy flows, entering the system at higher potentials and leaving it at lower potentials.
        - Much like the water wheel, a living organism is a mechanism that is operated by the downward flow of energy.
        - *As energy is transformed, it loses its value. Thus what is taken from the environment decreases as it is transformed.*
- Living things are means of stopping, or even reversing the cosmic drift toward maximum entropy (death)
    - Maintenance of life is achieved by offsetting the entropy produced by the very process of living with negative entropy obtained from the environment, by "sucking orderliness out of the environment"
    - Obtaining more negative entropy from the environment than positive entropy allows us to evolve.

        - we're utilizing increasing amounts of energy as it flows through living systems to build more complicated structures, rather than merely trying to MAINTAIN the vital process
        - *IE. We're over achievers*
- Life and death receive their most profound and illuminating definitions in terms of thermodynamics
    - **The maintenance of life is a continuous balancing of positive entropy with negative entropy**
        - **we try to increase what we have, while maintaining what we have**
- The evolution of life is the ascendance of negative entropy
    - we evolve because we get more organized
- Dying is the losing battle to overcome positive entropy
    - we're not organized, so we don't overcome it
- Death is the state of maximum entropy , of thermodynamic equilibrium

<u>Living Bodies and Habitats</u>

- Living bodies tend to persevere in motions proper to them indefinitely
    - this will only be terminated by opposition of one kind of another
    - opposition might come from the habitat of the organism, or within the organism.
        - Trees and fish are overcome only by outside forces
        - In some species, the moving parts of the organism become materially transformed with age, the health declines
- The life process encounters opposition or resistance at every point of contact with the external world
    - as it interacts with the natural habitat, it involves a certain amount of wear and tear as well as the transformation of the habitat
- ***Q#1: How does White characterize the relationship between living systems and the theory of thermodynamics*?**

- White states that "biological evolution might be defined as the progress of energy organization moving in a direct opposite to that specified for the cosmos by the second law of thermodynamics. Animals are more highly developed thermodynamic systems than plants; mammals, more highly developed than reptiles. He references Simpson (*The Meaning of Evolution)* "a change that seems often to be involved in [biological evolution] is increase in general energy or maintained level of vital processes…the metabolic system of reptiles has a low vital minimum…" . He finishes with comparing the energy levels between mammals, animals and birds.

<u>Extension of the Life Form</u>

- The life process extends itself two ways
  - the multiplication of numbers through reproduction (qualitative)
  - development of higher forms of life (quantitative)
- The lower the form of life, the greater tendency towards self-expansion in a quantitative manner (fruit flies)
- The highly developed the life form, the less tendency toward numerous offspring (dolphins)
- Man is always occupied with adjustment to and control over his environment, and with competition with other species for means of existence, survival and expansion. To do all of this requires energy. The organs of the body is used in process of survival, but ultimately, man alone possesses an elaborate extra-somatic mechanism, which involves the traditional organization of tools, customs, languages, beliefs, called culture.
- ***Q#2: Why is culture a thermodynamic system?***
  - Culture is an organization of things in motion, a process of energy transformations. White references Soddy to explain this theory. Soddy states "the laws expressing the relations between energy and matter are not solely of importance in pure science [physics]…in the whole human experience, they control, the rise and fall of political systems, the freedom or bondage of nations, the movements of commerce and industry, the origin of wealth and poverty, and the general physical welfare of the race…"

- Schrodinger states "[the second law of thermodynamics] governs all physical and chemical processes…even if they result in…the phenomena [of]…organic life, the genesis of the complicated world of organisms from primitive beginnings [and] the rise and growth of human cultures"
- Culture is a thermodynamic system because energy is used in the development of cultures. In addition, since culture is produced by man, and man is composed of energy, then culture is also derived from energy.

- Cultural systems can be compared to biological organisms
  - they both expend energy that is captured and harnessed in self-extension and self-maintenance
  - extend quantitatively and qualitatively
- Culture, as a thermodynamic system, may be analysed into the following factors: energy, tools, product
- Culture is a mechanism which serves man, and to do this it must harness energy and put it to work
  - tools – all the material means in which energy is harnessed, transformed and expended
  - Product – all goods and services capable of serving the needs of man that have been produced and formed by the cultural use of energy
  - energy – "the ability to do work"
  - White used the equation ***E X T >P*** to express the cultural process in terms of motive power, means of expression and satisfaction of need
    - E → energy involved
    - T → technological means of utilizing it
    - P → product or result which serves a need of man
- **Q#3: What is the role of tools in harnessing energy?**
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<u>Questions</u>