Entropy, Disorder, The Human Race, Religious Beliefs



Malcolm Jones explores whether the second law of thermodynamics – the tendency for systems to trend toward disorder – applies to human societies, such as organisational groups, states and even at a global level. History shows that humanity has been subject to periods of extreme disorder but what mitigating factors are at play to prevent an eventual "thermal death". Could religious beliefs and teachings play a part?

Introduction

The question is posed. Does the second law of thermodynamics influence humanity and does it have linkage to religious beliefs and teachings? Firstly, it seems strange to apply a physics law to a human aspect. Humanity is not a closed system in the physics sense, rather, it is influenced by its environment and is able to change the laws which govern it. This is unlike a closed physical system which cannot do either. In turn, a closed system will trend towards a state of maximum disorder. However, humanity does itself exhibit some characteristics similar in nature to that of a closed system, with a tendency to disorder unless acted upon by mitigating actions. In addition, these human negative attributes and mitigating actions are also well known in religious beliefs and teachings.

The Second Law of Thermodynamics

Everyone with a background in science will understand what the term entropy signifies when coupled with the second law of thermodynamics. It is a measure of the level of disorder and uncertainty, and lack of ordered information and, for a closed system, it inevitably moves in the direction of increasing disorder and uncertainty. A closed system is one which has no external interactions which can lead to a change in the internal laws that govern it. In such a system with some fixed laws, the thermodynamic process will continue until the system reaches its maximum disordered state – sometimes called the path to thermal death – unless mitigated by internal action!

Take the case of a simple china teacup. Its 'life' starts in the form of a set of naturally available disordered core materials. These are then taken through an **externally** applied set of energetic and information-based processes of mixing, shaping, and firing, resulting in the final ordered form of a cup.



This only occurs as the result of the application of externally derived, knowledge-based energetic processes. Of course, natural processes will lead inevitably to disorder of the ordered cup form. For example, it will quickly break into pieces by mishandling or even with the passage of time it will slowly disintegrate into a base set of materials of disordered form.

Any process to re-constitute the cup into its original ordered form will again require knowledgeable energetic action from an external source. The message here is that the progression to disorder is natural, easy to enact, can occur quickly, but the re-ordering process is more difficult and is slower to achieve.

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Humanity has inbuilt characteristics, both at the individual and group level, which can lead naturally to disorder, and if not checked can even lead to catastrophic disordered states. If humanity was a closed system, then its future would be somewhat doom-laden. Reversing the trend by internal action, based on information gained from knowledge of, and interaction with the external environment, requires the application of a great deal of information, effort, resilience, and energy.

In any non-closed system like humanity, these disordering and re-ordering processes give rise to a competing status. The human race's trajectory through time is governed by the balance between the natural 'entropy's' disordering laws inherent in the human character, and the wisdom, determinism, and energy needed to reverse the flow. Unfortunately, because disorder is characterised by being somewhat easy and can occur quickly, whereas re-order is characterised by the opposite, history shows a somewhat checkered characteristic through time.

The Natural Laws for Disorder

These are the human equivalent of the fixed natural laws in a closed system and are associated with some of the inbuilt nature of the human character. These are the disruptive negative characteristics of jealousy, hatred, revenge, spite, self-advantage, self-importance, antagonism, paranoia, etc, and even unhealthy competition. All potentially leading to conflict with others and creating disorder. This of course not only applies at the individual level but also at the group level. Each group can have its own 'group level-based characteristics' which in turn do not necessarily align with those of other groups, with resulting disorder between groups. This extends up to the state and even global level, where history shows, that this can lead to catastrophic disordered conditions, such as world wars.

A current global example is illustrated by the disorder arising from the conflict between the forces of democracy and those of a more autocratic and dictatorial alignment. If not suitably mitigated this could well lead to catastrophic global disorder and consequence. As our weapon-based technologies evolve ever further in the direction of mass destruction, this disorder could eventually lead to ever greater harmful consequence.



Another example leading to disorder on the global competitive and self-interest scale, is represented by the continuous trend of population increase coupled with an increased appetite for a better life, both challenging the earth's ability to provide the necessary resources.



It is hard to see these forces for disorder getting less strong. Also, it is generally accepted that global warming results from these appetites with increasing conflict between those who are the largest perpetrators and those who are the biggest victims.

History shows that humanity has been subject to instances of rapidly increased disorder followed by long term painful and energy intensive/wisdom-based recoveries. The second law of thermodynamic still very much in evidence. This is illustrated in Figure 1, which is not intended to show whether the long-term trend of disorder is increasing or decreasing with time, but there is increasing concern that the consequences might well do so, due to the ever more destructive nature of weapons of mass destruction (nuclear, biological, chemical, and cybernetic). Perhaps by example the peaks and the troughs in the figure might represent the last two world wars and the third trough and peak, by extension, might symbolise the current state of the world we seem to be heading into.

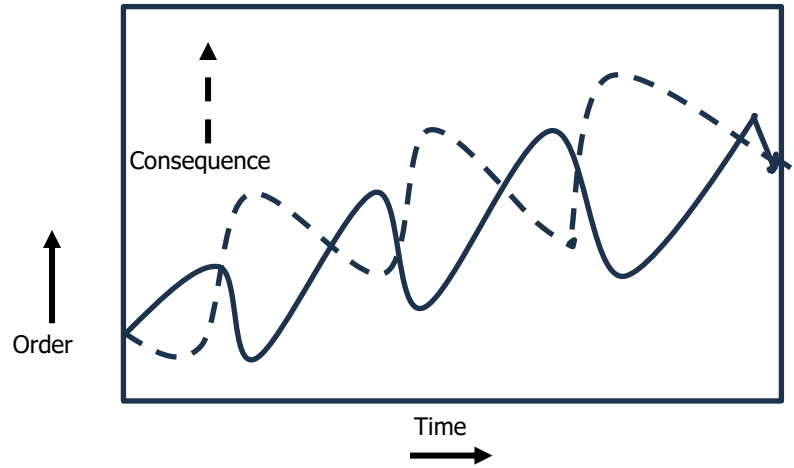


Figure 1. Progression of order and consequence over history.

Changing the Internal Laws and Religious Beliefs and Teachings

As noted previously the human-race needs not be governed entirely by fixed laws (of human negative character) and the inevitable entropy trend to disorder and uncertainty. Humans can change these behaviours for the better given sufficient intent, energy, determination, wisdom and knowledge of how to do so. However, the second law of thermodynamics still holds in that, disproportionate effort, supported by information gained from the 'outside,' is required to mitigate the disorder trend.

So, what were/are these disproportionate efforts aimed at mitigating the natural disorder trends? The earliest historical approach took the form of supernatural beings or Gods. The human-race was periodically subject to disasters, such as epidemics, earthquakes, volcanoes, floods etc. There was no scientific capability of understanding how and why these disasters arose, and of how to provide mitigation.

This 'unknowing' was attributed to the acts of supernatural beings, or gods, raining down punishments on humanity because of humanity's apparent misdemeanours.



It was felt necessary to appease such deities, through worship, paying homage and generally doing the 'right thing.' However, this often-included human sacrifice to satisfy the assumed revenge 'appetites' of the deities.

This approach eventually led to the concept of a more modern religious belief in a more benevolent God (or Gods), but who still required homage and doing the 'right thing' to ensure the relationship remained benevolent.

This required a need to follow a set of edicts in order to maintain the benevolent relationship. For example, Moses 'came down from the mountain' having received God's ethical directives – the 'Ten Commandments.' Some examples of which being: "honour you father and mother,

shall not murder, shall not commit adultery, shall not steal, shall not bear false witness against your neighbour, shall not covet." Compliance with these edicts either through belief or fear would act as a counter to the negative human characteristics, help to prevent disorder and lead to a better life and after-life.

Following on from this is the equivalent secular model of establishing human based laws, still with a strong relationship to the original religious directives. The laws were agreed at group level, and then applied to the individual, with measures of agreed punishment for non-compliance. This approach has now been extended up to state and even global government levels. With the correct choice of laws, their enactment and punishments, managed in what is seen as in a democratic manner, this represents the best form of human stability and order that humanity has achieved to date. Like the second law of thermodynamics this mitigating approach to disorder has required enormous, continuous, resilient effort and knowledge to be effective in combatting disorder. History has shown it not to be a continuous success.

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Summary

Although humanity is not a closed and isolated system, it nevertheless does show some of the major characteristics associated with a closed system with a tendency for moving in the direction of disorder, unless mitigated by internal rule changes for the better. Human's negative characteristics act somewhat like the entropy rules in its second law. However, unlike the fixed laws in a closed system, humanity can challenge and mitigate the trend to disorder.

Just as in a closed system, processes leading to disorder can happen more easily and quickly, than the man-made attempts to increase order. The latter requires a great deal of determination, resilience, energy, honesty, knowledge, and continuity.

So, humanity is not independent of the second law of thermodynamics. History suggests that the future will see a continuous series of eras of disorder and re-order. Certainly, the world currently appears to be in a serious state of increasing disorder.

Perhaps the status is best described by the perennial battle between 'good and evil.'

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Malcolm has more than 50 years practising as a scientist at AWE and has been awarded a number of national and international awards in recognition of his work. Much of this work relates to system safety and, in particular, to its application to nuclear programmes, where he has been the author of a number of safety standards. His current role is broadly of an advisory nature, having previously been the scientific adviser to AWE's chief Scientist, the Head of Warhead Engineering and the Head of Warhead Technical assurance.

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