INVESTIGATION INTO CONTROL OF THE GLOBAL SOCIAL SYSTEM

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Abstract: The paper offers a preliminary hypothesis of how the global system is controlled. Loosely interacting centers of control, together with less well-defined forces, control global social activity. Centers of control include government, international organizations, and informal networks. These forces have maintained relative social stability. However, population and aggregate global consumption are expanding in a fixed global environment, suggesting that aggregate socioeconomic activity is likely to alter the environment sufficiently to destabilize global society. The paper suggests ways in which the engineering community can help reduce the likelihood of global social disruption.

Keywords: Social, Control System, Time Lag, Limits, Feedback Loops, Global Stability

1. INTRODUCTION

How is the global social system controlled?

This question may disturb people concerned about the interaction between control and personal freedom.

Participants in global society include an array of individuals and organizations: nations, religious communities, cities, commercial organizations, illegal organizations, law enforcement agencies, etc. Additionally, ad hoc alliances pursue specific goals and, in many regions, there is a substantial underground economy.

A complex system is either controlled in some way or its behavior is random. Extended periods of social stability suggest that several levels of distributed control (not all of equal weight or reach) are operative. These loosely linked controls usually restore stability following perturbations, further suggesting there are mechanisms which seek societal homeostasis.

Feedback loops of different gains and time lags are present in the global social system. Uncoordinated control of this system tends to transfer costs (unwanted outcomes) to subsystems with long delay times.

2. FORMS OF SOCIAL CONTROL

2.1 Government

Governmental configurations fall into two overlapping classes: Levels of government: The number of levels reflects national and regional conditions.

Types of government: Representative, oligarchic, theocratic, autocratic, or communal. Governmental control may also be distributed.

2.2 Non-governmental Control

A partial list of factors affecting the global social system illustrates the challenge in understanding this system.

Professional Expertise The population of tropical regions was long limited by disease, infant mortality, and starvation. Introduction of miracle rice, antibiotics, and immunizations led to tripling of tropical population in the past 50 years. Instead of simply increasing the quality of life in these areas, the interventions increased population. This unanticipated surge in population demonstrates one effect of introducing technological interventions into non-scientific cultures apart from accompanying social changes designed to help the recipient culture adapt to the changed situation.

Communications and Mass Media Communications advances include global radio and television coverage. These forces create expectations which have not been met in much of the world. The mismatch between consumer desires (amplified to "needs" by advertising) and the ability to meet these needs represents a destabilizing force in society.

Personal Empowerment through Communications The internet and cell phones extend learning and opinion influence beyond government and commercial cities to towns and remote villages.

Religious Communities and Religious Authority In the 1970s, religion and ethics were rarely cited at technical conferences. These factors are now seen as relevant to social stability.

Illegal Organizations Criminal networks exercise social control through illegal traffic in drugs, arms, and people. Government resources allocated to combat crime are not available to traditional forms of control and social interventions (social safety nets).

The Underground Economy The underground economy exercises control by reducing tax revenues and by circumventing traditional channels of trade. This effectively reduces the influence of governments, corporations and banks.

Industrial and Commercial Interests These organizations may be larger and more influential than governments of small nations. They exercise substantial social control through marketing and public relations efforts. Most of their products have utility but may be produced without regard to social, environmental and other impacts of their products. The internal control networks of the organizations may view environmental and social impacts of their activities as externalities.

Non-governmental Organizations (NGOs) and ad hoc Coalitions These groups contribute to system control, both directly and through pressure on governments.

Personal Choices Individuals exert social control through market choices, political choices and behavioral choices. Clearly, sexual choices are a major mechanism for the spread of HIV/AIDS. This epidemic affects control of society.

In sum, social control is diffuse. No single group or government controls socioeconomic or political conditions.

3. TECHNICAL SOLUTIONS TO SOCIAL ISSUES

Governments may implement social, technical, or hybrid approaches to alleviating problems relating to population and economic growth. These remedies to problems are illusory if they simply re-locate a systemic constraint in time or place. Frequently, technical solutions support continuation of behavioral patterns beyond the inherent carrying capacity of a region or ecosystem. Continued expansion of population and economic activity beyond natural supporting structures and systems generally creates new crises at some time after symptomatic conditions appeared to be alleviated.

Technical approaches to alleviating problems include invention of new weapons, which in turn spur further research in armaments, antibiotics, whose overuse has given rise to resistant microorganisms, and genetic developments in grains. Food supplies are at risk through introduction of genetic monocultures in key crops. The most evident weakness of technical solutions is seen in the field of transportation. Feedback loops in transportation systems have short delay times. Postponed or relocated problems re-emerge in another form after an apparent solution is implemented.

An example from Switzerland illustrates the weakness of a technical solution applied to transportation. A major Zurich newspaper [NZZ, (2004)] reported that the worst traffic bottleneck in Switzerland was eliminated with the opening of a new tunnel. The same article indicated which nearby area would immediately become a new traffic bottleneck. This illustrates the illusory nature of a technical solution to a behavioral problem. In this instance, too many people and too much socioeconomic activity are concentrated in a geographically constrained area.

A more graphic illustration of a partially technical and partially social solution in the USA is linked with a rapid increase in population in and near Las Vegas, Nevada. The demand for water has grown proportionally. An interim solution, negotiated

between governmental units, allows Nevada to purchase a water allocation from Arizona. Undesirable consequences of the Las Vegas population growth lie in the future. When Arizona reclaims its water allocation because of growth in Phoenix and Tucson, a major political fight will emerge. Consequences of current overuse of water include destruction of ecosystems along the Colorado River as well as unchecked use of water to an extent that no significant amount of water reaches Mexico via the Colorado. This action is nearly unprecedented in international affairs. Tradition has held that downstream areas are entitled to continued historical flow levels from upstream sources.

3.1 Migration - an Illusory Approach to Overpopulation

People migrate from what they perceive as troubled regions (unfavorable economic conditions, instability, food shortages) to more desirable regions. Though governments may facilitate or inhibit migrations, people often find ways to move, whatever barriers they may encounter. Historically, starvation drove many migrations. Starvation is a lesser factor in migrations in the 21st century. Migration may temporarily relieve population pressure in one region. Resources and infrastructure in other areas are stressed by an influx of people. If migration brings people of cultural backgrounds not understood in the receiving area, sociocultural tensions may arise and later lead to civil violence. By relocating the problem of population pressure and failing to address its root cause, migration is an illusory way of addressing population pressure.

Effective solutions to social problems will ultimately reflect behavioral change rather than transfer or postponement of a set of problems, often secondary to unsupportable levels of population. The condition of the environment in areas of inmigration is rarely addressed in conjunction with migration. Consider the large-scale ecological changes accompanying population relocations in the Amazon Basin. FAO Forest Resources Assessment WP 27, Section 3.1 states that 48% of 1990 global tropical forests were in South America. At the 1980s deforestation rate of .97% per year, one-third of that forest will be gone by 2030. That is equivalent to one-sixth of the 1990 level of global tropical forests. The document indicates that deforestation in Central America and South Asia was even more rapid. Clearly, the capacity of the earth to support life will be substantially reduced within two or three generations unless tropical deforestation is halted.

4. OBSERVATIONS ON CARRYING CAPACITY

Malthus stated that the demand for food will outpace food supply for society. It now appears that there are other, more restrictive limits to the carrying capacity of the globe:

- Climate change may cause population dislocations.
- Water shortages and water distribution are growing sources of tensions.
- Water pollution may weaken entire populations, opening the door for major epidemics.

Other limiting factors include deteriorating air quality, and overstressed transportation systems.

5. DIFFUSE SOCIAL CONTROL

The operative social control outlined above is referred to in this paper as “diffuse control.” “Diffuse control” is not to be confused with “distributed control,” which is discussed elsewhere in control literature. Further discussion of issues of social control may be found in Kile (1975).

6. CONCERNS LINKED WITH DIFFUSE SOCIAL CONTROL

Populations with little explicit societal leverage (the poor of Asia or Africa) also influence the global system. Population pressure has led to expanded slash and burn agriculture. This accelerates deforestation and alters precipitation patterns. Arid zones and deserts expand as a result of deforestation. There is little evidence of reclamation of agricultural land which has fallen to desertification.

Environmental degradation is linked with the behavior of global subsystems which optimize their own expected outcomes, whatever the cost elsewhere or at another time. Widespread degradation, including “dead” zones in oceans, illustrate that changes are truly global. For example, the once “inexhaustible” Grand Banks of Newfoundland were so depleted of fish that they were closed to fishing for long periods.

If environmental decline continues, the diffuse, loosely coordinated control of our global system could unravel. This will be exacerbated if acutely affected nations act in desperation to improve their situations and spark conflict with groups competing for the same resources. Global society is indeed changing the environment through growth in both population and aggregate consumption. At the same time, the natural environment is not capable of growing. In effect, the present system of disaggregated social controls is decreasing the margin

of safety between carrying capacity and aggregate consumption.

Society has thus far not managed its interaction with the environment. The environment has no “voice” in global society, but the it does change under the impact of human activity. We may assume that environmental change will pass an inflection point beyond which change will accelerate and place significant stress on social functioning. No one is capable of predicting when that might occur. Moreover, there will likely be several such inflection points: one with respect to temperature change; another with respect to pollution loading; another with respect to floods, etc.

7. THE QUESTION OF LIMITS

We may conclude that either that there are no limits to population and consumption or that there are limits beyond which environmental change will restrain aggregate consumption (whether through shortages of material or higher death rates).

Most observers agree that there are limits. There appears to be no simple, single limit. Sparsely populated regions with adequate rainfall, can support substantial growth, while many desert regions, cannot adequately support their current populations without importing water and other limited resources. Regional disparities are growing. The historical record demonstrates that social disparity can lead to conflict.

8. REDUCING THE POTENTIAL FOR CONFRONTATION

Three actions could reduce the likelihood of confrontation: They are:

- Limiting population
- Limiting consumption
- Enhancing future prospects for existing populations.

Many scenarios emerging from studies of future change suggest rapid environmental change and other causes of social stress, leading to natural or social disasters. Few of these scenarios have occurred thus far. This has created a mood among the general public that people who warn of major change are simply crying wolf.

Major terror attacks occurred in Washington, DC and New York City on September 11, 2001. Earlier there was a nuclear catastrophe at Chernobyl. The worldwide public apparently saw these as isolated events.

There may be no general recognition of the potential for social conflict or disaster from environmental collapse until several catastrophes are clearly linked with environmental stress. Events of this type are likely in coming decades, but motivation to change individual and group behaviors is minimal. Public leaders seeking rarely venture beyond public consensus because they see little political gain from proactive change in the face of public apathy.

This apathy is linked to the time constants and complexity of feedback loops in interlocking environmental and social systems. If the behavior of a feedback loop, especially a complex feedback loop, is poorly understood or if delay in the loop is very long, people overlook the significance of the feedback. Nothing illustrates this more vividly than lengthy delays in dealing with air pollution and cigarette smoke decades after the discovery of their adverse effects on people. Much of this delay is traceable to the long time constant in the feedback loop linking deleterious actions with consequences accompanying these actions.

9. WHAT KIND OF SOCIAL CONTROL IS NEEDED?

Improvements in global control will require general agreement that the present system of control is a path to social conflict. “Social control” may suggest coercive government policies. Clearly, governments do employ both regulation and combinations of incentives and disincentives to control their populations. India and China have, at times, employed regulation, incentives, and disincentives to limit population growth. Other, less immediately obvious forms of social control may be even more effective. Religion and cultural norms and expectations promote high fertility rates in much of the developing world. One factor in promoting large families has been a perceived need to have at least one son survive into the old age of the parents. Because of historically high death rates, the only perceived way of assuring at least one surviving son was to have many children. Immunization has greatly increased survival rates and contributed to explosive population growth in many developing nations. The persistence of high birth rates in spite of falling death rates illustrates the power of inherited cultural norms. Current global behavior with respect to population is analogous to an addiction which leads an individual to enter a “twelve step” program. The first step in dealing with addictive behavior is to acknowledge that the present course of action is unsustainable.

Society should not be a dispassionate observer of environmental decline. Large scale social behavioral changes are needed. Individual aspects of decline may be disputed. Gaps in causal evidence have led to delay in confronting environmental decline. Both anecdotal

evidence and data suggest that the global environment is changing too rapidly for many species to survive.

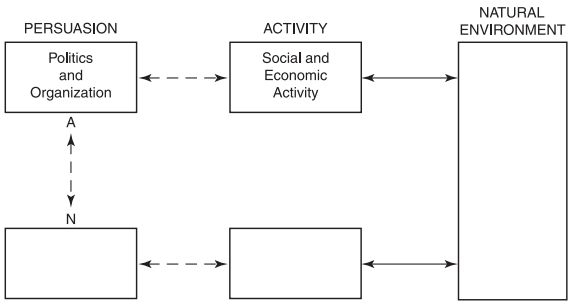

Figure 1. Interactions between Society and the Environment

Figure 1. is a simplified diagram of interactions among three elements. Two of these elements depict a series of social units A through N (for example, nation states or blocs, A through N)

Each social unit consists of two sectors:

- Persuasion (politics and organization), and
- Activity (social and economic activity)

The third element of the diagram depicts the natural environment.

The figure shows two types of interactions.

Physical interactions (solid lines):

- Compounded effects of physical action on the environment.
- Effects of the environment on action sectors.

Persuasion interactions (dashed lines):

- Feedback (information) from action sectors to persuasion sectors.
- Control signals from persuasion sectors to action sectors. The dashed line from Unit A to Unit N indicates political and organizational interactions among social units.

The figure emphasizes that politics and organization have no direct effect on the natural environment and that the environment affects politics and organization only to the extent that social and economic signals flow from action sectors of society (people and economic activity) to persuasion sectors. An alternative approach is outlined in Kile (1977). This approach is further developed by Kile (1980).

In sum, the environment does not react to what social leaders intend to do but only to whatever is actually done by society, whether directly by the people or through economic activity.

Conversely, the effect of the environment on human social activity will be a direct result of what we do. The motivation of any action may have positive or negative social effects in the present and the immediate future, but the action itself determines the long-term effect on human social and economic activity.

Whenever we act, we distribute the benefits and burdens of our actions among the present generation and our children.

10. CHALLENGES FOR THE ENGINEERING COMMUNITY

The task for the engineering community is to be actively involved with other professionals in convincing the public that signs of change are more than statistical aberrations, i.e., that these signs of change signal major impacts on society within the lifetimes of people now living.

At the same time, the engineering community can construct alternative scenarios which seem desirable to most people. These new scenarios must be believable to energize a constituency for study and action. The costs of action and inaction can be estimated and contrasted. Analyses should also note which changes may be irreversible.

Finally, the engineering community can help the public and leaders to slow the pace of technical integration because of the vulnerability of tightly integrated systems. Three recent episodes indicate the potential of social disruption from technological integration:

- Massive power outages in Switzerland and Italy.
- A huge power grid failure in Canada and the USA.
- The much feared Y2K problem.

The potential Y2K problem was based on a perception that massive failures of computer software might lead to social and economic chaos because many major software programs were written in the 1960s and 1970s and did not include provisions for dates beyond 1999. Fear of potential system failures triggered billions of dollars of spending to ensure a stable transition of computer programs on 1/1/2000; nevertheless, substantial uncertainty remained until the transition was completed successfully. The Y2K problem was avoided, but the furor it created illustrates how poorly we understand our interlocking systems.

In both cited instances of power grid failures, accusations were traded across international boundaries, indicating that leaders are more concerned with assessing blame for errors than with correcting systemic flaws which amplify transient instabilities and cause major failures.

A discussion of relevant leadership issues may be found in Kile (1999).

The paper has outlined difficult challenges for a profession accustomed to remaining in the background with on social and public issues.

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