Appendix 1. Glossary.

Attractor: In the mathematical field of dynamical systems, an **attractor** is a set of numerical values toward which a system tends to evolve, for a wide variety of starting conditions of the system. System values that get close enough to the attractor values remain close even if slightly disturbed. In non-mathematical terms, as used here, an attractor is a (set of) state(s) of a dynamic physical system toward which that system tends to evolve, regardless of the starting conditions of the system.

Basin of attraction: It is very common for dynamical systems to have more than one attractor. For each such attractor, its *basin of attraction* is the set of initial conditions leading to long-time behavior that approaches that attractor. Thus the qualitative behavior of the long-time motion of a given system can be fundamentally different depending on which basin of attraction the initial condition lies in (e.g., attractors can correspond to *periodic*, *quasiperiodic* or *chaotic* behaviors of different types). Regarding a basin of attraction as a region in the state space, it has been found that the basic topological structure of such regions can vary greatly from system to system.

Bifurcation points: Points in a system's trajectory where attractors and repellors collide or cancel each other out, or where different attractors pull in different directions, causing a loss of stability so that it is not evident where the system's dynamic will move next. One could think of a bifurcation point as a 'decision moment' for a system. The simplest example is a fold bifurcation involving a saddle point and a node. This is where the classical basin of attraction shrinks to nil and disappears. However, one can also have an unstable and a stable cycle collide, or have strange attractors collide with a range of unstable structures.

Cognitive space, and its spheres: The virtual space in which information-processing takes place in society. We propose the following structure of that cognitive space into three spheres. The core is composed of stable, well-balanced and developed mental formations in which closed categories dominate. The developing component around the core is composed of mental formations at the stage of coming into being, dominated by open categories. Around that sphere, we assume a range finds a sphere where there are no mental formations yet coming into being, but there is awareness of phenomena dimly perceived. This is the sphere of the known unknown. The information processing in the cognitive space is fundamental to the ways in which societies interact with their basins of attraction.

Entropy: There are two equivalent definitions of entropy: the thermodynamic definition and the statistical mechanics definition. In the classical thermodynamics viewpoint, the microscopic details of a system are not considered. Instead, the behavior of a system is described in terms of a set of empirically defined thermodynamic variables, such as temperature, pressure, entropy, and heat capacity. The interpretation of entropy in statistical mechanics is the measure of uncertainty, diffuseness or *mixedupness*, which remains about a system after its observable macroscopic properties, such as temperature, pressure and volume, have been taken into account. For a given set of macroscopic variables, the entropy measures the degree to which the probability of the system is spread out over different possible microstates. In this paper we look at the difference between the *expected* (macrostate*) entropy* of the way in which an interviewee describes certain phenomena, (which can be calculated on the basis of known and observable average variables), and the *observed* (microstate) *entropy*, which measures the actual description of the phenomena concerned. That difference is here considered as a proxy measure of the degree of uncertainty the interviewee has about the phenomena concerned.

Niche construction: In biology, the process by which an organism alters its own local environment (Odling Smee et al. 2003). These alterations can be a physical change to the organism's environment or encompass what occurs when an organism actively moves from one habitat to another to experience a different environment. Examples of niche construction include the building of nests and burrows by animals, and the creation of shade, influencing of wind speed, and alternation of nutrient cycling by plants. Although these alterations are often beneficial to the constructor they are not always (for example, when organisms dump detritus they can degrade their own environments). In this paper, the processing of information is considered to be a case of niche construction in which the human (or societal) information processing apparatus shapes and is shaped by the environment (in the wide sense) in which the society is embedded.

Nonlinearity: Describes a situation where there is not a straight-line or direct relationship between an independent variable and a dependent variable. In a nonlinear relationship, the output does not change in direct proportion to a change in any of the inputs. It may either change faster, so-called super-linearly, or slower, sub-linearly. Both cases frequently occur in complex systems. For example, when looking at the dynamics of urban systems, the surface of cities changes, according to any appropriate proxy measure, linearly with the size of the population, but energy use, as measured by electricity use, changes sub-linearly and information-processing changes super-linearly. The interaction between super-linear, linear and sub-linear dynamics can drive the system in very complex ways.

Resonance: Technically describes the phenomenon of increased amplitude that occurs when the frequency of a periodically applied force (or a Fourier component of it) is equal or close to a natural frequency of the system on which it acts. Thus, when an oscillating force is applied at a resonant frequency of a dynamical system it is some sense 'in tune' with the system. The system will therefore oscillate at a higher amplitude than when the same force is applied at other, non-resonant frequencies. In this paper we use resonance to indicate interactions in which the observation of outside phenomena reinforces some aspects of a society's cognitive structure, while other aspects of the observation do not and they challenge that structure. Such challenges will trigger changes in the cognitive structure that enrich it.

Technosphere: The domain that encompasses all of the technological objects manufactured by humans, but that is only part of it. It is a system, and not just a growing collection of technological hardware. It includes the goals, functions, dynamics and other aspects of the functioning of human systems in so far as they are determined by technology. Forest ecosystems, animals and machines, nanotechnology, the internet, highways, medical systems, power grids, human populations, political parties, governments and bureaucracies, robots and religions and their interactions with each other all impact on the dynamics of societal systems. In the technosphere approach, humans and their ideas are therefore part and parcel of the technosphere. Its dynamic is neither uniquely material nor uniquely societal, but truly technical – in the sense that existing technology is to an important extent considered to determine human thinking and behavior as well as the future development of technology.

Tipping point: A critical threshold in a system's dynamic at which a tiny perturbation can qualitatively or structurally alter the state or structure of a system. The term is particularly used with respect to climate change, indicating points on the temperature scale where the impact of climate change is expected to result in dramatic changes in many aspects of the living systems that sustain human existence on Earth. In this paper, the term indicates points in a system's trajectory where its information processing has to be dramatically restructured, not unlike a 'paradigm change' in the sense of Kuhn (1962). It is argued that this is often the case due to an accumulation of unexpected consequences of earlier system dynamics leading to what is experienced as a crisis, an incapacity of an existing information processing system to deal with the information needed to allow the system to have a harmonious interaction with its environment.