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WEEK 7 – Urban Complexity Science

Complexity Science

Complexity science is a broad and multi-disciplinary subject. In a wide range of systems that are the subject of study in biology, in the social sciences and in industrial applications, computational modelling is undertaken to study the behaviour of these systems; Mathematical developments and modelling approaches from physics can be used to better understand these systems; And expertise in domains from software engineering to systems biology can be used both to inspire new approaches and apply new results.

The concerns that complexity science addresses have developed from investigations from a varied intellectual ancestry. Some of it has developed from work in cybernetics in the 1940s, to work on general systems theory in the 50s, chaos and catastrophe theory in dynamical systems in the 1960s and 70s, to work on complex systems spearheaded in the 80s by groups like the Santa Fe Institute. Some of this work focussed on abstract mathematical systems and simple physical systems, e.g. sand piles, but more recently, interest has increased in complex adaptive systems, such as social systems, biological systems, and technological systems where the parts actively change the way they interact. The increased use of computer simulation and interest in biological questions created research in artificial life and the simulation of adaptive behaviour in the 1990s.

Now, in the 00s, complexity science takes in parts of all this rich background of work. An important part of the current emphasis of complexity science is its application to practical technological systems; industry needs to know how to design, manage, build and control systems as they increase in size and connectivity. They want to be able to build systems that are scalable, robust, and adaptive by using properties such as self-organisation, self-adaptation, and self-repair that biological systems utilise. Thus the contemporary applications of complexity science are complemented by a rich background of theoretic work, and continue to address deep scientific questions about nature.Complexity science is a subject of study that is in the perfect position of bringing together deep scientific questions with application-driven goals across many interesting domains.

Complexity science touches on almost all aspects of modern technology and science creating lots of exciting new opportunities in training, careers and research. One thing to be careful of: ‘complexity’ doesn’t just mean ‘complicated’. Complexity is not just determined by the number of parts a system has, for example. Engineered systems, such as a microprocessor or the space shuttle, might have a very large number of parts with very intricate design. But complexity science is interested in dynamical properties like self-organisation, adaptation, and emergence. Often engineered systems are designed to minimise these tricky dynamical properties – they can make the system difficult to design, predict and control. However, if desirable emergent behaviours can be harnessed and exploited they can help us to move beyond the limits of traditionally-engineered systems that are merely complicated.

Complexity Science Focus. [online] < http://www.complexity.ecs.soton.ac.uk/index >
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