

WHERE IS SYSTEMS THINKING IN DESIGN?

Systems thinking is new, and not new. Parts of it have been in design for a while. **Interaction Design** picked up on Gibson's notion of affordances, which placed emphasis not on the product or the user, but on the relations between them. **Experience Design** took into account the (temporal, contextual) complexity of users, and that design should step beyond the individual single user. **Service Design** has questioned the idea in **Product Design** that design ends with providing a plan for a future product, and that this product or plan can stay the same for a longer period. **Strategic Design** has been aware that the organisations that deliver services and products don't operate as single entities, but in a network of actors. **Social Design** has looked at how the larger scale of societal challenges and of individual behavior are connected and co-dependent. **Sustainable Design** has pursued the flow of stocks (materials, energy) at various scales, and emphasized cyclical use of these resources.

Currently, the term 'system' is hot again, as it was a few times before, and there is renewed interest in bridging disciplines, and collaborating at complex (societal) challenges.

But, as often, there are cool examples and confusing terms, and cool terms such as 'wicked problems' and 'systemic solutions' are readily claimed in a commercial context where companies want to appear ahead of the game. So there's plenty of heavy words and light meaning around.

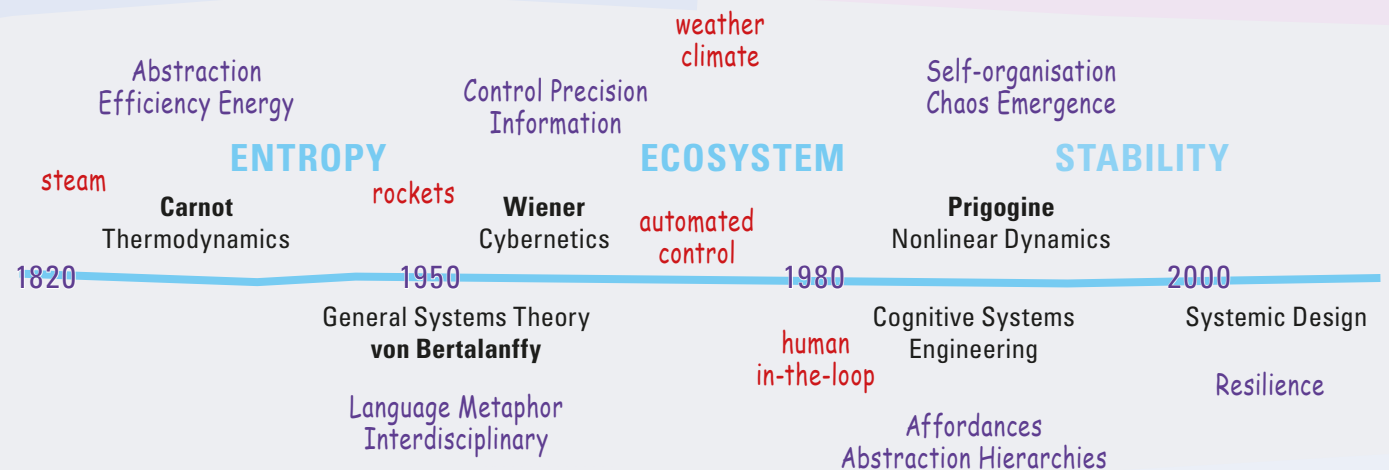
This map aims to give an overview of definitions of the terms in academic introductions to systems thinking. Another is to point out where it touches on design, and to provide some holds on how to apply its tools in your design work.

A VERY BRIEF HISTORY OF SYSTEMS THINKING

Systems thinking developed over two centuries across science and engineering. It has seen several waves of popularity, each time fed with experiences in different disciplines. One main theme has been abstracting (and mathematizing) structure and dynamics; the other has been uniting academic thinking about structure across disciplinary boundaries.

The historical root of systems concepts is usually placed with Sadi Carnot modelling the steam engine in the Industrial Revolution. He described the steam engine not as a series of metal pipes, burning coals, and steam, but in thermodynamic terms of temperature, flows of matter, energy and entropy. These highly abstract new notions provided a quantitative theory which helped making these machines (and many

others) more efficient. The next wave occurred after World War II, and concerned how to steer machines like rockets and planes not by brute force pushing, but by guiding it subtly by electronic signals: cybernetics. This produced the concept of 'information'. The engineering area of control systems tries to steer such devices to a target, with an emphasis on precision, safety, and robustness under noise. The third quantitative wave gained popularity with large computing simulations in the 1980s, and their use in population biology, weather prediction, and the first wave of Artificial Intelligence. Part of the fascination of the day was that seemingly simple equations can produce surprisingly complex and unpredictable behavior: fractals and chaos theory.



The other theme, of cross-disciplinary integration also had its waves. At about the same time as the cybernetics movement, the 'General Systems Theory' movement proposed systems as a shared language to connect and unite thinkers in various disciplines, ranging from law to psychology, sociology, medicine and organization design. The language of elements, boundaries, relations, worked in many fields, and was seen as a bridge between disciplines. In the late 20th Century, movements of 'systems design' and 'systems engineering'

studied how large project can be organized, and 'cognitive systems engineering' studied how to support people at complex tasks such as flying an airplane or running an industrial plant or a complex organization. In the past decade, the term **Systemic Design** has gained popularity to describe how designers can contribute to improving large-scale problems together with other actors from governments, societal organisations, and individual citizens.