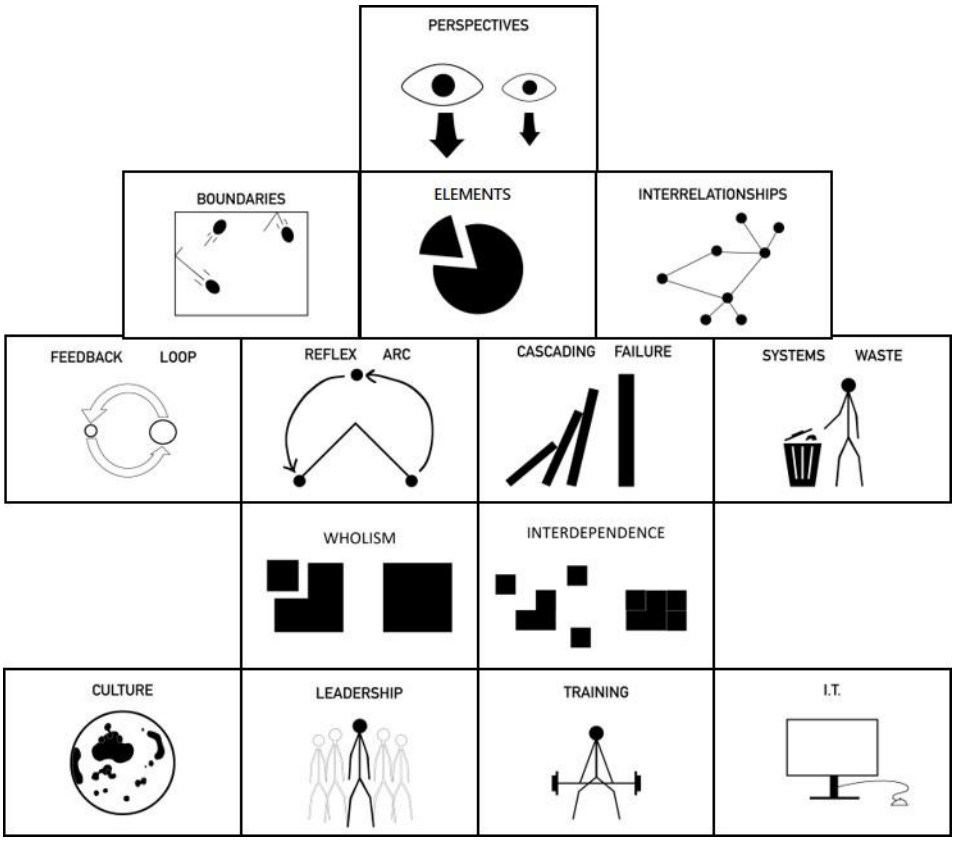
Systems Thinking 4



Contents

Welcome

This is our fourth communication! Last time we were all locked up, and social distancing. Now we are slowly emerging.

In 'Classic Theory Discussion' we have a look at:

a. **Systems level thinking for artificial intelligent systems**: This is an interesting article that considers psychological theories that are relevant to a learning system.
b. **A systems conference and some generic system principles:** the lock down has meant this conference is now online. So, it's your chance to go for a fraction of the normal cost.

In the ideas section we look at some simple concepts from an information systems handbook:

a. **System control and life cycle** - one notion is based on using feedback, the other is about all systems having to die.
b. **Warnier Orr Diagrams –** a systematic way to work backwards from the goal.

The systems theory and evaluation section considers a recent model for social change (2018), based on Donella Meadows work amongst other. One of the authors is Peter Senge, who you may remember as the author of 'The Fifth Discipline'. This was a very influential book about learning organisations.

In the controversy section we travel right back to the beginning to look at who created general systems theory.

As per the previous newsletters, we will gradually post elements of this newsletter over the coming period onto the "Systems Thinking and Evaluation" LinkedIn group. If you have not joined already, you can go to the following link and request to join. https://www.linkedin.com/groups/10508364/.

As always, a big thanks to **Julie Elliott**. She continually has interesting ideas and contributions.

Brian
Lewe
Ralph

PS:
This time we are going to have another ONLINE DISCUSSION for one hour led by Dr Ralph Renger, if you wish to join us:
Monday 15, June 10 am AEST
Sunday 14, June 5 pm MST

Join Zoom Meeting
https://zoom.us/j/99591216984?pwd=Uis3eThjaGdXSDZJcm5xOGJ6WWhVZz09
Meeting ID: 995 9121 6984
Password: 717070

The discussion will be on his continuing work using systems thinking to evaluate a local health department's real time response to the COVID19 pandemic. He will give an update on what he is thinking at this stage of the evaluation, particularly around FEEDBACK LOOPS.

Classic Theory Discussion

These are the foundation ideas from general systems theory. We have one new development approach using systems to look at artificial intelligence, and an interesting conference.

A. Systems-Level Thinking for Artificial Intelligent Systems[1].

The critical aspect of any system is the ability to adapt and grow in changing circumstances without losing internal integrity. This is reliant on feedback loops….

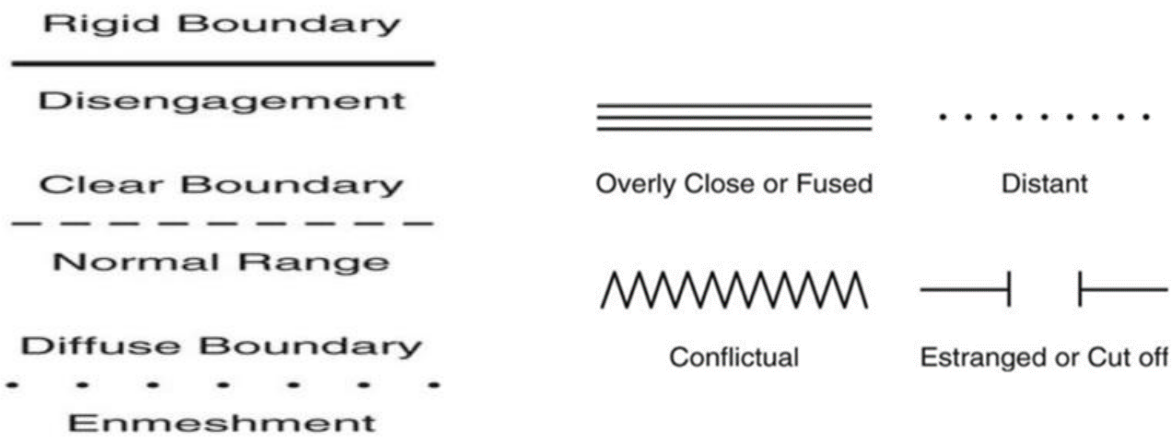
"One of the major changes required for long-term semi-autonomous or autonomous operation is continuous "life- long" learning methods that continuously adapt to not only changing environments, but changes within the system itself"

Dr Jim Crowder is an expert on artificial intelligence related systems and systems architect. He is a Senior Principal Systems Engineer at Raytheon Intelligence, Information and Services in Aurora, Colo., and Adjunct Professor at Colorado Technical University in Colorado Springs, Colo. His daughter is Dr Shelli Friess. They were sitting around a campfire chatting, and Dr Shelli started to bring human neuroscience concepts into artificial intelligence. This created the breeding ground for this article.

They provide an overview of the different states of systems that we have all been involved in. They do this by considering all the knowledge theories that potentially deal with a Self-Evolving Life Form (SELF). This SELF system faces a constantly changing reality, where knowledge is never complete, and interactions with other systems are creating continuous impacts.

Successful development of artificial intelligence has always given us three some hope of transplants into the future.

Figure 1: Salvador Minuchin's Boundaries and Conflictual Representations



[1] Crowder J.A., Carbone J., Friess S. (2020) Systems-Level Thinking for Artificial Intelligent Systems. In: Artificial Psychology. Springer, Cham. DOIhttps://doi.org/10.1007/978-3-030-17081-3_2. Download at this site: https://bit.ly/3h6EDde

B. The International Conference on Complex Systems

Julie Elliott has alerted us to this conference. Everything is online, so very reasonably priced! It is usually held every few years. The program is huge.

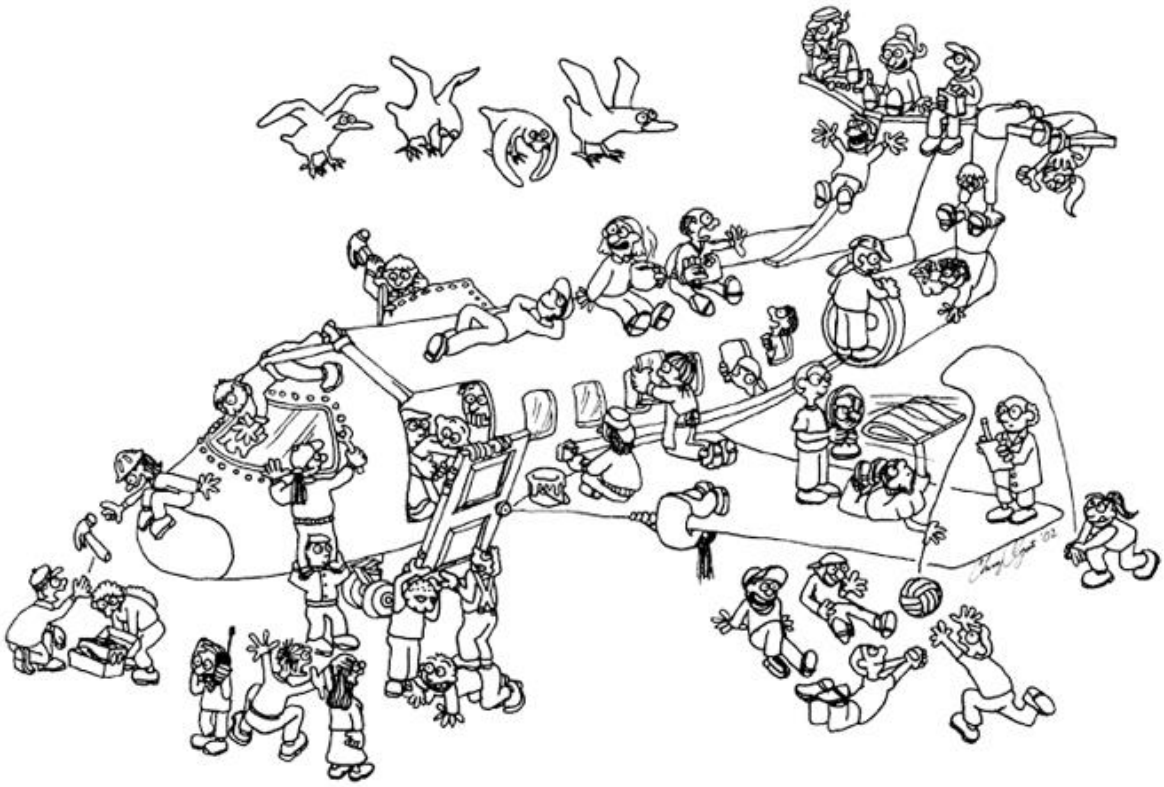
*"**The International Conference on Complex Systems** is a unique interdisciplinary forum that unifies and bridges the traditional domains of science and a multitude of real world systems. Participants will contribute and be exposed to mind expanding concepts and methods from across the diverse field of complex systems science."*

Conference Dates: July 26-31, 2020

Conference Website: necsi.edu/iccs-2020

Perusing the website, we came upon this complex system.

Figure 2: The Complexity of Airplane Design by Cherry Ogata



Obviously, this is designed to show some important systems principles, so we have had a guess at a couple that may apply.

Eighty Twenty Principle

The first is that with a lot of people building the plane, there appears to be a lot of redundancy.

"According to this principle, in any large, complex system, eighty per cent of the output will be produced by only twenty per cent of the system"[2]

[2] Richardson, K 'Systems theory and complexity: Part 1' E:CO Issue Vol. 6 No. 3 2004 pp. 75-79

To make this plane building more efficient it would appear we should get rid of some of the redundant nodes. However, in networks for which all the seemingly redundant nodes have been removed, and only relevant nodes remain, it was found that the network was very unstable - the slightest disquiet would cause a major upheaval[3].

High Flux Principle [4]

This leads to the high flux principle overshadowing the eighty twenty principle. The high-flux principle suggests that:

"*The higher the rate of the resource flux through the system, the more resources are available per time unit to help deal with the perturbation. Whether all resources are used efficiently may matter less than whether the rights ones reach the system in time for it to be responsive."*

[3] Bilke, S. and Sjunnesson, F. (2001). "Stability of the Kauffman model," Physical Review E, DOI: 10.1103/PhysRevE.65.016129

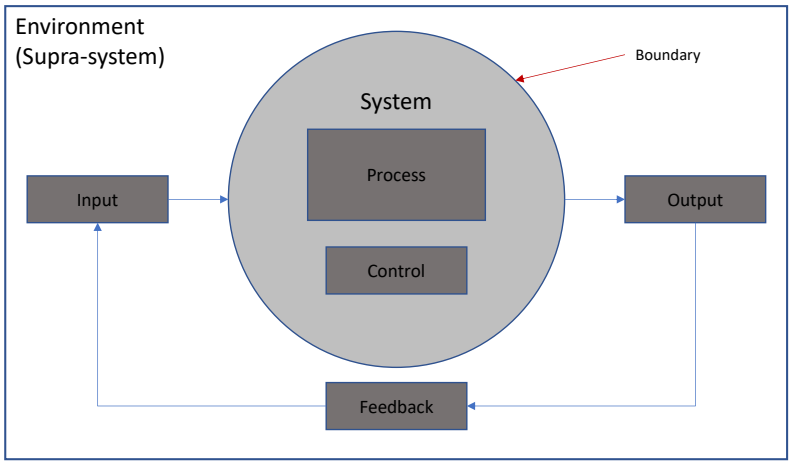
[4] Watt, K. and Craig, P. (1988). "Surprise, Ecological Stability Theory," in C. S. Holling (ed.), The Anatomy of Surprise, New York: John Wiley.

Ideas

A. Information Systems Analysis and Design[5]

Two ideas came out of exploring this area. The first is the notion of the importance of having a system control.

Figure 3: A simple representation of an Information System

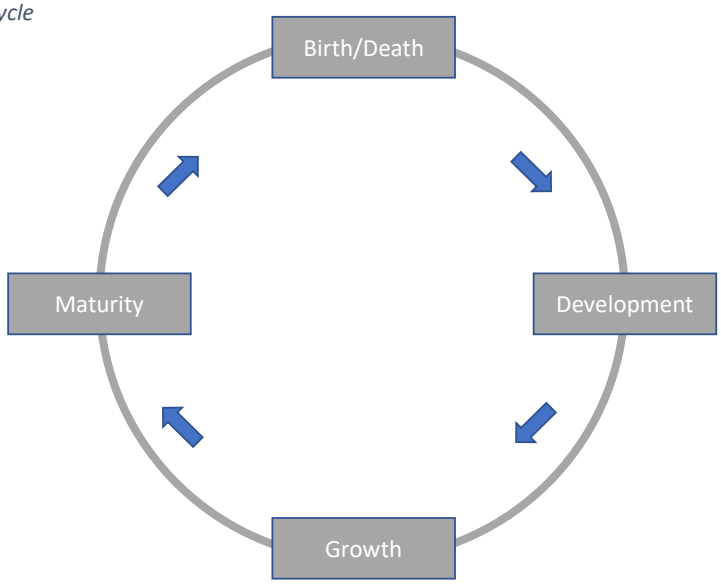


Control is defined as

"An expected value that can be compared with feedback. If the feedback suggests a deviation from the expected value (the control), the system reacts by attempting to adjust itself"

The second is every system has a life cycle. Systems die and a new or replacement system is born to take its place. Recognising the life cycle stage of any system then has important implications for how to evaluate it.

Figure 4: System Lifecycle



[5] Davis, W. & Yen, D. "The Information System Consultant's Handbook: Systems Analysis and Design" ISBN 13: 9780849370014. 1999 CRC Press

B. Warnier Orr diagrams[6]

Warnier - Orr diagram is also known as a logical construction of a program/system, and is similar to a flowchart process diagram for defining a system. A flowchart generally works towards a goal from when the system is initiated. This diagram works in reverse through the system from the goal.

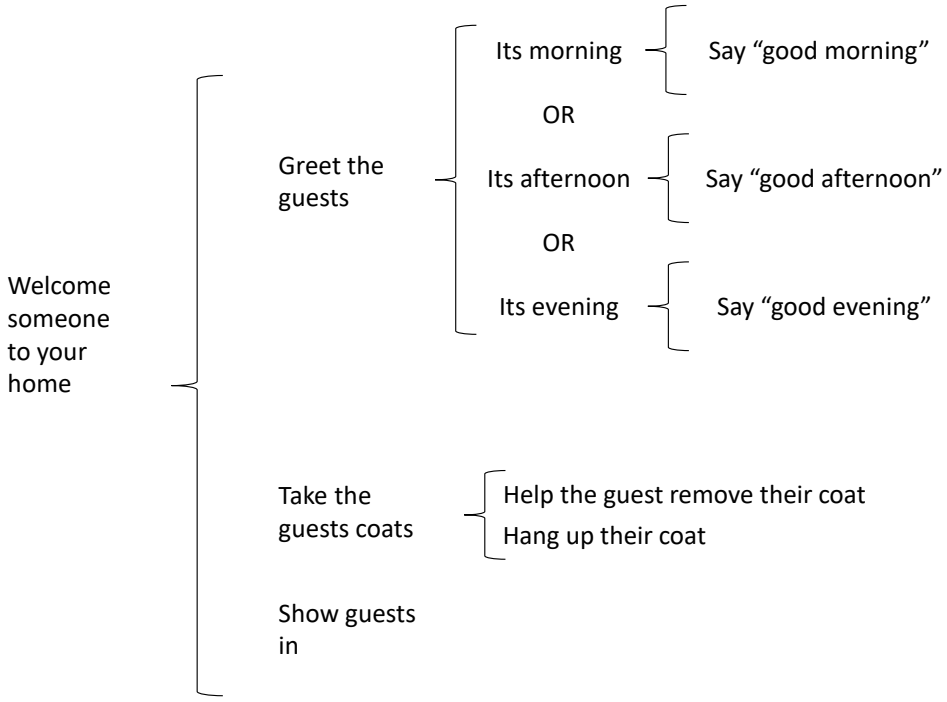
This diagram starts with the required output (the results), and then works backwards to determine the steps and inputs combinations that are needed to produce this output.

Initially developed in France by Jean-Dominique Warnier, and in the US by Kenneth Orr. The graphic is designed to be simple and show the movement of data. The data in this case is the guests and by using this diagram we can politely get them into our home with the same level of politeness each time. Additionally, we could give this job to our butler, who would then be able to do exactly the same.

The four basic constructs used on Warnier/Orr diagrams: hierarchy, sequence, repetition, and alternation.

A simple example is given below in Figure 5.

Figure 5: A Simple System for Welcoming using a Warnier Orr Diagram



[6] http://worldofdiagrams.blogspot.com/2008/11/warnier-orr-diagram.html

Systems Theory and Evaluation

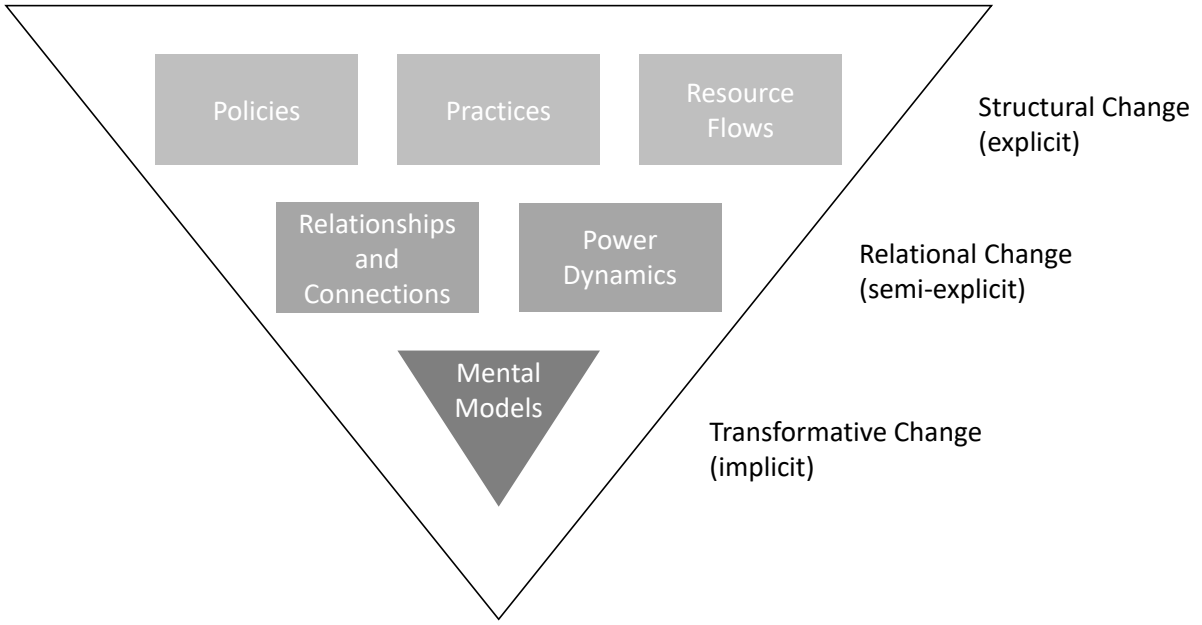
A. The Water of Systems Change

The ability of a program to create change is central to most evaluations.

This model, created by Kania, Kramer & Senge (2018)[7], considers the necessary big picture system considerations for systems change. The authors have drawn on previous systems change and systems thinking works to put together a systems change model that supports and informs efforts such as collective impact (which is very trendy right now). The antecedents for this model are thinkers such Fisher & Waterson, and Donella Meadows. We covered Donella Meadows work briefly in the last newsletter.

The central notion is that enduring change must consider the alignment of all three levels of change (explicit to implicit). The constant interaction between the levels means that any conflict will always favour change to the position of the implicit level.

Figure 6: Shifting the conditions that hold the problem in place



With such esteemed thinkers providing the background material for creation, this model has a depth of thought that should be considered. As the saying goes "all models are wrong, but some are useful".

Mental models are always seen as the most powerful and the most difficult to change. Most change models describe this element as 'culture'- the way of operating at a level taken for granted (the way we do things around here).

Further depth on these levels can be found by going back to the original community activists of the sixties and seventies, and the work of Saul Alinsky[8]. John Turner has also done some great work on power in "Explaining the nature of power: A three-process theory".[9]

[7] Kania, J, Kramer, M. & Senge, P. (2018) "The water of Systems Change" published by FSG Consulting, https://www.fsg.org/publications/water_of_systems_change, accessed June, 2020.
[8] Alinsky, S. 'Rules for Radicals', Random House, ISBN 0-394-44341-1, 1971
[9] Turner, J. "Explaining the nature of power: A three-process theory" European Journal of Social Psychology, 35, 1-22, 2005, DOI: 10.1002/ejsp.244

B. Policy Evaluation – The Magenta Book

This is part of what we wrote last time about the Magenta Book:

"The Magenta Book 2020 (March) Supplementary Guide on Complexity outlines key concepts and points to consider in evaluation when working in complex and challenging policy areas. It is clear, and well put together. It deals with many problems evaluators face normally in evaluations and gives a systems type rationale for its' methods."

The Centre for the Evaluation of Complexity Across the Nexus (CECAN) has just released a webinar (April, 29) which lasts for about an hour. It discusses the key concepts.

CECAN Webinar: Handling Complexity in Policy Evaluation - The Magenta Book 2020 Supplementary Guide
So now, you do not have to read the whole book. The webinar did drag on just a bit.

C. A systems approach to the evaluation of natural resource management initiatives

This article is mentioned, rather than reviewed.

Bellamy, J., Walker, D., McDonald, G. & Syme, G "A systems approach to the evaluation of natural resource management initiatives" Journal of Environmental Management (2001) 63, 407-423, doi:10.1006/jema.2001.0493

It would be great if readers also had other examples of using a systems approach to evaluate natural resource management.

Controversy Corner

Julie Elliott originally drew our attention to Brian Castellani's (2018) map of complexity sciences. Prof. Castellani saw systems science and cybernetics as the forerunners to complex systems theory.

If you have forgotten all the theorists, click here for a quick refresh.

https://www.art-sciencefactory.com/complexity-map_feb09.html

Dr Lewe Atkinson then drew our attention to **Ludwig von Bertalanffy** (1901-1972) as the 'Systems Theory Founder'. Unfortunately, he was for the period of the war a member of the Nazi party. **That is a bit controversial.** After the war he did go through denazification, and then taught and worked in London, Canada and America.

In the 1920.s he wrote a book "Theorestische Biologie" that was significant. It contained the system theory of the organism. He then expanded this theory into general systems theory of biological, behavioural and social systems.

"The Bertalanffian rationale for building a science of social systems is based on the assumption that social organizations are like living organisms in the sense that both display wholeness, interact with their environment, exhibit strategies of self-maintenance, and experience cycles of birth, growth, maturity and decline."[10]

However, before his theory, Alexander Bogdanov (1873 – 1928) , a Russian medical researcher , philosopher , and economist, had developed a theory called "Tektology" (the science of structures)

Using the terms "complex" and "system" interchangeably , Bogdanov distinguished three kinds of systems:

1. **Organized complexes** where the whole is greater than the sum of its parts
2. **Disorganized complexes** where the whole is smaller than the sum of its parts
3. **Neutral complexes** where the organizing and disorganizing activities cancel each other (this reminds me on my local council).

He had a big influence in Russia. Russian constructivism adopted 'tektology' as it's guiding philosophy, which influenced lots of art (all those constructivists). He also published in German and was widely read in Germany and Austria.

The paper "Tektology, Russian constructivism, and Man with a Movie Camera[11]" looks at the influence Bogdanov had. **The controversial element** is that Ludwig made no mention of Alexander. Still the Bolsheviks and the Nazis didn't see eye to eye, and lots of theories have developed at a similar point in time.

A theory developed by people at either end of the political spectrum at a similar time is somewhat amusing.

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[10] Global Association for Systems Thinking https://bit.ly/3haCUUj accessed 9 June, 2020

[11] This paper can be downloaded here….https://bit.ly/3f5ONZQ

Contribution Team

i. Julie(Elliott)

Julie is best known as Executive Producer on the zombie apocalypse movie "Me and My Mates Vs the Zombie Apocalypse" (2014).

Julie Elliott is also a PhD student at the School of Media and Communication, RMIT University. Her research project is 'Developing Complexity-congruent evaluation theory and practice.'

Contact: julie.jcelliott@gmail.com

ii. Lewe (Atkinson)

Lewe likes to wear Hawaiian shirts and play the banjo.

Lewe is also the powerhouse behind Haines Centre for Strategic Management (Brisbane). He lives and breathes systems thinking – and is always working towards the practical application of system thinking principles to business (and government) sustainability.
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iii. Ralph (Renger)

Ralph's daughters refer to him as 'the arrow' because of his hair style.

Ralph has published over seventy articles in academic journals, and taught systems for more years than he can remember. For the last thirty years he has presented to conferences around the world.

Contact: ralph@justevaluation.com

iv. Brian (Keogh)

Brian has recently found out his name is most well-known as a dog's name because of bravery during WW11. The book '**The Amazing Adventures Of Bing The Parachuting Dog"** was published in 2012 (they changed Brian's name to Bing!!!)

He has a company 'Cobalt59' (www.cobalt59.com.au) with a lovely person called Julieanne, and he likes working with the people above.
Contact: briankeogh@icloud.com