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On the role of systems thinking in design and its application to public self-services

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Core activities & grounding

Driven systemically:

- Problem identification
- Problem understanding
- Problem description (modelling)

- This approach together with
  - cybernetics, cognitive science and complexity,

  offers the main platform for a theoretical framework to our design students for reference and grounding.

Here we posit it as offering a theoretical framework for Design Culture rather than a methodology for Design Practice only, which it does as well.

By way of introduction…

- Systems as an approach appeared more than half a century ago, in response to the failure of mechanistic thinking and vitalism to explain biological phenomena. 'System' is a complex and highly interconnected network of parts, which exhibit synergistic properties, where the whole exceeds the sum of its parts. It is a typical paradigm of an interdisciplinary domain, which in its trajectory through time and applications, has amalgamated other domains such as 'Biology', 'Information Theory', 'Management', 'General Systems Theory', 'Cybernetics' amongst others.

- Systems Thinking requires shifts from traditional classical decomposition or reductionist ways of doing things. It looks at relationships (rather than unrelated objects), at connectedness, at process (rather than structure), at the whole (rather than just its parts), the patterns (rather than the contents) of a system, and context. It offers a perspective which provides tools for understanding relationships between things and does not look for a single answer to a problem within the confines of a single discipline (Moore & Kearsly, 1996/2005).

Design and Systems Thinking

- The design of a product / system will, in its life cycle, have to carry from the beginning all aspects, notions and ideas and the relations amongst them in the praxis of design.

- Designers do know that the wider their spectrum in examining a design problem the more they will gain in the robustness of their solutions. Time and resources constrains them, however, and direct their efforts to the inevitable reductionism.

- What designers should know is that reductionism can lead to serious mistakes if they ignore the consequences of not considering the power of Systems Thinking in design problem solving.

- That is mostly because, simply stated, parts of a system (subsystems) cannot identify and show properties of the system unless they themselves are considered and recognized as parts of it and have their inter-relationships to each other acknowledged.

Design and Systems Thinking

- Also, Systems Thinking designers should welcome and utilize complexity in their Design Problem description, being aware that this actual complexity, if recognizable and describable, shows richness in the design problem description.
- That realization leads again to the observation that complex design problems,
  - i.e. the human-centric, ill-structured ones,
- cannot be considered in a reductionist way because that obviously will lead to losing the emerging properties of the system/problem space for which they design.

Example

- The argument here is that there should be unifying grounded knowledge which provides methods, methodologies and ways of thinking which give power to the ‘toolbox’ to conduct and direct groups of designers in their praxis towards design solutions from the beginning.

- In the case of Self Service Design which is currently offered mostly via Self Service Terminals (SSTs) such as ATMs and other self-service machines, there are also properties of the designed systems which have been eventually identified (it could be said through trial and error) and which could have been in the designed system from the beginning if the holon was the driving thinking tool through Systems Thinking.

- An example of this is the overriding properties of ‘privacy’ meaning that the design and locating of an SST should ensure customers need for privacy when they are using it, as well as their understanding of safety. That situation refers to what could be called the “users subsystem” whose relationships with subsystems such as ergonomics and location / allocation and architectural design, to mention a few, would have made them surface as properties from the beginning. As a result the design team would be aware of the relevant importance of privacy and safety in their tasks.

Case Study: installing more SSTs

A bank decided they needed to install more bill payment machines inside the branch bank building because of the high volume of use and the subsequent customer queues.

However, just “throwing more machines at the problem” created many new ones.

For the customers:

- The space inside the bank was further restricted, waiting areas were more cramped.
- Most of the customer seating was removed, - especially resented by the older members of the public.
- Some decided to take their custom elsewhere

For the bank managers,

- the new SSTs obstructed their line of sight which they needed to carry their duties which include the monitoring of the bank’s operations and directing staff to go where they were most needed at any given time during the day: for instance moving between teller stations and customer query stations.

Case Study: more SSTs

- As a retrospective ‘fix’, the designers installed CCTV (Closed Circuit Television) cameras trained on the positions of each member of staff, so that the bank manager could continue to monitor operations.

- However, this is a one-way communication system, so staff were no longer able to communicate non-verbally with their superiors, as they had done when they had reciprocal direct line of sight. This had meant that they were co-responsible for the need to change positions, that they had seen the problem and were already preparing to move to where they were needed.

- Furthermore, the CCTV cameras gave them the feeling they were being “spied upon” and they resented them and this led to bad feeling between the staff and manager and demands that the manager agree not to make use of the cameras. representing not just a loss of time and investment, but damage to staff –manager relations.

Case study: more SSTs, more problems

- Thus, new problems were created, that were more serious than the old, leading to increasing the disruptions in the bank rather than solving the issue of more billing machines to meet demand.
- Had a Systems Thinking approach been used, it would have brought up these requirements and conflicts much earlier.
- This would have given an understanding of the design context that would have have been really useful to know and could have prevented some ‘mistakes’.

Utilising the notions of complexity and variety

- Complexity should be welcome because of the richness it offers
  - Subscribe to the view that the more complex a system appears to be the 'healthier' it is, because if understood, it offers more ways to deal with problems than a less complex one.
- Variety can be seen in a similar way
  - Cybernetics provides the notion of requisite variety (i.e. the minimum number of choices needed to resolve uncertainty) to the property of self reference, as well as to many other emerging properties.
  - in cybernetics it has been introduced to measure the potential of a system to defend itself against external threats or interference in the sense that only variety controls or defeats variety.
    - e.g. In the case of the design of self service or the actual SST, Systems Thinking designers will possess the knowledge to add in to their methods the determining of the variety of demands, i.e. the number of different service demands.
- Designers should be aware of the usefulness of knowing the number of different ways users will demand service.
  - They will know to look for the variety of services that should be provided and what the SSTs should be able to deal with.
    - e.g. notion of requisite variety for dealing with demand, will lead the designers to those involved in the relevant subsystems (e.g. Service Design) for dealing with, for instance, accessibility.

Accessibility problems = design opportunities

For older people, or those with a disability, or simply non native speakers, using SSTs may be difficult, or even impossible

- Wheelchair users may not be able to get close to the controls of the SST
- For partially sighted users, the print on the screen or the buttons may be too small or without sufficient contrast
- People with literacy problems or older people may find that SSTs time them out, because they need longer to make the decisions asked for by the SST

- Yet such needs, if recognised, can actually offer creative opportunities for designers, that enhance the usability and accessibility of the SSTs and the services for everyone.

Utilising the notion of Self Reference

- The notions of Complexity and Variety are very useful in the study and understanding of the living systems, (as well as to creative design) of which the resulting artefact is part.

- Also in designing a product, the property of self reference could make a difference, especially in cases where Cognitive Engineering is considered important.

- A normal human can always use self reference when something is wrong with him/herself and protects him/herself to the best of his/her ability.

- In contrast a mentally ill person or an autistic child cannot do that.

- Consequently, an artefact that breaks, which usually is not expected to possess that property, cannot self reference either.

In the example on Accessibility, Self Reference would help the Designer to test for the user's understanding of his role in the self service process.

In conclusion

- Design methods, methodologies, techniques etc, in order to utilise Systems' theoretical approach, have to be applied, acknowledging the existence and the role of the human problem owner.

- That simply means that the user/human cannot be removed from the design problem.

- Acknowledging that the human is part of the Design Problem, allows one to retain and utilise its systemic nature with its calculation and self organizing capabilities.

- All the above are valid in living systems (organisms) where their systemic nature allows for the notions of self organization, autopoiesis, and calculation.

- As a result a number of emergent properties of a designed system could influence the end result as well its life cycle.

Inter-disciplinarity, Multi-disciplinarity and Trans-disciplinarity

- Despite more than 40 years of cross-disciplinary practice in universities there is still a lack of precision about what the terms ‘inter-disciplinarity’, ‘multi-disciplinarity’ and ‘trans-disciplinarity’ actually mean.
  - Multi-disciplinarity describes situations in which several disciplines cooperate but remain unchanged
  - Inter-disciplinarity there is an attempt to integrate or synthesise perspectives from several disciplines
  - Trans-disciplinarity, on the other hand, has been taken to involve a transgression or transcendence of disciplinary norms
    - “whether in the pursuit of a fusion of disciplines,
    - an approach oriented to complexity or real-world problem-solving,
    - or one aimed at overcoming the distance between specialised and lay knowledges or between research and policy”

Concepts

- Complexity (unfortunately leads to attempts for reductionism)
- Emergent properties
- Variety (requisite variety)
- Self reference
- Closed (as far their organisation)
- Open (as far as energy and matter)