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Building a Systemic Designer's Library: Borrowing from multiple disciplines to develop systemic design mental models

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Adding to the systemic design toolkit by borrowing concepts from physics, medicine, and economics.

This presentation expands on the use of metaphors and analogical thinking in systemic design by offering a work-in-progress catalogue of mental models drawing concepts from multiple disciplines to support systemic design approaches. It first explores how analogical thinking supports systemic design and then catalogues how practitioners have previously used metaphors as tools that facilitate design activities (from products to services and systemic interventions). Adding to this catalogue, I present mental models using analogues drawn from different disciplines and show how doing so can offer new perspectives, mental models, and techniques designers can adapt to strengthen their practice. I present sample mental models drawn from physics, medicine, and economics and show the possibilities these offer to systemic design activities, such as framing problem spaces, generating objective ideas, and facilitating change.

KEYWORDS: systemic design, transdisciplinary, metaphors, analogical thinking, analogies

RSD TOPIC(S): Methods & Methodology

Presentation description

In this presentation, I explore how analogical thinking and transdisciplinarity can augment systemic design practice and present mental models using analogues drawn from physics, medicine, and economics.

Analogical thinking

What is analogical thinking, and how does it support systemic design work?

Analogical thinking is a process where people solve problems by making the unfamiliar familiar. By exploring structural similarities between the problem at hand and a more familiar problem (i.e., goals, constraints, procedures), problem-solvers surface solutions or methods that might have worked in the analogue and apply an analogue to the problem at hand (Gick, 1986). Systemic design, in its very nature, invites thinking in analogues and metaphors. Doing so makes it easier for practitioners to engage with systems by making the complex and intangible more digestible, concrete, and actionable or engageable-with (Lockton, 2021). Because of its strength, analogical thinking has been used in various ways in design work.

Analogical thinking used in making sense of systems and (re)framing issues

Metaphors and analogues are often used in making sense of systems. Lockton (2021) cites that the practice of mapping features of an unknown situation (such as a system) to an existing or familiar one makes it easier for designers to understand “where the leverage points might be” by using the analogue. As a research tool, metaphors also help designers take familiar domains to “find similarities and differences between it and the unfamiliar domain” (Saffer, 2005), which increases understanding of the system (unknown domain) itself. Designers in the public and social innovation sector were found to use metaphors in problem framing by situating the problem at hand in another context. For instance, the use of “maps” and “ice bergs” helped teams “reflect on the systemic elements of the problem space” (van der Bijl-Brouwer, 2019). Saffer (2005) cites how Schon (1979) noticed stakeholders in an urban housing project would see it as a “blight on the community” and “disease that must be cured,” therefore orienting the problem frame towards “removing or curing.”

Analogical thinking used in communicating perspectives, experiences, and ideas

Metaphors are used as communicative devices for stakeholders and system participants to express how they see the system they are in. It reveals how participants understand systems from their viewpoint and the assumptions underneath (Lockton, 2021; Dudani, 2021). It surfaces their experiential knowledge of living within a system, uncovers the mindsets at the root of systems, and allows stories to be made tangible and easily "plugged into" system mappings (Dudani, 2021). Aside from understanding nuanced views of a system, analogical thinking is also used to convey solution concepts to others, such as designers-practitioners and stakeholders (Saffer, 2005). Using analogies and metaphors also creates legitimacy for strategic changes within organisations, increasing understanding and acceptance across stakeholders (Cornelissen & Clarke, 2010; Cornelissen, 2011; Etzion & Ferraro, 2010; Hargadon & Douglas, 2001; Suddaby & Greenwood, 2005 as referenced by Cornelissen et al., 2011).

Analogical thinking used in generating ideas

Metaphors offer designers the opportunity to "create juxtapositions" and "use metaphors as a brainstorming technique" (Saffer, 2005). For instance, Lockton et al. (2019) demonstrated that generative metaphor processes could inspire new concepts, prompting ideas that were "presumptively unlikely to have occurred without the prompts of [metaphor] cards." A study by Casakin (2007) looking at the design processes of novice architecture students showed that metaphors play an important role in "supporting the design of innovative products." Examples can be found in biomimicry. For example, Japan's bullet trains are designed as an analogue of another existing object with goals and constraints. By drawing inspiration from Kingfishers' beaks, Japanese engineers were able to redesign their trains to remove the loud "boom" sound they used to make (The Biomimicry Institute, 2021).

Transdisciplinarity

Creating mental models by drawing on analogous concepts from different disciplines

In a sense, everything is a system—a car, a human body, an economy. If everything is a system in its own way, perhaps it may be useful to borrow concepts from how other disciplines deal with systems and draw metaphors and mental models from there.

Transdisciplinarity, "broadening one's playing field to look at disciplines outside your own" to glean useful "principles, methods, and actions" (Dorst, 2018), can help practitioners expand the knowledge bases we draw from in approaching systemic design work, in the same way, that expanding our mental models can "foster change by facilitating how we see the world" (van der Bijl-Brouwer & Malcolm, 2020).

Dorst (2018) demonstrates, for example, how reframing the problem situation from the eyes of someone from a different discipline can bring solutions not previously considered. Dorst (2018) used an example of reframing a "hotbed of alcohol-related violence" into a "music festival" to get stakeholders to think of interventions to reduce violence akin to how an event organiser would ensure festival-goers can sober up and go home safely.

Van der Bijl-Brouwer et al. (2019) show how transdisciplinary approaches can enrich systems change by drawing from diverse ways of knowing (academic, community, Indigenous). Complex, multifaceted issues like water scarcity can also be addressed through transdisciplinarity—for example, researchers identifying policy gaps and recommendations in response to severe droughts in the lower Mekong River Basin are currently integrating hydrology, geosciences, social-institutional science, and economics to achieve this (Economy & Environment Partnership for Southeast Asia, 2021).

Transdisciplinarity can also help designers and practitioners to sharpen their own practice. Designers, for example, can draw concepts from law and their practice of archiving case decisions to be used as precedents for future cases as a way to learn from collective wisdom (Dorst, 2018). Farnam Street's (2022) work in developing mental models for general decision-making by drawing concepts from various disciplines also

illustrates the same, such as how thinking of social systems like biological ecosystems creates a starting point for understanding how a social system works.

Mental models

Drawing concepts from physics, medicine, and economics

Boundary framing is the practice of "selecting boundaries and considering the associated meanings" in the boundaries we choose (Jones, 2014). I propose that physics concepts like energy, work, and mass can be used to facilitate this process - the boundaries we select to convey how much "mass" of a system we want to "move" reflects what we value but also what we can realistically address with given timeframes and resources. While in systemic design, this looks like framing the boundaries of the problem space we wish to address, in physics, this translates into framing the boundaries of the object we wish to move forward.

Systemic design principles of "idealisation," identifying an ideal state or desirable outcome, and "purpose," agreeing on purposes and the appropriate level of purpose (Jones, 2014), can also be enriched by concepts from medicine. By framing systems as analogous to human bodies in the context of medicine, defining the ideal state (e.g., healthy body and healthy system) becomes easier while accounting for the fact that multiple elements/systems within our bodies drive that ideal state. In a similar vein, if we are aiming for that ideal state (healthy body), medicine balances this with available resources to define realistic objectives (e.g. aiming for acute relief of symptoms can be analogous to fixing symptoms of deep systemic issues in the short term, while preventing worsening can be analogous to aiming to change mental models sitting at the root of systemic issues).

Jones (2014) and van der Bijl-Brouwer & Malcolm (2020) reference systemic design principles of continuous adaptation and evolutionary design approaches, where designers should expect processes, solutions, and systems to diverge from expected paths across time and therefore need to take "multiple steps to shift the problem situation in the desired direction" (van der Bijl-Brouwer & Malcolm, 2020). Drawing from the economics concept of marginal analysis – which seeks to answer whether the additional step forward is worth the cost it entails – we can derive a mental model of

how to think about where to direct continuous adaptation, what constraints we are playing with, and how far we should push the envelope each time. Marginal analysis allows us to weigh the benefits of taking steps forward against the costs of adapting to evolving constraints and needs as time passes.

Ways forward

Possible approaches designers can take to choosing disciplines to draw from and the concepts to use in thinking of analogues are inspired by activities outlined by Gick and Holyoak (1980). This includes representation and abstracting, a problem-solving/design approach, and mapping.

I invite practitioners to reflect on the following questions:

> What opportunities and challenges could situate designerly activities in disciplines other than design, especially given the complexity they are grappling with, bring? What could we learn from other disciplines to shape our practice?
>
> How might we leverage collective wisdom from various disciplines to understand complex, systemic issues, design interventions to begin dissolving them, and implement these sustainably?

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