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CONTEXTS

SYSTEMIC DESIGN ASSOCIATION

Finding (a theory of) Leverage for Systemic Change: A systemic design research agenda

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Abstract

To search for leverage is to use systemic design to find ways to accelerate progressive systemic change. The theory of leverage was first conceptualized by Donella Meadows with "Leverage Points: Places to Intervene in a System" in 1997. Yet while Meadows's typology of leverage points is popular and influential, little has been done to critique or substantially advance her ideas since they were first published. As a result, we lack a modern theory of leverage. In this article, I relate systemic change to the search for leverage and outline why leverage matters. I present a brief overview of Meadows's original work. Then, I synthesize the major contributions that have built on Meadows's theory of leverage in the last 25 years. Next, I present a critique of Meadows's original work, highlighting what we know about leverage and what we have yet to learn. This includes the development of a framework identifying how the degree of leverage relates to the acceleration of progressive (or retrograde) systemic change. Finally, I organize these ideas into a research agenda featuring four areas: dimensions of leverage, methods for leverage, strategy with leverage, and execution on leverage. Meadows wrote about the metaphor of "dancing with systems." By advancing leverage theory, I believe we can better learn to "dance with systemic change."

Keywords: leverage, systemic change, systems theory, research agenda

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Introduction

Finding leverage is fundamental to effectively achieving systemic change.[1] To search for leverage is to find the places in a system where our efforts are best placed to have the most impact. Gaining leverage is, therefore, about identifying the unique innovations changemakers can make in a system and applying those contributions in the best possible places. Or, sometimes, it is the reverse: finding the most important phenomena in a system that must change and working backwards to identify how changemakers may be positioned to start a movement. At the core of the search for leverage in systemic change is a vital conviction that our levers are long enough: we just don't know where to put them.

Systemic design can help with that. Systemic design is fundamentally an interdiscipline that provides theory and tools for creating positive change in complex systems (Jones, 2014). Changemakers use systemic design and its tools in the search for systems innovation (Mulgan & Leadbeater, 2013) or social innovations (Phills et al., 2008): transformative ways to create change more efficiently and effectively than existing solutions. Many changemakers aspire to target "leverage points": places in a system where the least effort yields the biggest impact (Meadows, 1997). Finding leverage points is, therefore, a crucial task for systemic change, and, in turn, systemic design techniques and tools that help identify leverage points could become essential tools in working on wicked problems (Rittel & Webber, 1973). However, to develop these tools, we first need a good understanding of leverage in systemic change. Unfortunately, our current understanding of leverage is insufficient. Meadows' (1997) article should have sparked a rich conversation on what leverage means and how changemakers can work with it. Instead, there have only been incremental advancements on Meadows's work. Additional radical, valuable paradigms about leverage surely exist—in fact, I signal to some of these later in this paper—but Meadows's typology continues to be the only framing commonly referenced and used in systems change work. Moreover, several important weaknesses in Meadows's typology remain uncriticized. This paper is, therefore, both a critique of "Leverage Points" and an echo of Meadows's original call to arms: an invitation (again) for scholars and practitioners in systemic design to "think more broadly about the many ways there might be to get systems to change" (Meadows, 1997, p. 3).

I begin with a brief overview of systemic change, underscoring why the search for leverage is so important. Second, I provide a review of leverage theory so far. I present a brief summary of Meadows's (1997) "Leverage Points" and highlight its key contributions. Then, I review recent contributions that have revisited and revitalized conversation about Meadows's

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1 A note on language: here I use the phrase "systemic change" exclusively to refer to systemic change, systems change, systems transformation, and so on. Some may use these terms interchangeably. However, the term "systemic" specifically addresses what is special about these kinds of problems and the nature of the innovations that make progress on them. "Systemic" means "to refer to a system, especially as opposed to a particular part." "Systems change" refers to changing a system's parts, almost agnostic to the structure and dynamics of the gestalt of the system. "Systemic change" refers to changing the whole system—e.g., its function, structure, process, or context (Gharajedaghi, 2011), whereas systems change tends to be focused on addressing specific aspects of a particular system. Therefore, systemic change addresses larger, deeper, more fundamental issues within a system, often involving integrating conflicting perspectives and finding new views of the system as a whole.

leverage points for the first time in 20 years. I conclude my review by outlining three key reasons why Meadows's piece should not be the only root of leverage theory. Third, I present some signals of possibility for modern ideas about leverage. I conclude the paper with a research agenda outlining some potential ways forward for a modern theory of leverage.

The search for leverage

Many of the issues—climate change, poverty, racism, indigenization and reconciliation, education reform, and so on—that repeatedly pop up in headlines, on policy agendas, in non-profit mission statements, and in popular discourse can be viewed as "wicked problems" (Rittel & Webber, 1973). These kinds of challenges are unrelenting. Hundreds of millions of dollars can go into initiatives focused on them only to yield *zero* evidence of progress (see, for instance, the Gates Foundation's "Intensive Partnerships for Effective Teaching" program; Stecher et al., 2018). To make progress on problems of this nature, people often seek systemic change. This means first recognizing that the problem takes shape as part of a system: a set of interconnected phenomena that give rise to emergent events and dynamics (Boardman & Sauser, 2013; Meadows & Wright, 2008). Second, it means recognizing the problem is not even necessarily a problem at all: it is one pattern of behaviour resulting from the interactions of many different actors and phenomena in this system. Third, seeking systemic change means realizing that, to change this pattern of behaviour, changing any one part of the system will likely be insufficient. Instead, the system itself needs to be changed, requiring many small (and probably some large) shifts in the behaviour and relationships between the system's parts. Thus, the change intervenors desire is systemic: it is a transformation of the whole system, not simply its parts. Moreover, the change must (eventually, at least) be adopted, perpetuated, and propagated by the actors, mechanics, and dynamics of the system itself.

Systemic change has been addressed by many disciplines and fields. Researchers in systems thinking and systems dynamics have spent decades addressing how to understand and model systems, seeking to predict the most powerful forces in systems, how changes might be implemented to influence those forces, and what their long-term effects might be at scale (Forrester, 1994; Forrester, 1995). Building on the systems sciences, management theorists have connected systems thinking to organizational learning, business, and cross-system collaboration, seeking to develop organizations and networks aligned and directed towards achieving the same systemic objectives (Gharajedaghi, 2011; Kania & Kramer, 2011; Senge et al., 2007). Meanwhile, the fields of change management have witnessed a systemic turn, with scholars adapting conventional program evaluation tools to recognize the realities of wicked problems. These approaches attempt to map an organization's capabilities and activities to the best possible interventions while assessing the impact of these initiatives (Abercrombie et al., 2018; Alford, 2020; Murphy & Jones, 2021; Wilkinson et al., 2021). Policy theorists have also examined how to craft policy and law targeting key issues in service of accelerating progress (Rava, 2019; Sekhran et al., 2017) and systemic change (Bason, 2010; Ferlie et al., 2011; Taylor, 2013). Goodchild's vision for "relational systems thinking" (Goodchild, 2021) combines systems thinking with Indigenous worldviews to centre the role of relationships in service of *gichi gakinoo'imaatiwin* (the act of great or deep teaching): (systemic) teaching so powerful and mutually beneficial that positive change can be the only result. Work in the

field of strategy has recognized the imperative to integrate systems approaches in pursuit of the most effective strategic approaches to making change (Brown, 2012; Murphy & Jones, 2020b; Van der Heijden, 1997). Similarly, studies of social innovation explore how to identify the most effective solutions for social problems, where value created by the innovations accrues for whole systems (Mulgan, 2006; Mulgan et al., 2007; Phills et al., 2008; Westley, 2008; Wheatley & Frieze, 2006). The ambition of transition designers is design-led transformations of systems towards more sustainable futures (Irwin, 2015). Transition designers aim to craft solutions that are ideal for local contexts while, at scale, they lead to solutions to global problems. Systemic design combines systems thinking and design thinking in pursuit of systemic change (Jones, 2017; Jones & Van Ael, 2022). Systemic designers' work in systemic change involves, for instance, helping craft the most effective social innovations (van der Bijl-Brouwer & Malcolm, 2020); understanding what and how to scale to achieve systems change (Mulder et al., 2022); critically anticipating the possible consequences of interventions (Krippendorff, 2021). Finally, and especially more recently, systems thinkers have directly connected systems thinking and systemic change work, creating guidance for applying these ideas to systems problems in service of changemaking (Foster-Fishman et al., 2007; Mahajan et al., 2022; Stroh, 2015).

Systemic problems are often so intractable—so wicked—that good intentions are simply not enough. Most systemic change projects seek to "move the Earth": to change their worlds at scales far beyond their apparent capabilities. That is why, across the varied disciplinary approaches referenced above, a common issue emerges: what are the most effective ways to achieve systemic change? In other words, how do changemakers best use their resources, relationships, and actions to achieve the greatest impact? What are the smallest shifts they can make that will create the biggest movements? These questions underpin the search for leverage.

Finding leverage: why it matters, and why we need a theory

Finding leverage is important for achieving systemic change because it allows change to be made more efficiently and effectively. By identifying the points within a system where small changes can have a large impact, it becomes possible to target those points and make changes that can have a cascading effect throughout the entire system. This can be more efficient and effective than trying to make changes at other points within the system, which may have less of an impact or may be more difficult to implement.

For example, imagine a societal system in which there is a high level of poverty and inequality. One way to try to address these issues might be to provide direct aid to those who are struggling financially. While this might help some people in the short term, it is unlikely to lead to significant systemic change because it does not address the underlying causes of poverty and inequality. Instead, it might be more effective to focus on finding leverage within the system that could lead to more long-term change at scale. This might include things like reforming tax policies, improving access to education, or addressing other systems dynamics that contribute to poverty and inequality. By targeting these leverage points, it may be possible to achieve more lasting, systemic change.

Yet, despite the substantial effort scholars and practitioners have invested so far, finding leverage is still more an art form than a science. A key reason we do not have a more robust theory of leverage may be a lack of recognition of the commonality of these issues. As I will soon discuss, leverage theory has remained largely untouched since Donella Meadows's prior work that popularized the concept of "leverage points." The remainder of this paper presents a study in the form of a critical analysis of papers on leverage so far. This analysis provides an overview of what we know and what we don't. It also centres several key ideas about leverage that have been missing from the conversation, possibly due to an over-emphasis on leverage points. By aligning these fields on the issue of finding leverage and by providing a common research agenda and concrete research questions to answer, we can create a framework to support a future theory of leverage.

Towards leverage theory

The beginnings of leverage theory: Meadows's "Leverage Points"

Perhaps the most renowned resource on leverage in systemic change is Donella Meadows's (1997) "Leverage Points: Places to Intervene in a System." Meadows was an environmental scientist, activist, and systems thinker who wrote extensively about the importance of understanding systems. She did not coin the term "leverage points" in her 1997 article, but it was the first formal treatment of the term in the context of systems thinking. As was her hallmark, Meadows's treatment of leverage points was clear, concise, catchy, and constructive. Through simple tables and storytelling, she provided a compelling framework, socializing the concept of leverage points into a core tool for systemic change. A key contribution of Meadows's article was to challenge the mythological legacy of leverage points. Before this article, leverage points were thought of as trimtabs (Fuller, 1963), silver bullets, panaceas; the heroes and villains who magically change history. Meadows defined leverage points formally as follows (p. 1, emphasis added): "These are **places within a complex system** (a corporation, an economy, a living body, a city, an ecosystem) **where a small shift in one thing can produce big changes in everything.**"

Meadows also highlighted how leverage points are often not mysteries at all. Instead, they are well-known phenomena—only they tend to be pushed in the wrong direction. An example she used to illustrate this idea was growth. According to her retelling of how "Leverage Points" came to be, Meadows was at a meeting about how NAFTA and the World Trade Organization were likely to make the world worse, not better. While paying attention to the discussion at the meeting, she realizes that the actors there were inventing a huge new system without the "slightest idea of how this complex structure will behave" (p. 2). Worse, she thought the initiatives would crank the system in the wrong direction by encouraging growth when it should be controlled or discouraged.

At the same meeting, she identified that the controls being developed by NAFTA and the World Trade Organization to prevent the system from degrading were focused on weak points of leverage. In response, she interrupted the meeting by taking over some flipchart paper and articulating a list of "Places to Intervene in a System (in increasing order of effectiveness)." This typology, later revised, would become the third key contribution and

arguably the most important and popular takeaway from the article. It is reproduced here as Table 1 alongside examples drawn from a hypothetical system (individual financial health during a recession).

Meadows's typology achieved a few significant things for leverage theory. First, it gave changemakers formal language for leverage beyond the search for the mythical leverage points. Second, it suggested the importance of ranking the relative power of phenomena in a system and provided a framework with which to do so. By showing how leverage could be found in different types of phenomena in a system, Meadows enabled users of her typology to point at different forces in a system and compare their utility. Third, crucially, the typology suggested that the first and the easiest phenomena to target when addressing systems problems—constants and parameters in the system—are often the least effective at achieving systemic transformations. Fourth, while arguing that more influential types of leverage points are the ones that changemakers should seek to change, Meadows provided an important caution that they would be the hardest to change.

Gaining leverage: developments on Meadows's leverage points

Meadows's (1997) "Leverage Points" seemed to be immediately popular and has since become a foundational resource in the field. According to Google Scholar, as of this writing, it has been cited over 2,500 times. However, while many have referred to and used Meadows's ideas about leverage, surprisingly, little has been done to directly review or advance her ideas in the 25 years since its publication. In this section, I briefly review some contributions that build upon Meadows's work.

Twenty years after "Leverage Points" was published, Abson et al. (2017) adapted Meadows's typology into a hierarchy of "system characteristics." They combine each of Meadows's types of leverage points into four such characteristics (in increasing order of system depth):

- **Parameters:** mechanistic components of the system. Includes (12) parameters, (11) the size of buffers in the system, and (10) the structure of stocks and flows.
- **Feedbacks:** the drivers of internal dynamics resulting from interactions between elements of a system. Includes (9) the length of delays relative to the rate of system change, (8) the strength of negative feedback loops, and (7) the gain around driving positive feedback loops.
- **Design:** the forces in a system that govern feedbacks and parameters, such as (6) the structure of information flows, (5) the rules of the system, and (4) the power to change system structure.
- **Intent:** the worldviews, values, and goals of system actors shaping and underpinning the mental models of the system and how it should behave. Includes (3) system goals, (2) the paradigms of the system, and (1) the power to transcend paradigms.

Table 1. Twelve types of leverage points, in order of increasing power (adapted from Meadows, 1997).

Twelve types of leverage points in order of increasing power	**Example**
12. Constants, parameters, numbers (such as subsidies, taxes, standards)	Wages, interest rates
11. The sizes of buffers and other stabilizing stocks relative to their flows.	Current levels of debt/assets
10. The structure of material stocks and flows (such as transport networks, population age structures)	An individual's financial structure (e.g., fixed costs and incomes)
9. The lengths of delays relative to the rate of system change	How long it takes to find a higher-paying job
8. The strength of negative feedback loops relative to the impacts they are trying to correct against	Rising costs of living vs fixed income
7. The gain around driving positive feedback loops	Recession causing reduced spending
6. The structure of information flows (who does and does not have access to what kinds of information)	How aware you are of impending recession/future rising costs
5. The rules of the system (such as incentives, punishments, constraints)	Who suffers as a result of poorly managed recessions
4. The power to add, change, evolve, or self-organize system structure	Central banks, Ministries of Finance
3. The goals of the system	GDP Growth
2. The mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises	Growth above all
1. The power to transcend paradigms	Choose between paradigms: growth, sustainable development, flourishing

The authors called these four characteristics "realms" of leverage. They argue that interventions target one of these four characteristics. Most importantly, they show how the deeper characteristics constrain the interventions that are possible at shallower levels.

Similarly, Kania et al. (2018) reconfigured Meadows's typology into six "conditions" of systems change:

- **Policies:** Rules, regulations, and priorities that guide the actions of a government, institution, or organization, as well as those of others.
- **Practices:** Activities undertaken by institutions, coalitions, networks, and other entities with the goal of promoting social and environmental progress, as well as the procedures, guidelines, or shared habits that make up the entity's internal operations.
- **Resource flows:** The allocation and distribution of resources such as money, people, knowledge, information, and infrastructure.
- **Relationships and connections:** The quality of communication and connections between actors in the system, especially those with diverse backgrounds and perspectives.
- **Power dynamics:** The allocation of decision-making power, authority, and both formal and informal influence among individuals and organizations.
- **Mental models:** The habits of thought, deeply held beliefs, assumptions, and default ways of operating that have a powerful influence on how we think, act, and speak.

In parallel with Abson et al. (2017), Kania, Kramer, and Senge (2018) order these conditions from explicit, structural changes (Policies, Practices, and Resource Flows) to semi-explicit (Relationships and Connections, Power Dynamics) and implicit (Mental Models). As with Meadows (1997), the latter phenomena are more powerful and more difficult to change. "The Water of Systems Change" was written for a philanthropy audience in the hopes of helping leaders of foundations understand the "water" that they've always been swimming in by contextualizing their work as systems change.[2] As such, an important contribution of this framework is the attempt to distil Meadows's (Meadows, 1997) sometimes-overwhelming ideas into a more accessible framework.

Fischer and Riechers (2019) later iterated on their earlier work with Abson et al. (2017), adapting the four realms of leverage into a framework spanning from causal to teleological explanations of systems change. "Material" (previously "Parameters") and "Processes" characteristics rely on explanations of systemic change rooted in causality, while "Design" and "Intent" characteristics are increasingly rooted in teleological explanations. This, they argue, is a nuanced but important distinction. When designing systemic change projects with leverage, interventions can be combined using principles of both causality and teleology:

2 The reference to water comes from an unattributed joke originally written by David Foster Wallace in the 2011 novel Infinite Jest. Here's the original: "This wise old whiskery fish swims up to three young fish and goes, 'Morning, boys, how's the water?' and swims away; and the three young fish watch him swim away and look at each other and go, 'What the !@#$ is water?' and swim away."

forecasting the potential impact of desired changes while back-casting from desired impact to potential changes. This should encourage systemic changemakers to identify deeper interventions that may be more likely to create lasting, large-scale change. Fischer and Riechers (2019) also note that leverage points interact with one another. A change in deep leverage points (e.g., a shift in mindset) can lead to changes in shallow ones (e.g., visible progress), which can lead to changes in additional, deep leverage points (e.g., belief in the approach). This is unsurprising to anyone working in systems, but a powerful insight for the use of leverage in systemic strategy. Finally, the authors highlight the value of leverage points as a methodological boundary object, giving scholars and practitioners with sometimes-incompatible approaches a common comparator to work with and thus fostering collaboration.

Birney (2021) adapted Meadows's twelve types of leverage points into a slightly different set of four "systemic qualities" from Abson et al.'s (2017) "systems characteristics." They are (a) configuration of system structures and flows, (b) patterns of relating and organizing, (c) whole systems goals, and (d) paradigms and mindsets that underpin the system (Birney, 2021, table 1, p. 755). They draw on their work with Forum for the Future to show the use of these qualities in a variety of real-world case studies. Finally, they adapt the four qualities into a worksheet for practitioners, asking questions under the theme "How do you know a system is changing?" and identifying opportunities for change by asking "Where might you intervene?" for each quality.

In a talk, Ison (2019) presents a critique of what he calls the "systematic" conceptualization of systems adopted by Meadows (1997). Ison suggests that Meadows was acting "non-reflexively." He argues that the very notion that there are places to intervene in a system suggests a certain epistemological view of systems: specifically, that they are more systematic than systemic. Ison challenges this view, arguing that it implies a superiority of technology and method over the world that may not actually exist. He suggests that this way of viewing leverage is, instead, a frame choice, referencing Lakoff (2010) and Checkland (1985) while echoing Ulrich (1988). These critiques underscore the notion that a leverage points perspective is, itself, one of the paradigms that Meadows seeks to enable intervenors to transcend.

Murphy and Jones (Murphy & Jones, 2020a) developed a semi-quantitative methodology for analyzing causal models of systems in service of identifying potential leverage points. They adapt measures of structural analysis from systems dynamics and centrality analysis from graph theory and social network analysis to the graph structure underlying causal loop diagrams. Both structural leverage analysis and centrality leverage analysis act as generative techniques for the analysis of systems, suggesting sets of phenomena that are the most important in the system according to its structure. Used as seeds of conversation and inspiration by systemic designers and systems stakeholders, these suggestions help inspire nuanced conversations about the importance of leverage in systemic change and suggest starting points for systemic strategy. These techniques are particularly useful in large, dense models that are otherwise difficult to analyze, explore, and discuss. An additional contribution of this work is the recognition of novel types of systemic forces relevant to leverage analysis. In addition to leverage points, phenomena in a system may act as

bottlenecks (forces that sit between other phenomena and may gatekeep potential change) and **signals** (highly connected elements that may be useful lead measures for changes happening less visibly/more slowly elsewhere in the system). These concepts complement Meadows' (1997). For instance, perhaps a particular buffer may be an especially problematic bottleneck, while certain parameters are valuable signals that interventions are working.

Murphy and Jones continued this work by integrating it with strategic planning and change management (Murphy & Jones, 2021). They critiqued conventional theories of change for being overly reductive and linear, blinding users to the systemic issues that perpetuate and propagate the problems they're trying to resolve. Further, in parallel with Fischer and Riecher's (2019) observation that leverage points interact with one another, Murphy and Jones (2021) showed how to identify connections between possible interventions, potential leverage points, bottlenecks, signals, and goal phenomena in a system. These connections can be visually traced and laced together, creating theories of systemic change and action (ToSCA) for use in systemic change management. Finally, for any causal model, their techniques can be used to identify systemic theories of change, providing the basis for strategic options that can be adapted into comprehensive plans for systemic change—what they called systemic strategies.

Finally, in a publication released almost in tandem with Meadows's (1997) "Leverage Points", Klein and Wolf (1998) explore a different definition of leverage points in the context of sensemaking and AI research: "the application of experience to detect fruitful starting points in the construction of novel courses of action" (p. 158).[3] This framing reinterprets the core metaphor of leverage points not as fulcra where changemakers will place levers but as holds, they use to grasp strategic options when rock climbing. Holds, they say, are not context-free features: they are dependent on the climber (their size, their skill), the rock (the crevices and cracks available), the environment (how wet or dark it may be), and the interaction between these actors. Thus, identifying leverage points is a skill that benefits expertise and experience with a system. Identifying leverage points, according to Klein and Wolf (Klein & Wolf, 1998), provides us with fragments of sequences of actions with which to interact with a system. They are kernel ideas and approaches, helping to get the process of designing started.

[3] These concepts were not published in the context of systemic change, and they did not reference Meadows's paper, so they seem to have been missed in the broader conversation. Nonetheless I find the contributions valuable in this context.

Getting stuck: the limits of "Leverage Points"

Meadows's (1997) "Leverage Points" has been an invaluable resource for systemic change. However, while there have been developments based on Meadows's work, there has been little critical analysis or validation of the original concepts. This is unfortunate, as there were several important weaknesses in Meadows's original essay—issues that Meadows herself highlighted as work for future scholars.

First, the leverage points typology was a work in progress. Meadows (1997) wrote that she wanted to "[…] place the list in a context of humility and to leave room for evolution." She continued, "what you are about to read is a work in progress. It's not a simple, sure-fire recipe for finding leverage points" (p. 3). Yet, what have we done for the past 25 years but use it as a simple, sure-fire recipe for finding leverage points? A second related issue is that "Leverage Points" lacked substantive evidence and justification. The article was published in a magazine, and as such little is offered by way of background research.[4] Similarly, the only evidence Meadows offers for the validation of her typology is the aforementioned moment of insight in the NAFTA/World Trade Organization meeting. Later, she writes that the list "was not exactly tightly reasoned," adding "as I began to share it with others, especially with systems analysts who had their own lists, and with activists who wanted to put the list to immediate use, questions and comments came back that caused me to rethink, add and delete items, change the order, add caveats" (p. 3). Therefore, a modern theory of leverage should respond to Meadows's request for evolution, validating and augmenting this original work. Is Meadows's typology an exhaustive list? What other types of leverage might matter? How do these intersect with the notions of bottlenecks and signals identified by Murphy and Jones (2020a)? Are there other senses of leverage that would aid the design of interventions and strategies for systemic change? Answers to these kinds of questions would be valuable contributions to both theory and practice in systemic change.

The third issue is perhaps the most critical one: for the prescriptive use of some of her ideas, Meadows relies on non-actionable metaphysics. In her discussion of systems goals, for example, she writes, "I have watched in wonder as a new leader in an organization comes in, enunciates a new goal, and swings hundreds or thousands or millions of perfectly intelligent, rational people off in a new direction" (p. 18). She offers no prescription for how systemic changemakers might do this themselves. Granted, perhaps this is meant to be the domains of leadership scholars, where theories such as post-industrial leadership (Rost, 1993), the social change model of leadership (Komives & Wagner, 2016), transformational leadership (Bass & Riggio, 2006), or system leadership (Senge et al., 2015) might be better suited to explain these capabilities. Nonetheless, a modern theory of leverage needs to at least provide direction to wayward changemakers searching for the "how" of systemic change. Systems goals are not the only place where Meadows deferred prescription. Of transcending paradigms, she wrote, "If no paradigm is right, you can choose whatever one will help to

[4] I, for one, would love to review the original uses of the term "leverage point" in the context of systems change. Substantial effort has been placed on researching leverage points in statistics (e.g., Rousseeuw & Zomeren, 1990), but the two concepts do not appear to relate directly whatsoever.

achieve your purpose. If you have no idea where to get a purpose, you can listen to the universe (or put in the name of your favourite deity here) and do his, her, its will, which is probably a lot better informed than your will" (p. 19). Again, it may not have been her responsibility to tell readers how exactly to understand how to transcend paradigms, but it is the responsibility of a modern theory of leverage.

These issues do not dispel the value of the original work. Instead, they provide the grist necessary for modern review. In her attempt to dispel the myths of leverage points, Meadows may have perpetuated their status even further, leaving a formal, comprehensive theory of leverage untouched for decades. Our understanding of leverage therefore remains somewhat crude. This lack of nuance in the understanding of leverage and other systems features hinders the ability of systemic designers to fully understand the mechanisms and dynamics of changing systems. A well-established theory of leverage would help designers know where to intervene, what innovations to make, and how to craft better strategies for accelerating systems change. In the next section, I attempt to organize what we know, what we don't, and where we might go next in pursuit of a modern theory of leverage.

What we know and what we don't

Let us begin with the obvious: **systems are complex.** Understanding them—even a little—takes time, effort, and luck. Understanding them completely may be impossible, especially as our interactions with systems (even simply observations) change them. This unknowable complexity gives us the first and perhaps most important arena for future work on leverage theory: how might systemic designers methodically identify features of leverage for systemic change? This includes analytical, evaluative work, assessing which ones are most valuable from our theory and research before intervenors can test interventions and gather evidence. It also includes describing and even predicting the effects of changing different features of leverage on the system.

Different types of leverage points exist. Meadows's typology is not the only useful one, as Murphy and Jones (2020a) have already shown. Additionally, the second typology shows that there are multiple ways of identifying leverage points. What other ways do we have of understanding leverage in systems change? How do these qualities interact and intersect? For instance, Figure 1 shows an excerpt of a causal loop diagram for a hypothetical education policy system. A leverage point is identified: a shift in the goals of the education system. However, Figure 1 also shows the importance of a bottleneck: funding available for to support the new policy. This bottleneck is "only" a buffer and thus relatively ineffective compared to the goal according to Meadows's typology. However, if the funding gap is large enough, this buffer acts as a major bottleneck for change in the system. If answered, these questions would allow systemic designers to identify different dimensions of leverage in systemic change, encouraging the design of more robust strategies for accelerating systems change.

Leverage is recursive. System phenomena, including leverage points themselves, may be decomposed into subsystems. These subsystems have their own unique leverage features. Breaking up a system into subsystems for analysis and strategizing and then recomposing them and relating the new strategies could be a useful method for finding purchase on otherwise inaccessible phenomena. For example, in Figure 1, the phenomenon "change in the goals of education" could be investigated as a standalone system in which the goals of education are an emergent property of the interactions between the values and behaviours of students, parents, teachers, schools, policymakers, and so on. Identifying key features of that subsystem may unlock new ways forward on the whole system. So, how might systemic designers effectively decompose systems phenomena into subsystems to find leverage? Research in this arena would allow systemic designers to work with multiple layers of leverage in systemic change.

Leverage is relative. As highlighted by Fischer and Riechers (2019), leverage points interact with one another. As highlighted by Klein and Wolf (1998), leverage is also relative to the "climber": the actor seeking to intervene in the system. That is, the latent value of a leverage point to one intervenor may be drastically reduced for another (e.g., with less access to that phenomenon) and yet greatly increased for a third intervenor (e.g., because they could take advantage of additional, contextual "grips" in the system that strategically combine to generate greater potential for change). Thus, in addition to identifying many potential features of leverage in a system, changemakers must also find ways to map, understand, and use relative leverage. Research in this arena would allow systemic designers to work with multiple chains of leverage in systemic change.

Leverage creates narrative. Klein and Wolf's (1998) framing of leverage as useful for construction parallels Fischer and Riechers's (2019) teleological perspective on leverage. Both suggest that a key contribution to thinking about leverage is not simply asking, "what are the most powerful forces in this system?" Rather, Klein and Wolf's version of leverage points asks: "Where are we? What can we do from here? Which is the best thing to do?" And Fischer and Riecher ask, "What is the system trying to do? What are we trying to do? How do we work backwards from there?" These reflections suggest that thinking about leverage can change the way systemic designers problem-solve. Finding the features of leverage in a given system is therefore not only important for designing strategic solutions, but it is also an excellent way of creating conversation with stakeholders about what should be done. Even if our initial ideas about the important features are wrong, discussing leverage gives system stakeholders holds with which to talk about how their system works.

Leverage is strategic. We may combine different features of leverage via recursion and relativity. These combinations create narratives for evaluation and, eventually, for teleology, helping galvanize stakeholders in coordinated systemic change. These views of the system's leverage features can then be used to create theories of systemic change and action, which can themselves be combined into robust strategies for systemic change (Murphy & Jones, 2021). These products of leverage analysis could be essential tools in systemic change management.

We don't know much about tactics for influencing different kinds of leverage points. In particular, the types of leverage points in the "design" and "intent" characteristics of Abson et al. (Abson et al., 2017) are unwieldy and inaccessible by definition. Are there some best practices in designing solutions to address different kinds of leverage points? Perhaps scholars can develop a library of actionable design principles useful for templating systems innovations that work well for certain features of leverage.

We have yet to explore how to evaluate features of leverage. What are some stopping rules for the analysis phase? How can a systemic designer know if they have identified sufficient features to begin intervening? How can intervenors address indeterminism (Lukyanenko & Parsons, 2020) in evaluating systemic change such that they can assess whether our interventions are implemented as designed?

Finally, **finding leverage is ethical.** We have to ask whether the effort placed on these issues is worth it. Does leverage really matter? Clearly, most systemic change initiatives focus on pressing issues in which good intentions are insufficient. History is replete with challenges in which interventions that meant well failed to produce progress on systemic problems (e.g., Stecher et al., 2018), leading to an ineffectual use of time and resources. Worse, however, are history's examples of interventions that exacerbated problems (as exemplified by the "Fixes that Fail" systems archetype; Braun, 2002). Ergo, for any systemic problem, innovations can accelerate change on a focal issue in either a positive or negative direction:

- **Retrograde systemic innovations** are "misinnovations": they worsen the behaviour of the system, scaling systemic issues such that the focal problems become more rampant, intractable, and/or catastrophic. Meadows's (1997) reflections on economic growth describe one of these types of systemic innovations.
- **Progressive systemic innovations** are desirable: they shift phenomena in the system towards new structures that lead to transitions (Irwin, 2015) or reorganizations (Holling, 2001), resolving the problems that inspired the intervention.

Depending on how much leverage an innovation has over the system, innovations can also be anything from futile through catalytic to transformational:

- **Futile systemic innovations** fail to have a major effect on the system, leading to changes that are absorbed into the system's behaviour without any impact on the focal problems.
- **Catalyst systemic innovations** accelerate progress in the right direction, setting transformations of the system in motion.
- **Transformational systemic innovations** rapidly bring about a change in system structure, leading to immediate resolution of the focal problems.

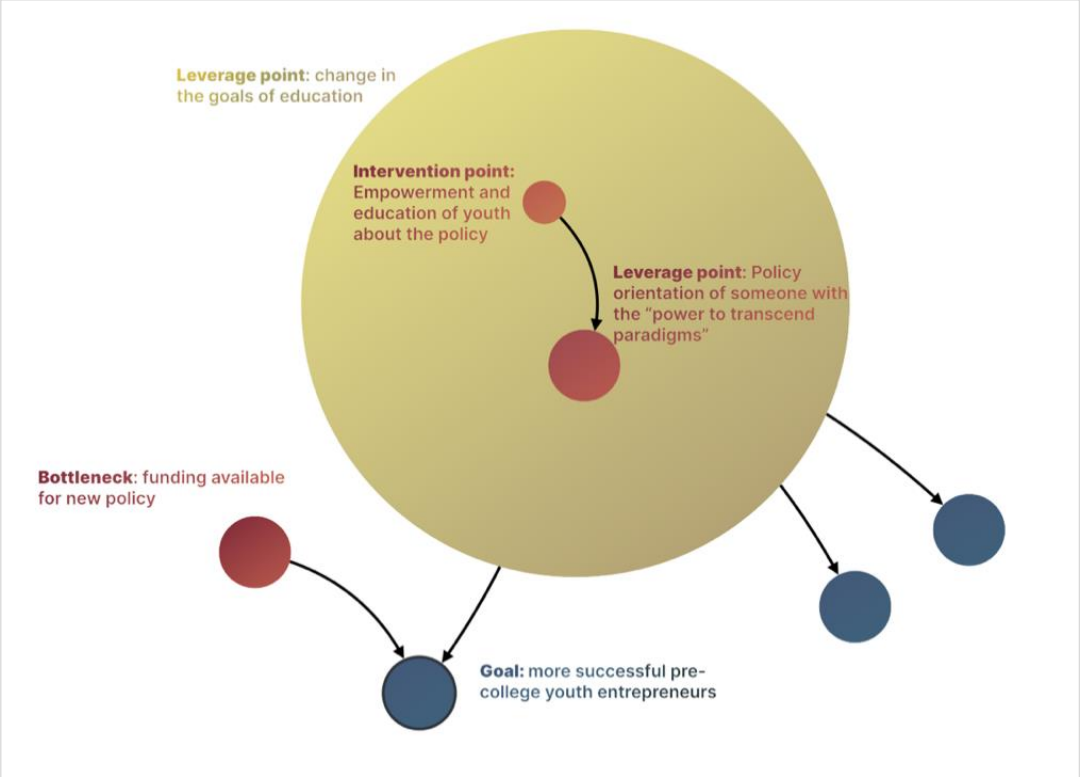


Figure 1. Leverage points, bottlenecks, and recursive structures in a system

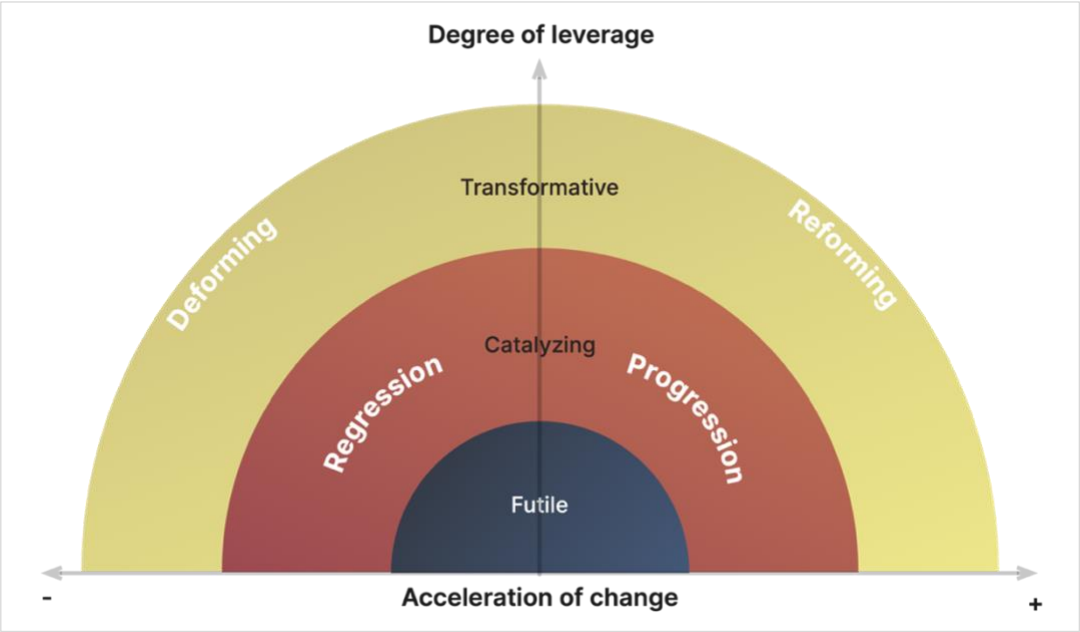


Figure 2. Degrees and directions of accelerating systemic change

We can map interventions along these two axes. Figure 1 shows how finding leverage in systemic change initiatives is a moral imperative. First, issues of systemic change are often ethical ones in which stakeholders suffer more the longer the issue persists unresolved. As the diagram shows, when changemakers design systemic interventions, they are accelerating or decelerating change to some degree and in some direction. Second, in line with Meadows's (1997) early arguments, it is possible to identify leverage points and push them in completely the wrong direction. Changemakers, therefore, have a responsibility to understand the directions their interventions are driving the system in before accelerating change in that direction (Figure 2). Changemakers must strive to do everything they can to understand the direct and indirect effects of systemic change to ensure they are not doing harm.[5]

What's next: a research agenda

Table 2 outlines a research agenda for leverage theory in systemic design. Is Meadows's (1997) typology complete, or are there other types of leverage points—or other frameworks for characterizing leverage—that could aid the design of systemic change? What other features of systems might matter to systemic change? As discussed earlier, other types of phenomena—bottlenecks and signals—seem to exist. In addition, different leverage points can be connected and layered in systemic change strategies. These questions investigate the nature of leverage and a system's potential for change by theorizing about the **dimensions** of leverage. A possible future study to investigate the nature of leverage further is a systematic literature review (Okoli & Schabram, 2010) forward-citing from Meadows (1997) to identify all papers that have used her ideas. Those papers may discuss additional aspects of leverage and the systemic potential for change that could be codified into new and useful frameworks.

Answering some additional questions may give rise to new **methodologies** for finding and evaluating leverage for systemic change, a crucial toolbox for systemic design to offer systemic change work. What are the best ways of identifying leverage points? How might systemic designers validate the leverage points they identify? One study that could provide answers to these questions is a survey of systemic design practitioners asking how they approach these issues. This survey could summarize and highlight best practices. Further, how might changemakers track and evaluate the designed interventions that target these leverage points? How can they know if their designed interventions act on the leverage points in the ways they think they do? How can they know if changes to the system are actually caused by these interventions? Some work in design science may be useful here, as these interventions could be framed as designed artifacts and these questions concern indeterminacy (Lukyanenko & Parsons, 2020). Gregor and Jones (2007), for instance, developed the notion of a design theory that sought to establish rigour around the design and assessment of information systems. This concept could be adapted into "leverage theories,"

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[5] Of course, this discussion ignores some glaring normative issues. Progressive for who? Transformational to what end? Critical questions about power and perspective are crucial, here, but these questions are beyond the scope of this paper. See e.g., (Murphy, 2018; Troop, 2022) for deeper discussions of these issues.

tracing the basis of a potential leverage point to the assessments of interventions that target the phenomenon.

How might changemakers plan for leverage? Specifically, how is leverage best used in developing, implementing, and evaluating strategic plans for systemic change? How might changemakers account for their context when designing for leverage? Could a sensitivity to the changemaker's position in the system lead to more effective systemic theories of change and action? Similarly, how should changemakers act on leverage points? For a given type of leverage point, are there best practices for making a change? These questions concern **strategy** and **execution**, using the features of leverage to create effective plans for systemic change, put them into action, and evaluate their success. A longitudinal study that could investigate these issues could follow a "systemic change lab" (Bellefontaine, 2012; Boyer et al., 2011; Hassan, 2007; Westley et al., 2012) that adopts a systemic strategy. This study would trace and compare the impact of interventions using different approaches to leverage theory.

Dancing with systemic change

A few other issues with thinking in terms of systemic leverage are worth discussing. The first is perhaps the most fundamental: the search for leverage implies a search for control, in which the seeker is separate from the system itself. This, we know, is never the case. Whenever a changemaker interacts with a system, they are also part of the system (Bateson, 1991)—even if they are "only observing" it (Gibson, 1986). Yet, in "Leverage Points," Meadows encourages an external, mechanistic perspective of systems and how they change (perhaps owing to her background in the "hard systems" perspectives of systems dynamics; cf. Forrester, 1994). This is a perspective of hers that seems to change over time. Meadows's *Thinking in Systems*, published posthumously in 2008, contains "Leverage Points: Places to Intervene in a System" (revised as chapter 6) and follows it with an essay of Meadows's originally titled "Dancing with Systems" (chapter 7; Meadows, 2008). The essay suggests a shift from the mechanistic view encouraged by a leverage points perspective. In fact, Meadows states directly that "We can't control systems or figure them out. But we can dance with them!" This issue of mechanistic control is echoed by other systems thinkers who highlight another key problem for the search for leverage: not only can changemakers not control systems, but the nature of systemic change itself is unpredictable and only fully explicable in hindsight (Juarrero, 1999). While systems are purposive, the ways they pursue their purposes—and, indeed, what those purposes will truly emerge to be—can only be fully understood in retrospect. The unknowability of systemic change only becomes more pronounced the more dramatic the change is (Juarrero, 1999). This unknowability leads classical systems thinkers such as Bateson to caution action: "we are not yet surely ready to tackle this gigantic problem of planned intervention", he writes, as we may base any plan of action on erroneous, reductive premises (Bateson, 1991, p. 254). Moreover, Bateson implies that systemic unknowability may lead to bias in strategic planning, as thinkers impinged by a lack of understanding of key systemic or cybernetic principles may instead pursue the most "beautiful" solutions (what Bateson, 1991), calls "aesthetic determinism".

These issues are critical in all senses of the word. They imply that leverage in a system cannot be understood or used, meaning that the search for leverage is unimportant, even dangerous. Yet, dance itself is a system (Pangaro, 2019). To dance is to learn while doing. We can always learn how to dance better (or at least differently), and we can always learn more about who (or what) we're dancing with, as well as what environment we're dancing *in*—but the only way to learn is by dancing. Moreover, dance is iterative. We may not know where exactly the dance will go after the next movement but developing a theory of leverage will provide us with better ability to recognize the contexts, constraints, and dispositions of the current state of things—giving us more affordances (Scarantino, 2003) for what the best next step may be. In other words, advancing the theory of leverage means engaging with systems via incrementalism and muddling through (Flach et al., 2017; Lindblom, 1959; Norman & Stappers, 2015). Additionally, that the pathways of systemic change are only knowable in retrospect implies that systemic change inherits the properties of serendipity (Busch, 2022). Serendipity cannot be planned for, but it can be planned against; the best (and perhaps the only) way to prevent serendipity is to prevent learning. This means that a dance with systemic change cannot be choreographed. The question is not what the ultimate, perfectly designed dance with a system is: it is what the *next best step* is. The more a changemaker learns, the more readied (Bateson, 2022) they will be to identify and use leverage to produce progressive, transformative systemic change.

Conclusion

When we talk about leverage, we talk about the power structure of a system, where "power" means "the ability to bring about change in systemic behaviour." Finding leverage means finding advantage: identifying the phenomena in a system with the greatest potential to multiply or compound a changemaker's efforts to achieve the impact they want. Identifying and using leverage points, as Meadows (1997) originally defined, is currently the most useful way to analyze and understand the relative change potential of any phenomena in a system, but there may be others that give changemakers even more perspective and control over the "physics" of change in a system.

Meadows wrote that the most powerful type of leverage point of all is the ability to transcend paradigms. To be able to transcend paradigms is to realize that there *are* no paradigms ontologically: that the paradigms changemakers adopt (or that adopt the changemakers) are ultimately about their choices. My first hope for this article is that I have shown that Meadows's original typology, while integral, is but one of many possible paradigms changemakers can use in advancing systems change. Others include leverage as strategy and leverage relativity, but I do not expect that that is an exhaustive list. It is my second hope that other thinkers and doers who have tackled systems change will help us transcend paradigms in systemic design, bringing their own paradigms to the fore, challenging what we know about how change happens in complex systems, and providing new tools and practices with which to change our worlds. Our levers are long enough. We just need to know where to put them.

Table 2. A research agenda for leverage theory

Research area	Research questions	Existing research	Possible studies	Possible contributions
Dimensions of leverage	- Is Meadows's (1997) typology complete? - What other features of the "physics" of systemic change might matter?	- System characteristics (Abson et al., 2017) - Conditions for systemic change (Kania, Kramer, & Senge, 2018) - Other types of phenomena (e.g., bottlenecks, signals; Murphy & Jones, 2020) - Relative leverage: chaining leverage points (Fischer & Riechers, 2019) - Relative leverage: the context of the changemaker (Klein & Wolf, 1998) - Recursive leverage	- A systematic literature review (Okoli & Schabram, 2010) of leverage points, especially using forward citations (Haddaway et al., 2022) from (Meadows, 1997)	- Understanding the nature of leverage and other mechanisms of change potential in systemic change
Methods for leverage	- What methodologies are best to identify and select leverage points? - What kinds of evidence will help validate leverage? - How might theories of change (Gregor, 2007) be designed for leverage theories? - How might systemic designers limit indeterminism (Lukyanenko & Parsons, 2020) in leverage theories?	- Meadows's (1997) typology's order of effectiveness - Leverage analysis (Murphy & Jones, 2020) - Assessing potential for change (Birney, 2021)	- Surveying practitioners in systemic design on how they identify, assess, and address leverage points to identify common habits and best practices	- How to identify phenomena useful for leverage - How to evaluate and compare possible leverage points in the analysis phase - How to evaluate the effectiveness of chosen leverage points with evidence gathered from implementations

Research area	Research questions	Existing research	Possible studies	Possible contributions
Strategy with leverage	- How is leverage best used in developing strategic plans for systemic change? - How are leverage-based strategies best presented and communicated? - How are leverage-based strategies best evaluated and measured?	- Systemic strategy (Murphy & Jones, 2021) - The epistemic benefits of a leverage points perspective (Fischer & Riechers, 2019) - Identifying conditions for systemic change (Kania, Kramer, & Senge, 2018) - Relative leverage: chaining leverage points (Fischer & Riechers, 2019) - Relative leverage: the context of the changemaker (Klein & Wolf, 1998)	- "Systemic change labs" tracing and comparing the impact of interventions using different kinds of leverage	- How to use leverage to develop better strategies for systemic change - How to account for relative context in the design of high-leverage strategies
Execution on leverage	- What are the best ways to target different kinds of leverage for systemic change? (E.g., how might we help actors in a system track all of the relevant paradigms?)	- Fruitful friction as a tactic for transcending paradigms (Buckenmayer et al., 2021) - Systemic change happens via multiple dimensions of change (Mulder et al., 2022) - *Design Journeys* offers several chapters on taking action after identifying leverage points (Jones & Van Ael, 2022)	- "Systemic change labs" tracing and comparing the impact of interventions using different kinds of leverage	- How to design innovations for each type of leverage

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