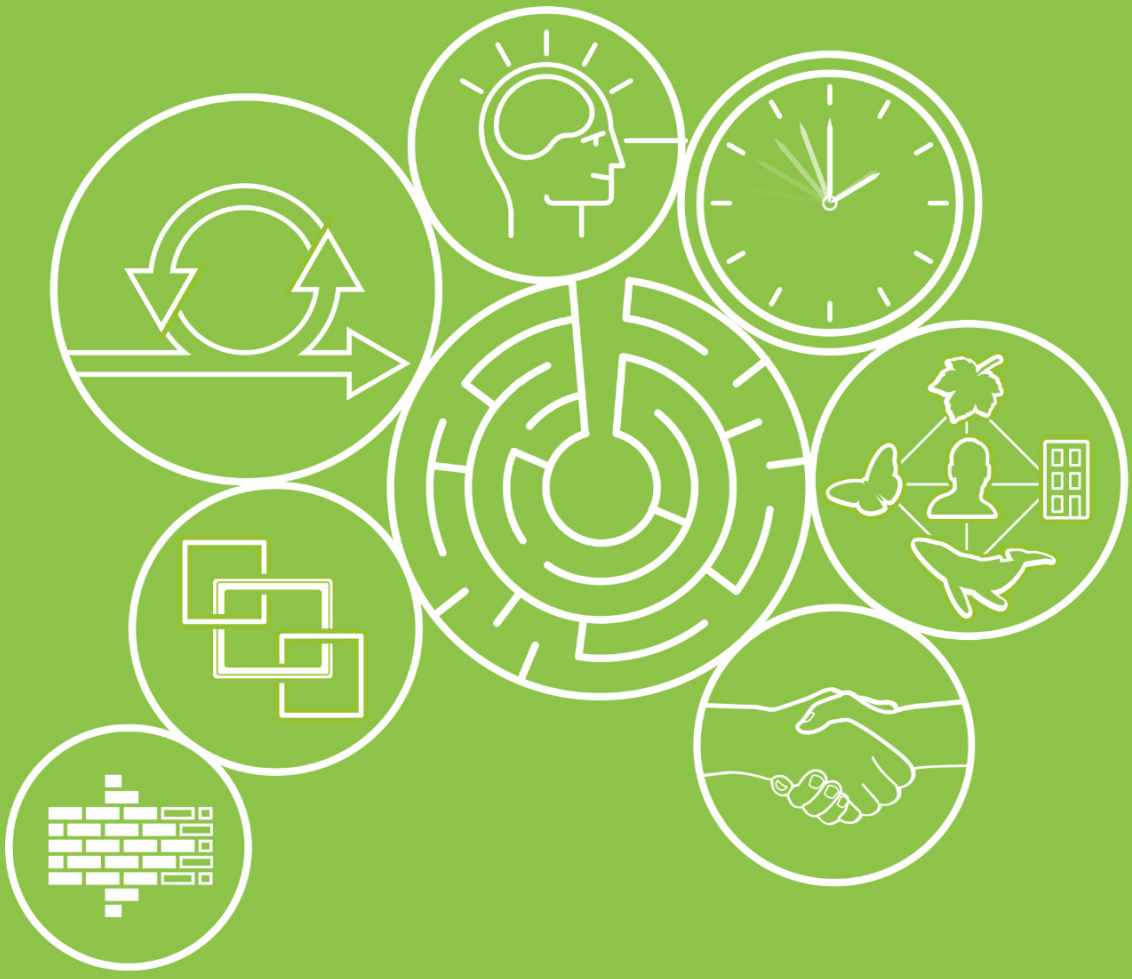

THE ART OF SYSTEMS CHANGE

Eight guiding principles for a green and fair future

CONTENTS

LETTER FROM THE AUTHORS

Many of us met for the first time in the days before we sat down to write this book. While only fifteen individuals, we represent fields as diverse as engineering, computer science, anthropology, and ecology, with professional backgrounds in research, public policy, organizational change, design, and conservation. Some of us have long-considered ourselves 'systems thinkers' while others are at the start of a personal journey into the principles and practice of systems change. We are, however, united by our experiences wrestling with some of the world's most intractable problems, and our deeply held conviction that we can only achieve transformative change by embracing, rather than ignoring, complexity.

In an increasingly turbulent world, we felt it was important, and increasingly urgent, for us to step out of our daily professional lives and reflect on *how* we and the global community can create the transformative change needed for a sustainable and equitable future.

Changing systems requires new ways of working, and a commitment to long-term change. We, and this book, do not have all the answers. We are all working to master the art of systems change; and we hope that by sharing our experience, we can propel others to take the first steps on their own systems change journey.

This book emerged from three long days in the dark of a Washington, DC winter during which we distilled our experience thinking about and changing complex systems to share with others passionate about driving change. As our book demonstrates, systems change is a journey. We hope this book piques your curiosity, and provides tangible steps that you can take forward in your work.

Finally, we would like to acknowledge all those that helped make this happen, including Barbara Ruehling, Raewyn Whyte, Agathe Baëz and Henrik van Leeuwen from Book Sprints Ltd who facilitated this Book Sprint, illustrated, designed, and copyedited the book; Alex Bakta and Matthew Twombly for

additional illustrations; and Kate Graves, Stephanie Hernandez, Kimberley Marchant, and Alexander Nicolas who supported us during the writing process. And thanks to Christo Fabricius, Nasser Olwero, Chris Weber, Danielle Currie and Justin Connolly for helpful feedback. We were inspired by the contributors to the 2018 WWF Fuller Science for Nature Symposium, including Arun Agrawal, Molly Baldwin, Emma Carrasco, Leslie Crutchfield, Paolo Gaudiano, Yolanda Kakabadse, Manmeet Kaur, Kavita Prakash-Mani, Nik Sekhran, Linda Booth Sweeny and Darren Walker.

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Cite as:

Fuller Transformation Collaborative. (2019) “The art of systems change: Eight guiding principles for a green and fair future.” Washington, DC: World Wildlife Fund.

A CALL TO ACTION

"There comes a time when humanity is called to shift to a new level of consciousness... that time is now." - Wangari Maathai

Nothing remains constant except change itself. Harnessing this wisdom is critical to taking advantage of new opportunities as they arise, and to anticipating and responding to the acceleration of environmental and social change. The global human population is projected to continue rising to around 10 billion people by 2050 and 11 billion by 2100 (UN DESA, 2017), creating more urgency than ever before to figure out a way to increase the well-being of a growing number of people without compromising the natural world and climate on which we depend. Yet, in just over 40 years, wildlife populations have declined by 60% (WWF, 2018), while global emissions of greenhouse gases have increased by more than 90% (IPCC, 2018). The United Nations' 2019 Global Environmental Outlook provides more context to this urgency, highlighting that more than 50% of all people now live in urban areas with the number projected to increase to 60% by 2030. This uptick in urban living brings with it new logistical, infrastructural, political, and social challenges and opportunities for sustainability and systemic change. Furthermore, the past decades have seen exponential growth in the use of, and advancement in, technology in every facet of society, which can have massive effects on society and the environment — both positive and negative. When put all together, the components of global change — and their increasing rate of change — can appear stark and overwhelming.

This alarming rate of negative global change invites a moment of collective reflection: with all our efforts, why have we not yet reversed the trajectory of global change? There's no easy answer, but it starts by accepting that the world is complex — comprised of myriad interlinked components. Enabling lasting change

requires embracing this reality, and working with greater intent to transform the actual systems that perpetuate our perceived problems.

The ongoing humanitarian and environmental crises of today have led to the realization that our business-as-usual approaches to problem solving may no longer be serving us (UN Environment, 2019). Reflecting on our collective practices in different change sectors, we can start to see more clearly some of the consequences of our actions:

- We have looked at society's problems in silos, and not always considered the interrelated systems that create problems.
- We have perceived ourselves as outside change-makers, and not actors embedded in the complex world we strive to change.
- We have privileged the quick wins instead of the long-term gains, undermining our own efforts to create change in the long term.

While the root causes of these mistakes are complex and challenging to address, we can begin to recognize that many of the tools used for planning and action actually *perpetuate* our habits (Vervoort & Gupta, 2018). Many of our tools encourage us to reduce our scope of focus and plan in a linear cause-and-effect way. Yet by decoupling our actions from the systems in which they are embedded, these tools can encourage us to oversimplify the complexities and dynamics of systems. Many times, oversimplification can lead us to actions that inadequately address the specific concerns of a diversity of stakeholders, or lead to unintended consequences that may undermine our capacity to reach our goals.

Times are changing: there is growing recognition that nature is a fundamental source of human well-being and an irreplaceable base for economic development (IPBES, 2019). This provides us with an opportunity to rethink how we design our actions that can safeguard and restore not just ecosystems, but also people's lives. The biggest example of this is evident in the participatory formulation and global adoption of the United Nations' Sustainable Development Goals. These ambitious global goals aim to address, in an integrated and equitable manner, the great acceleration of threats to the world, reflecting the urgency and scales at which change must take place.

"The nature conservation agenda is not only about securing the future of tigers, pandas, whales and all the amazing diversity of life we love and cherish on Earth. It's bigger than that. There cannot be a healthy, happy and prosperous future for people on a planet with a destabilized climate, depleted oceans and rivers, degraded land and empty forests, all stripped of biodiversity, the web of life that sustains us all." - Marco Lambertini, Living Planet Report 2018, WWF

A visualization of the SDGs that implies that economies and societies are seen as embedded parts of the biosphere.
Image Credit: Azote for Stockholm Resilience Centre, Stockholm University

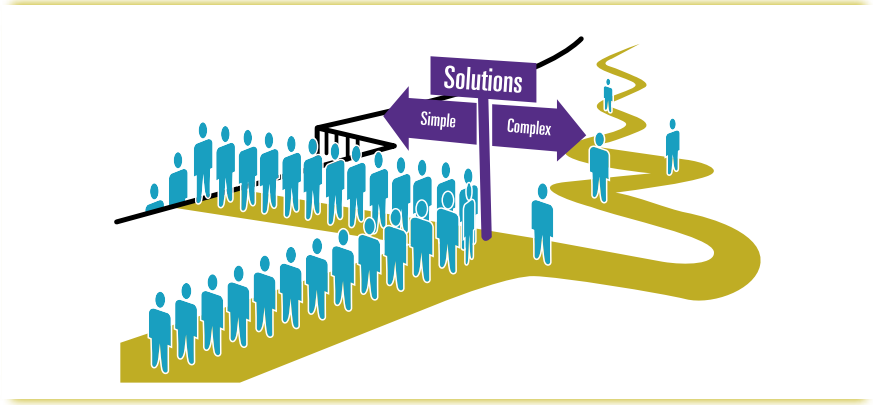
The path ahead

For those who have made careers out of addressing environmental or societal problems, the idea of working in systems is not new. Nature is comprised of ecosystems. Humans live in social systems, have developed cultural systems, and depend on health systems. Yet most of our systemic challenges are being tackled on uneven terms. The environmental and social challenges are woven into systems that offer little hope of achieving change through incremental or narrow actions. A bigger impact requires stepping back to expand the view of the problems we hope to solve, hearing more voices, seeing more connections, and better understanding how complex systems work.

We need to approach change differently. We start by looking farther out, seeing not just the immediate fix, but longer term, fundamental shifts. We let ourselves imagine what might be possible if we could change the rules that define the way things work. We think about the world in terms of diverse actors, who each have their own desires and needs, and who ultimately need to be included in the solution.

The vision of a new way of working inspires and guides a different kind of change. Instead of projects focused on making a specific fix, we can help guide a transformation from the way the systems work today to the way we hope they could work in the future. It's a process of co-learning that engages diverse people — even people that some might consider to be opponents. Unlike the thoroughly planned project, this change inevitably involves uncertainties with many unexpected twists and turns. We can help guide the discoveries and pivots needed to keep moving in the right direction.

This isn't just a better outcome for one narrow part of the system, but ideally a better way of being in the world for everyone. It is our job to look beyond the constraints of the current system and find solutions that can endure in an uncertain future.


Solutions
Simple
Complex

USING "THE ART OF SYSTEMS CHANGE"

Over the last decades, there have been many influential thinkers and change-makers writing about and practicing the art of systems change. Many foundational texts exist about systems thinking, system dynamics, and systems change across a range of sectors and disciplines. Throughout this book, we draw on and synthesize many ideas and concepts that were first introduced by systems thinkers such as Carl Folke, Buzz Holling, Donella Meadows, Elinor Ostrom, Peter Senge, and David Stroh. In Annex 1 we have provided a list of the key references that have informed the content of this book, as well as additional suggested reading for those keen to learn more about the art and practice of systems change.

This book has been designed to speak to change-makers in all stages of the systems journey. Part 1 outlines the fundamental tenets of systems thinking, and describes their implications for our understanding of the world. As most of the sustainability challenges we tackle are complex problems that arise from complex systems, learning the foundational concepts of systems thinking is a critical first step to developing the capacities needed to address the challenges of today.

Part 2 introduces a set of principles for working to achieve long-lasting solutions to tackle our most pressing challenges. Built on the collective wisdom of influential system thinkers and the co-authors of this book, the eight mutually reinforcing principles synthesize key concepts and capacities that change-makers across sectors can develop to tangibly integrate systems thinking into practice. In each chapter, we introduce a principle, why it's important, how to work with it, and provide simple 'daily practice' prompts that can help you cultivate both your individual and institutional capacity for changing systems.

Throughout both Parts, we share stories and examples of both complex systems and problems that arise from system structures and behaviors. We also share insights on methods and approaches for working effectively within complex systems. And finally, we conclude with a vision for the road ahead, and for the journey each of us is embarking on.

PART I: UNDERSTANDING COMPLEXITY

WHAT IS A COMPLEX SYSTEM?

"In nature, nothing lives alone" - Rachel Carson

We all live and work within systems. Sometimes we recognize this, while other times we do not. We understand the world is dynamic and changing — that it will take time to set up a new process or resolve a conflict, or that enacting a new policy may have far-reaching impacts over many years. Yet systems often behave in ways we wouldn't expect, and the full impacts of our actions can be difficult to see. Being more knowledgeable about systems characteristics and behavior, and more intentional about our approach, can help us make better decisions, avoid unintended negative consequences, and achieve our goals.

The aim of this chapter is to provide a foundation or review of basic concepts for seeing and understanding complex systems. Many of the ideas synthesized in this chapter were first introduced and communicated by a number of systems thinkers, listed in Appendix 1. Also included in Appendix 1 is a longer list of resources which explore systems thinking, structure and behavior in more depth.

Introducing types of systems

Meadows defined a system as a set of things — people, cells, molecules, or anything — interconnected in such a way that they produce their own pattern of behavior over time. A system is more than the sum of its parts. Its elements are organized in a way that achieves something.

The earth is made of many systems, with larger more complex systems containing many nested subsystems. At the same time, the situations that result from how systems behave produce problems that sit along this same spectrum. Systems

(and the problems that they produce) can be described as *simple*, *complicated,* or *complex*.

A bicycle is a **simple system**. Take a wheel off of a bicycle and it won't function as intended to take a person from point A to point B. Fixing the problem of a broken bicycle is relatively straight forward, you can follow instructions without years of experience and likely get the outcome you expect. A space shuttle is an example of a **complicated system,** comprised of intricate relationships that must all work to be successful. Fixing the problem of a broken space shuttle requires significant preparation, experimentation, training, and specialized equipment. When a complicated system becomes problematic, it can be fixed by diagnosing what is wrong and adjusting or replacing a component with relatively predictable results.

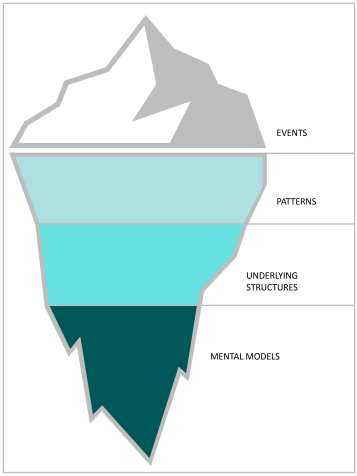
A forest is an example of a complex system. Image © Shauna Mahajan

A complex system is a system with behavior that can be more difficult to predict. Its complexity emerges from the system's underlying structures and relationships. Complex systems are dynamic, behave in non-linear ways, and are made up of components that learn from each other. Examples of complex systems

include a human, a family, a forest, or even a national economy. Unlike with simple or complicated systems, you cannot act within a complex system the same way over and over and achieve the same results. Sometimes, solving problems in complex systems can be relatively straightforward. For example, relieving a child's headache may be as simple as giving a medication. Yet, that same child may suddenly develop an allergy to cats, which is near impossible to predict. For this reason, we need a new way of approaching our work and world.

When addressing social and environmental challenges, we need to recognize that we are working within extremely complex and dynamic systems. These are also the types of systems we are least equipped to deal with. However with the right mindset and tools, understanding them is possible!

The Iceberg



To explore what makes any one component of a system complex, and how it contributes to a complex system, we must look below the surface. Many times the events or actions we see are the result of underlying structures, relationships and beliefs. For this reason, a common metaphor used to understand complex systems is the Iceberg Model (Goodman, 1997).

The '*events*' are the easiest things to see, right at the surface. We can ask and answer the questions "what just happened? what is our current problem?"

- *A mine is polluting a local river.*
- *I've been eating a lot of ice cream.*

Just under the surface are *trends and patterns* of those events through time — we ask "what patterns have been happening over time?"

- *An increasing number of mines have been opened along the river.*
- *I've started eating more ice cream since I've been biking to work.*

Creating these patterns are the structures and relationships that lead to those trends. — "what forces or structures are in place that created these behaviors?"

- *Tax rates on extractive businesses have steadily declined for the last four years, creating an incentive for mining. In addition, the newest method of mineral extraction relies on large quantities of water for cooling equipment - making mining close to rivers a good business decision.*
- *When I bike to work, I bike past my favorite ice cream parlor.*

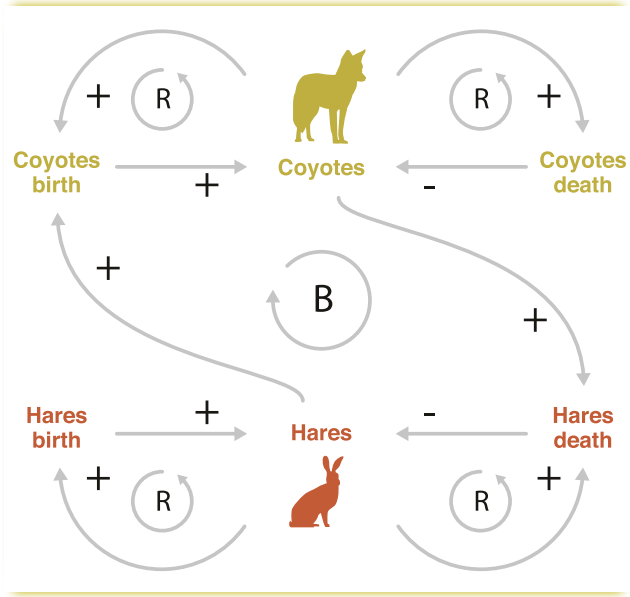
Finally, at the base of the iceberg are the underlying mental models, beliefs and culture about how the system works

- *Economic development is the most important consideration for a country. Mining is the best option for this land. Mining companies can't be responsible for accidents.*
- *Because I've exercised by biking to work, surely I deserve a little treat.*

Using the iceberg model can help uncover differences in the ways people perceive problems, and the underlying causes of them. The further down we work on the iceberg, the more transformational change will be.

Describing Complex Systems

In order to start to understand and work effectively within systems, it's important to have a common language for the features of systems that each of us may be familiar with, but lack words to describe. To introduce some common terms and concepts used to describe complex system structures and behaviors, let's take a look at a hypothetical example – coyotes and hares in the United States. Coyotes (*Canis latrans*) are small predators native to North America. They are very tolerant of disturbance and eat a diverse diet. For the purpose of this book, we will use hares (*Lepus* sp.) as their main prey.



A causal loop diagram (CLD) illustrates the dynamic relationship between coyotes and hares

Stocks and flows

Systems are made of elements which can be divided into **stocks** and **flows.** Stocks are easy to spot, because they are always nouns – people, roads, etc. Flows are labeled as rates of change or activity – speed, birth rate, etc. Let's explore this

through the coyote and hare example. Hare births over time (a flow), increase the hare population (a stock). Likewise, deaths of hares (a flow) decrease the stock of hares in the world. This is important because stocks only change as a result of in- and out- flows.

The behavior of any system can be seen in patterns of stocks over time. Recognizing the difference between stocks and flows is also important, because there is an intrinsic **delay** between the changes in stocks. Just because there is now more food for coyotes, an increase in hares will not instantly increase the number of coyotes. Each stock is impacted by multiple in- and out- flows. And likewise, even though predation pressure increases with more coyotes, this increase won't immediately reduce the hare population. The impact of **time delays** in complex systems affects the results of any action within the system and our ability to see and recognize those results.

Feedback loops

Systems are composed of elements and interrelationships. Relationships between elements often create **feedback loops.** When a coyote eats a hare, that means fewer hares will be born later in time. A large coyote population leads to more coyotes being born; and when there are more coyotes, there are fewer hares, since they are being eaten by the many more coyotes. Fewer hares means less food for the coyotes, which "feeds back" to limit the coyote population. This is an example of a **balancing feedback** loop correcting the change in the system. A related loop exists if natural predators are removed from the environment. Without predators, hares reproduce more quickly, the population grows, and it leads to even more hares being born — creating a **reinforcing feedback** loop amplifying the activity in the system.

System boundaries

While not a direct component of a complex system, how we define and understand the problems we are addressing depends very much on the **boundary or frame** we are using. Given that the world is interconnected, we must draw a conceptual boundary somewhere in the greater system to make it possible to understand and solve a problem. We couldn't fully manage a population of coyotes and hares in

the real world without considering other "outside" influences such as disease, hunting pressure, or other forms of mortality. How we define our boundary matters, and is often subjective.

System behavior

System structure is the source of system behavior. System behavior reveals itself as a series of events over time. While individual variations and choices might influence the timing or frequency of specific events, the overall pattern of behavior is determined by the structure – the interrelationships, elements, feedbacks and time. A change in the social ties in a network, a tiny modification to a rule, or the addition or removal of a feedback mechanism often leads to changes in *patterns of behavior*. Returning to our example, if you were studying the population of these coyotes and hares, you could see their numbers oscillate as a result of the reinforcing and balancing feedback loops mentioned earlier. Without other major changes in the system, the populations of coyotes and hares would reach a **dynamic equilibrium,** or steady state in biological terms.

Identifying relationships and feedback loops are critical to understanding **non-linear** patterns of behavior. Non-linearity refers to outputs that are not proportional to the inputs. Because of feedbacks or multiplicative effects, seemingly slight changes to initial conditions can disproportionately affect the system. Returning to our coyote and hare example, if the population of coyotes is removed, the number hares will grow exponentially — their *rate* of population growth increasing over time.

Because of their dynamic behavior, systems can change or shift over time, often hitting **thresholds.** A threshold is a point or a condition in a system that when crossed, triggers some kind of change. For example, the hare population may grow until a point where all the hare's food is eaten and the population collapses. Sometimes a threshold is crossed that causes a larger, more permanent change in the system, also known as a **regime shift**. A regime shift is often used in ecology to describe a relatively sharp change from one regime to a contrasting one, with internal dynamics and feedbacks that often prevent it from returning to a previous regime (Biggs et al., 2009; Scheffer, 2009); or can have cascading effects across scales (Rocha et al., 2018).

And finally, the behavior of a system can also be **emergent**. Emergent behaviors arise from the interactions between components, where those behaviors and properties would not exist in isolation. They *emerge* from the inter-relationships and dependencies that exist within the broader system. A classic example from ecology is risk reduction and enhancement behavior. For example, a prey species (for example, a hare) may adopt a behavior to avoid being eaten by a main predator (for example, a coyote). This behavior could increase or decrease the risk that a hare is consumed by another predator in the system, and create a new pattern of predator-prey relations in the ecosystem (Sih et al., 1998)

Another example of emergent behavior is a traffic jam (Bonabeau et al, 1995). A traffic jam may form when a large number of individuals, with slightly different speed and stopping distance preferences, drive their cars to work at the same time of day. No single car can cause the traffic jam, yet it emerges through the interactions between individual cars.

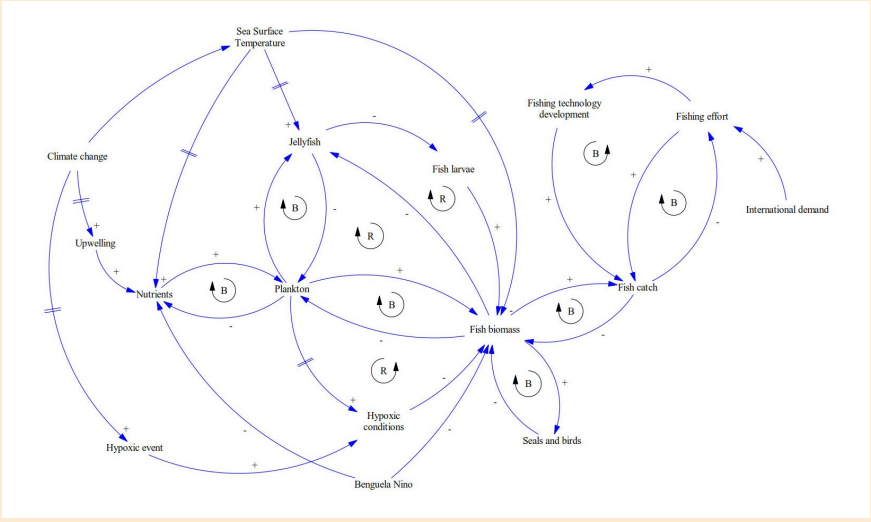
Speaking systems with a sardine state shift

Dynamic systems are all around us. We use a story and a **causal loop model**, (a qualitative model that contain variables and causal relationships in a system) to disaggregate variables and show interrelationships in the Namibian sardine fishery. In this chapter, we also revisit terms that are frequently used when describing complex systems and complex problems.

Focusing our **boundary (or frame)** off the coast of Namibia, sardines dominated in the Northern Benguela marine system up until the late 1960s. From the 1960s until the mid-1970s, the sardine fish **stock** started to decline from fishing pressure; and by 1975, the stock had collapsed (Cury & Shannon, 2004). The system had crossed a key **threshold** where sardine populations reached a number so low they could no longer reproduce. The ecological **regime shift** that occurred as a result led to the collapse of both the sardine fishery and other pelagic fish stocks.

With no other species with a similar ecological role to the sardine acting as an adequate replacement, repercussions echoed through the food chain. After the collapse, fishing pressure shifted to other pelagic fish. Fluctuations in these **stocks** occurred throughout the 1980s (Roux & Shannon, 2004).

The balance of this system can be understood by looking at the **feedback loops** that surround pelagic fish. For example, pelagic fish feed on plankton biomass. When fish biomass is low, plankton biomass increases. When plankton biomass is high, there are more food resources available for fish. In this regime, there is a natural fluctuation between plankton and fish biomass, keeping the system in balance (Cury & Shannon, 2004).



Many rapid and slow changes over time, including for example, fishing pressure and a hypoxic event and a slowly changing climate, led the system's dynamics to shift over time. This led to the eventual collapse of many other pelagic fish stocks in the region and an increasingly stable and large jellyfish population. **Time delays** are present in the system – some of the drivers such as climate change and fishing pressure did not change the system state for several decades; but once shifted, the system became 'locked' in a new state where low fish biomass was reinforced by the surrounding ecological conditions.

The new state was not desirable from a social perspective; as fish stocks had rapidly declined, impacting the fishing industry. To intervene in the system, one could look for different **leverage points**: key points in the system, that if changed, could alter the dynamics and shift the system into a new regime. Speculative leverage points in this system could include reducing fishing effort and removing jellyfish to reopen the ecological niche for pelagic fish species.

Example adapted from: Sophie Belton, Carolina Holmberg, Catarina Larsson, Shauna Mahajan, Juan-Paul Roux, Juan Carlos Rocha. Northern Benguela Marine System. In: Regime Shifts Database, www.regimeshifts.org. Last revised 2013-08-26 08:47:14 GMT.

Cause and Effect

How cause and effect work in a complex system is different compared with simple and complicated systems. We typically would assume that X causes Y; or in our example, fewer coyotes causes more hares. Therefore, if we wanted to achieve Y (more hares), we would strive to achieve X (fewer coyotes), without consideration of how achieving Y might impact the rest of the system. If we do not succeed at X, either we are not trying hard enough or, we assume, we need to find something else that will directly cause Y. Cause and effect are important, but in a complex world, things are not this simple.

In simple or complicated systems, associations can be learned over time, where repeated experiments can be conducted to arrive at some objective answer. We can learn through experience or more formal study that a material has some properties that make it an effective glue, or that eating a plant cures an ailment. We don't need to know the underlying mechanism for this type of knowledge to develop; we just need to understand and establish that the association exists and is predictive of outcomes.

Many of the most compelling insights from the formal study of complex systems highlight that seemingly simple systems can develop unexpected patterns of behavior. For example, when Edward Lorenz decided to re-enter the numbers for an early climate model and exclude the last several digits to save time on the computer, he expected that his estimates would converge on his prior simulations. What he found instead was that very small changes in data lead to very different weather patterns — a term he coined 'the butterfly effect' (Lorenz, 1995).

Ultimately such results led to dynamic theories of complex systems later referred to as chaos theory (Oestreicher, 2007). While the term 'chaos' suggests randomness or disorder, the basic idea is that small changes in complex systems can lead to divergent results over time. Small changes to the structure of systems can result in even more profound changes. For example, the basic mechanisms of a disease may be well understood and may be used to predict whether or not a disease outbreak will become an epidemic, informing action such as immunization or closing of schools. However, small differences in the structure of a social

network can make an even larger difference, regardless of the initial values or parameters used to describe a particular cause-effect relationship.

Complex problems emerge from complex systems

A common piece of wisdom shared by system thinkers is that the systems we live in and strive to influence are often designed to do exactly what they are doing. Meaning, the problems we perceive result from systems that have been structured to generate certain behaviors. It is these structures and behaviors that sometimes intentionally, or unintentionally, create the problems we strive to solve. This is why solving complex problems is such a great challenge. Yet by accepting this, we increase our ability to identify actions that better fit the problems that emerge from system structures and behaviors. This acceptance helps us adjust our actions as the problem itself continues to evolve.

Returning to the hare and coyote example, the relative numbers of coyotes and hares is always fluctuating, slightly altering our view of the system at any given time. By understanding that many systems work in cycles with spatial or temporal patterns, we can better sense how, when, and why we should intervene in managing these species. Dynamic systems are harder to fully predict and with long delays and nonlinear relationships, and actions on one part of a system often lead to unintended consequences from feedback effects. Though fairly common, unintended consequences usually result from a poorly understood problem or operational mistakes.

When solving complex problems, we need to pay closer attention to the structure, behavior, and cause and effect relationships that we observe in systems. While many times it's impossible to prove a relationship exists, we need to make our assumptions explicit about how something happens. This way, we can better understand the system structure, test our assumptions, and solve challenging problems by identifying one or many **leverage points.** These are places in the system where a small change could lead to a large shift in behavior.

USING A SYSTEMS APPROACH

"We can't solve problems by using the same kind of thinking we used when we created them." - Albert Einstein

Now that we're thinking of the world around us in a different way, what do we do about it?

While it may be hard (and unsettling) to let go of methods and tools we feel comfortable with and to think in new ways, the potential payoff in terms of creating real results will be worth it. The challenges we face building a sustainable society require us to embrace the complexity of systems. For this we need to equip ourselves with the knowledge, tools, and approaches suited to the challenge.

In this book, we present two ways to help navigate systems change. The first are four recognized phases of systems change, introduced in this chapter. There are many tools one could use during these four phases of change, a few we introduce below and build upon in the annex of tools. The second involves a set of eight guiding principles of practice that we, the authors, believe are important within the phases of systems change (see Part 2). It is by seeing the phases of change, adopting the principles of practice, and opening our minds to new ways of being and working in systems that will get us on the path to long-term change.

Phases of systems change

The Four Phases of Systems Change is a framework adapted by David Stroh (2015) from the 'creative tension' model (Fritz, 1989; Senge, 1990). While other frameworks exist (e.g., the Prosci ADKAR Model; Prosci, 2019; Theory U; Scharmer, 2007), we find the four phases approach clear and useful for the

purpose of this book. These phases serve as a compass to orient and guide the process of systems change. In any context, these phases may be iterative, with an initiative moving cyclically through the phases, or dipping into one and then jumping forward.

Phase 1: Lay the foundation for change

For change to happen, especially deep long-term systemic change, people and organizations need to be interested in creating change. They need to be aware that something isn't working and that something different needs to be done. *Why aren't we solving the problem we've been working for so many years to solve? Why aren't our interventions working the way we expect? Why does this problem keep coming back?* These might be the types of questions people are asking. Awareness that change is needed, desire from actors to finally solve the problem at hand, and a readiness to devote time and resources to the process are critical.

Phase 1 is essential in laying down the foundation for change through listening, building trust, a collaborative mindset, and a shared mission for how to move forward, together. This process can be a deeply personal one, and building a coalition of stakeholders willing and able to drive change — while also being open to the possibility of personal transformation and change — is essential (Page et al., 2016). During this phase, it is critical to cultivate an open, welcoming space where different opinions and perspectives are acknowledged and encouraged. It is also important for those involved to accept that moving through this process will not be easy. Laying out the phases of change, and building commitment for when the process becomes confusing and uncertain, will ensure that change can happen.

Phase 2: Understand the system

Through building the foundation for change, it may become clear that every actor has a slightly different perception of the current system — even if they are generally using the same terms and language! A sure sign of people not sharing the same understanding of the dynamics behind a problem, is being convinced that *they* have the solution — while others are equally convinced of *their* solution.

The primary focus of this phase is to develop as complete a picture as possible of the problem being tackled. Building support for this phase can be challenging, with people sometimes feeling tired of planning and analysis. There can also be a strong temptation to curtail this initial exploratory phase in order to jump to conversations about the future system, or about how change may occur. However, a superficial understanding is unlikely to yield new insights about the fundamental dynamics driving the emergent properties of a system. Not having a shared understanding of the underlying dynamics of the problem is one reason it's still a problem.

Everyone carries internal assumptions and beliefs about the world and how it works — shaped by our knowledge and experiences. The tendency is to assume that others think the same way. In order to develop a shared understanding, it is important to externalize our mental models and make our assumptions explicit. Making our assumptions explicit can mean exposing beliefs and assumptions about cause and effect that may be invalid, or revealing hidden biases. This process of developing a common language and shared understanding of the system also acts as a crucial time for the coalition of stakeholders to address and work through unspoken hierarchies and power dynamics, especially as they relate to knowledge (i.e., whose knowledge counts or 'counts more'; Moser, 2016).

Being able to evaluate the logical implications of a proposed change often requires us to create a visual model of the system we are working within, whether with pen and paper or with a computer. Tools can help us do this. Tools such as spatial maps, social network graphs, causal loop diagrams, stock-and-flow diagrams (see Tools Annex for more details) can help us understand the relationships and feedbacks within a system, and identify barriers or opportunities for action (Kim, 2000).

Phase 3: Commit to a desired future

Once you are committed to change and have a solid systems-based picture of the problem you are tackling, it's time to envision a future or goal. With diverse stakeholders, it's important that efforts can be aligned toward a shared goal — even though each actor may be working differently.

Sometimes we can intuit through experience of learning from many failures, but in a complex system, those lessons are often rooted in the past structure of a system that has already evolved (Drimie et al., 2018). For example, we may want to restore a system to a previous state, but path dependence in a complex system often means that we cannot get back to the same place by going backwards (at least, not directly). Tools that provide insights from analysis help us overcome many of our personal biases and fallacies, and uncover the range of leverage points that are actually accessible to us.

There are a variety of futures tools, such as scenarios (Kahane, 2012), to help think about a more desirable future from a systems perspective. The Three Horizons Framework is a useful heuristic device to enable participants to move from the present towards a radically different future (see Annex 2; and Sharpe et al., 2016). Other experiential futures techniques include convening positive 'seeds' of change that exist at the margins of society today, but which offer some glimpses of a more positive future, or envisioning what distant futures could look like (known as the Manoa Mash-up Method; Pereira et al., 2018).

Finally, with the problems we are trying to solve and how complex the world is, it is impossible to *fully* predict the future. Nor would we want to. What if our actions create an even better future than we could anticipate? We want to be open to emerging futures we couldn't predict. Additionally, it's possible (and even likely) that we didn't fully understand our system, and we want to make sure we are adapting to our evolving understanding.

Phase 4: Bridging the gap

Closing the gap between where you are and where you want to be requires actors in the change process to have the desire, commitment, ability, and capacity to make the changes needed. It is also important to choose intervention points carefully to reach long-term systems change. Leverage points are places in a system to intervene where small changes can have big effects. Leverage points, by their nature, are not intuitive (Meadows, 2008). We can begin to uncover leverage points as we shift our understanding from superficial events and patterns, to understanding the structures, relationships and norms that generate those events

and patterns. There are many types of leverage points which vary in their overall potential for impact. Shallow leverage points are often more obvious and involve simply changing the parameters of a system — such as through taxes, subsidies, or standards. It is typically easier to address shallow leverage points; but in reality, over the long term, these shallow points do not dramatically change the structures that are driving a system generating unwanted behavior (Abson et al., 2017). To achieve enduring change, we need to take the time to uncover deeper leverage points — points that begin to address the underlying rules or goals of the system, or the mindsets/paradigms that made the system arise in the first place (Meadows, 2008).

Not every person or organization needs to (or should) take the same role or same action. Each actor has a niche, and that is important to identify and support. Bridging the gap takes commitment to the process, understanding of the problem, and regular space and time for reflection and strong communication between actors (Pereira et al., 2018). To achieve long-term change in systems often takes a repeated engagement over time, especially for the more complex problems we address.

Tools for systems change

When we talk about 'tools' for systems practice, we are typically referring to specific methods and approaches that can support coalitions during the four phases of systems change. Many tools exist and toolkits have begun to emerge that contain collections of methods that can help guide systems transformation (e.g., Enfors-Kautsky et al., 2018).

Tools can help in many ways throughout the phases of systems change. For example, they can help us test our own individual assumptions about systems or bolster our understanding about relationships in a system. They can help create transformative spaces and a place for dialogue about systems, model how change might play out in the future, and help us think radically differently about futures. One thing many tools have in common is the capacity to tell stories. No matter which phase you are in, the insights from any effort to understand a system (or

change it) must be shared. Stories provide a universal and compelling way to understand a system, and learning how to "tell the story" of a system and communicate to other actors or stakeholders is fundamental to driving change (Galafassi et al., 2018).

While tools can support us throughout all the phases of systems change, it's also important to remember that no single tool will provide us with a complete picture of a system. And even more important, different tools will be suitable for different types of people. Systems tools vary in how much one has to know. For example, building a causal loop diagram requires specific skills, while sketching mental models of systems is a fairly simple task to master. Each tool helps us see complex systems in a particular way by calling attention to a specific feature of a system. But, in doing so, each tool also introduces a bias in interpretation or explanation of a complex system. Bringing systems tools into a setting carelessly can just as easily reinforce status quo approaches if they are not facilitated or implemented with care and attention to power, incentives, underlying world views, and hidden agendas (Marshall et al., 2018; Moore, et al., 2018). Always put the problem and the context first, and then assess what tool might be a good fit.

In this book we do not provide a comprehensive overview on how to apply tools to system change processes. But to help you start thinking about tools for systems practice, we have provided a short series of practical how-to guides for select systems tools in Annex 2.

PART II: PRINCIPLES

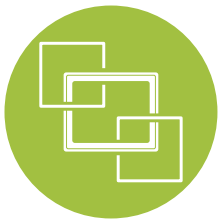
EIGHT PRINCIPLES FOR CREATING SYSTEMS CHANGE

Working within complex systems to create change involves first developing literacy on the basics of systems thinking (introduced in Part 1) and building the capacities required to enact lasting change in systems. Given the complexity of systems, the specific operational tools relevant for designing and implementing 'systems-aware' interventions will vary markedly with context. Thus, following a prescribed sequence of steps, facilitated by rigid toolkits, can actively undermine our attempts to incorporate systems thinking into our work. Instead, each of the principles outlined below represents an essential idea for how to incorporate systems concepts into practice.

The principles are arranged broadly sequentially, mirroring the design, implementation, and monitoring of an intervention. To create change in systems, we must blend the behaviors described in these principles so that they are mutually reinforcing, no matter where we may be on the systems journey.

Principle 1: See ourselves in the system

We are all part of the systems we strive to change. By seeing this, we can sharpen our awareness and attune ourselves to the feedbacks and relationships that occur between our individual and collective actions and the broader systems we exist within. Cultivating mindfulness, humility, and acceptance of the complexity we exist within provides space for reflection, which can in turn make us strong and resilient agents of change.



Principle 2: Identify our frames

How we define problems shapes how we find solutions. Our perceptions of problems are often limited by our experience, values, and beliefs. Failing to recognize this can increase the risk of misdiagnosing problems based on incomplete understandings of systems. By developing the ability to identify, stretch, and reduce our frames when needed, we increase our capacity to see problems in the context of the systems that generate them, increasing the set of solutions we can perceive.

Principle 3: Co-create with intention

Creating social and environmental change that lasts relies on the behaviors of all actors in a system. Intentional co-creation involves defining problems and solutions together with actors in a system, and includes creating a safe space where the diversity of views and visions for the future can co-exist. Not only is co-creation an ethical way to drive change, it is essential for building a coalition of actors with the capacity for enacting change.

Principle 4: Explore time and scale

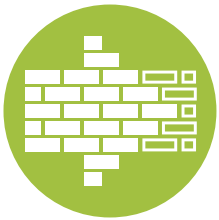
We are often tackling problems with limited time at too small a scale. Developing a sensitivity to both time and scale can help us become attuned to the underlying patterns and trajectory of systems change. With this attention, we can design actions in ways that harmonize time and scale, and build solutions that work with - and not against - systems.

Principle 5: Find simplicity in complexity

The belief that there exists a simple solution amidst great complexity is important for those wrestling with intractable problems. By working to truly understand and navigate complexity, we train ourselves to discern points of leverage that offer opportunities to transform system structures, patterns, and behaviors. By identifying simple solutions, we're equipped to communicate the elegance of systems change, and build stronger foundations and coalitions for change.

Principle 6: Experiment iteratively

Described most simply as 'learning by doing,' experimenting iteratively builds our capacity to think and act both quickly and slowly. Systems are always changing; and to ensure our actions are fit for purpose in an ever-changing world, we need to build the ethos of learning and experimentation into ourselves, our organizations, and the systems we inhabit. Experimenting iteratively offers us a way to use our experiences as opportunities to learn, integrate, and adapt.



Principle 7: Align structure with change

The characteristics of the formal institutions that govern our work to change systems have the power to either inhibit or advance our capacity to drive change. The environmental and social systems we strive to influence are complex and adaptive, therefore the institutions and programs that address these problems must also have the capacity to adapt and respond to changing conditions.

Principle 8: Act based on evidence

Acting with evidence encourages evidence-based reflection, which aligns monitoring with the knowledge needs and actions of all actors in a system. Monitoring change in complex systems goes beyond measuring the finite impact of our actions and includes understanding the dynamics our actions influence, the relationships that exist, and the trajectory of structural change.

Using Part 2: Eight principles for creating systems change

Part 2 of this book is designed to be a practical guide to support the integration of systems thinking into practice. We introduce each of the eight principles for creating systems change and describe the fundamental individual and/or collective behavior the principles emphasize. We introduce why each principle is important for working in systems, and offer 'daily practices' for each.

The daily practices are designed to be simple exercises or tasks that can help build competence and comfort in the art of systems practice, preparing for a deeper dive into some of the more complex tools for systems change. The practices can be woven into work, or amplified to serve a project team or organization. In the annex of this book, we have introduced samples of these tools that can take your individual practice to the next level.

Principle	Related dynamics of complex systems
Principle 1: See ourselves in the system	We are part of the complex adaptive systems we try to change. There are feedbacks and forces generated by our actions - and those of others - acting on us that we are not normally aware of.
Principle 2: Identify our frames	Systems cross multiple scales, while our individual and institutional frames are often more limited; how we frame our problems determines the solutions we seek.
Principle 3: Co-create with intention	Any one person's knowledge of a system is incomplete; co-creation helps create a more complete understanding of the relationships and structure of a system to tackle systemic problems.
Principle 4: Explore time and scale	There are intrinsic time delays between action and response, which impact the results we see and when we see them. Systems cross multiple scales; and complex systems are nested within each other at different scales.
Principle 5: Find simplicity in complexity	While complex, systems can be understood by distilling patterns, trends, or principles that reflect underlying structures and behaviors, and leverage points can be focused on to create longer-term change.
Principle 6: Experiment iteratively	We usually have to act with incomplete understanding of complex systems and their dynamics; iterative experimentation allows us to adapt our programs as we act and learn.
Principle 7: Align structure with change	The structures of formal organizations and institutions can either foster or inhibit working with the dynamics and trajectories of complex systems.
Principle 8: Act based on evidence	Working with complex systems requires us to be more intentional in what we're measuring and why, and how information is used by people and organizations at different scales.

Principles and related dynamics of complex systems. ***This table presents how each principle for creating systems change, introduced in Part 2, embodies the elements of complex adaptive systems introduced in Part 1.***

PRINCIPLE 1: SEE OURSELVES IN THE SYSTEM

"You are not stuck in traffic. You are traffic." - TomTom

How did we get here?

Since the late 1700s, Western society has embraced a reductionist way of seeing the world that breaks complex problems down into smaller parts. This approach has led to great efficiency and a revolution in our understanding of how our world works. But it has also inadvertently created silos in our understanding around the problems we seek to solve (Gallagher & Appenzeller, 1999). While we have become very good at specific things, we have lost our ability to see systems — we can see the wood now, but not the trees from which it came.

This has also affected how humans think of themselves in nature. The separation of society from nature (Murdoch, 1997; Goldman & Schurmann, 2000) has left humankind with an impression that nature is something that we can control and manage, especially as technological innovation has progressed (Rogers, 1994; Zimmerman, 1979). However, with the magnification of anthropogenic climate change (IPCC, 2018) there is an increasing recognition that the assumption that humans can control nature is flawed. It is this assumption that has perpetuated the perceived dichotomy of 'us' versus 'the system.'

Many cultures around the world do not see a separation between nature and society — they see the world from a systems perspective. In indigenous Andean cultures, notions such as 'Buen Vivir,' 'Sumak Kawsay,' or 'Living well' talk of a systems approach of seeing all life as interconnected and interdependent (Acosta & Martinez, 2009). These diverse, more systemic approaches to nature and how humans relate to the environment have been incorporated into global assessment processes, emphasizing the need to recognize diverse perspectives as a way to help us think more systemically about global challenges (Diaz et al., 2015).

Why does it matter?

A fundamental lesson we can take away from ancient societies, and the perils of today, is that we — including the individuals and organizations trying to change the world for good — are part of the linked social, cultural, political, and environmental systems we seek to change. We bring with us our own world-views and ways of seeing and interacting with the system. Our presence and actions within systems can influence the dynamics of systems, through creating feedbacks, shifting system relationships or power dynamics, or pushing certain

stocks over a threshold, and change system behavior altogether — even if innocuous or on a micro-scale. In return, we are likewise influenced *by* the systems we are within, which evolves how we view and interact with the system in future — an eternal feedback loop of self within system.

In any context of enacting change, it is easy to fall into the mentality that it is 'them' or 'something else' that needs to change. Yet, we all have a degree of agency in influencing systems around us — be that our families, communities, or global environmental systems. With this agency comes an obligation and a moral responsibility to reflect on how our actions influence the systems around us, intentionally or unintentionally. When we get caught up in the business of our everyday work, our frame can narrow and we can misjudge the role we play in systems we are striving to influence. We can overestimate our power in a situation and exert effort where we have little control, or underestimate the power our actions can have. To be effective at driving change, we must be aware of how our actions change systems near and far, while simultaneously reflecting on how the system may be changing *us*.

How do we see ourselves in the system?

Systems practice encourages us to situate ourselves and our organizations within systems, not separate from them; and to recognize that acting within systems comes with a responsibility to each other and to every living organism on the planet. There are at least three ways for seeing ourselves better in the system: embracing mindfulness; being humble; and expecting the unexpected.

Embrace mindfulness

Being more aware of our role in systems can emerge from simply being more mindful. Mindfulness can be most simply described as a way of being *aware* that is studied, practiced, and defined in many different ways across cultures and societies around the world (Chiesa, 2013). Practicing mindfulness can be as simple as taking a pause to reflect on and cultivate empathy for someone who expresses a different opinion. At an organizational level, it can mean taking deliberate time to

consider both the successes and failures of a particular week, month, or year — providing space for teams to collectively think deeply about questions such as: *Why did that outcome happen? How did my (or our) actions influence people or systems around us, intentionally or not? In what ways have I (or we) been affected by people or the system around me (or us)?*

Seeing ourselves in the system requires mindfulness on both an individual level and the organizational level. It calls for acceptance that sometimes we may be wrong, and that our actions have consequences for both ourselves and the world. By practicing mindfulness in our everyday lives, we can sharpen our ability to reflect on individual roles within our teams, organizations, and in the systems we seek to change. Even how we show up, present ourselves, and make choices can be system interventions in their own right. To achieve a mind-shift at the organizational level, the change must first begin with individuals. It is up to those individuals to create the space for collective reflection, fostering trust in oneself and the systems around us, so organizations can also have the space to step back, reflect, and shift agendas and identities as needed to keep up with an ever-changing world.

Be humble

Heightened awareness also teaches us to be humble. Humility can serve as a useful reality check, reminding us we are all actors in a large complex world. This reality check is empowering as it allows us to accept when our ideas fail or when we are wrong. This gives us the freedom to be more intentional with our actions and to change course as often as needed without remorse, striving towards actions that have the capacity to drive lasting change in the outcomes we care about.

Reflecting on our position within a system also brings with it an empathy whereby we are able to see the perspectives of others. This allows us to see our own biases and appreciate that the assumptions that we make about the system are not necessarily the same for other people. We can begin to recognize the limits of our own expertise, as no one person can ever be an expert on an entire system. It is vital to acknowledge these limits and to seek guidance from others to complement our own knowledge base — whether it is as an individual, an organization, or even a network.

A rich return from seeing ourselves within the system is that as we start to recognize our biases and work at the margins of our expertise. Our theories about how change happens start to fray, and we formulate new ways of enacting change that may be more powerful. As these new avenues open up, it is important to keep taking a pause to check-in with ourselves and the system. This will allow us to catch ourselves before falling back into old habits, and to evaluate where we have shaped and been shaped by the system.

Expect the unexpected

Insights from systems thinking demonstrate that it is not always clear what the exact outcomes of a particular action are going to be within a system (Longstaff, 2010). Moving away from a single cause-and-effect mentality and towards an appreciation of how acting in one aspect of a system could have unforeseen implications elsewhere is another way to recognize our relative position within a system. This requires us to become comfortable with acting when we are unsure of the specific outcomes of our actions, and encouraging a mindful acceptance of the results, be they right or wrong.

Change cannot happen without disruption. Sometimes this can be uncomfortable, but it is a necessary part of enacting transformative change. There is a power to disruption; but with this power comes a responsibility to act with a clear eye to the consequences of our actions, even if these are unforeseeable. A concomitant aspect of appreciating unintended consequences is building up a certain level of comfort with uncertainty. Coping with surprise or the unexpected is a capacity that is necessary for effectively employing a systems approach — and one which can strengthen our awareness of our place within that system.

Daily practice

- Think of a problem you are trying to solve, big or small. What role do you play in the problem? Are there assumptions you're making that keep the problem going?
- One day a week, document at least five reactions (positive, negative or neutral) you have to situations you encounter. Situations can be as simple as emails you receive, informal conversations you have, or meetings you attend. What dynamics are behind these situations? Observe over a period of one to two months how your reactions evolve.

PRINCIPLE 2: IDENTIFY OUR FRAMES

"He who frames the question determines the answer." - Donella Meadows

We are always thinking within a specific frame — bounding the world around us by any multitude of factors. It may seem that the forest ends where the trees stop growing, but what about the roots? Or the seeds that have flown out of the forest, on the wind, and into the neighboring fields? What about the people who entered the forest, gathered berries, and shared them with their loved ones around the fire built from the fallen forest tree limbs? How much carbon gets absorbed from the atmosphere into the trees that make up this forest? It's important to both be conscious of what is missing in our view, and yet recognize the need to define and bound a problem area we choose to work on.

What is a frame?

We all limit what we focus on based on awareness, desire, opportunity or pure necessity. Frames can be looked at in two ways. The first is the lens through which we see the world, often described as our 'mental model' (Moon et al., 2019). The second - while often influenced by the first - is the boundary we use in defining the problem we are trying to solve. Frames can be limited by geography, institutional department, organization, sector, or by our individual values, beliefs, and experience. The frames through which we see the world define our perception of events, patterns, and system behaviors and structures we experience. Some of the common domains we use to narrow our frame are:

- **Geography**. If a project is focused on protecting a forested region in the Amazon, then the frame has necessarily been narrowed to one specific type of natural landscape. Yet considering a broader geographical context may provide insights into the forces affecting the targets of the conservation intervention, such as the economic drivers moving into the region from the neighboring Andean mountains.

- **Culture or history.** Individuals and groups will understand a problem based on the information they have, which is often rooted in culture or personal or collective historical experience. For example, community-based interventions may be fraught with failure, not because the concept is flawed; but the frame of the implementers may fail to consider the norms, values, and traditions that determine priority setting among the intended beneficiaries of the intervention (Lubilo & Child, 2010).

- **Field or sector.** Projects embedded within individual institutions are often framed by the goals of an institution, the sector they are in, and/or the educational background of staff. For example, a conservation group may deem a project successful if direct threats on wildlife are eliminated. Yet, by ignoring others' frames, the conservation project may cause a feedback of increased attacks on livestock by wildlife. Subsequent loss of income in neighboring impoverished farming communities may promote retaliation and undermine the success of the program.

- **Ecosystem.** Institutional structures, for example within national governments, often divide the management responsibilities for different ecosystems. Mangrove management may fall under the jurisdiction of a forest department, despite the deep ecological and social linkages with coral reef systems managed by a fisheries department.

Why does it matter?

Sometimes systems or problems can be explored by considering multiple levels of a frame demonstrated in applied research (Audouin et al., 2013) — for example, starting with an exploration of the macro-level processes, and then zooming into a sub-section of the system to delve into more details. Stretching or changing our

frames might make our world temporarily more difficult and confusing, yet the scope and possibilities of the solution grow by choosing the right frame at the right time. Expanding or re-evaluating the frame may increase opportunities, uncover new talents and resources, increase understanding of the root causes of problems, broaden the perspective, and expand the number of pieces available to create a new system solution.

The frames we work in impact how we define the problems we are solving, the opportunities we are taking, the people and organizations we are working with, and the impact we are having. We may be causing unanticipated outcomes that we never realize — making a task harder for someone outside of our frame. We might be creating solutions that don't last because we didn't consider other impacts, or the passage of time. We may have chosen the wrong frame or missed the opportunity to see leverage points, synergies, or novel solutions.

While a focus allows us to act, narrowing our frame too much can mean we may fail to see interactions in the broader system that could influence our ability to achieve our goals.

Framing the problem of food in South Africa

Participants in the T-Lab prepare food together. Image © Megan Lindow

Why are discussions about the food system in South Africa so challenging? Not only is one dealing with complex social and ecological systems comprised of many diverse actors and logistics that spread across time and space; but for food in South Africa, the outcome of 'success' is the provision of a basic need and a human right. In the South African context, it is impossible – and in fact irresponsible – not to engage with the legacy of apartheid, race, inequality, land, and even culture.

Researchers in South Africa facilitated a process called a "Transformation Lab" (or a T-Lab) designed to interrogate and strengthen an alternative food system in the Western Cape, South Africa. The team convened groups of people working on food to see the system differently, re-frame problems and identify opportunities for innovations to make a difference. To do this, from the beginning, the team needed to frame the problem broadly enough to account for the many interaction systems that contribute to food insecurity in South Africa, but narrowly enough to set in motion a process to drive change. The participants the team selected to engage in the T-Lab were diverse enough to include different frames of the food problem, but narrow enough that participants could trust one another and engage in dialogue that could lead to tangible action. And the re-framing didn't stop there. During the whole 'T-Lab' process, through various activities like cooking together, lectures, and observing edible plants in traditional landscapes, participants broadened their individual frames to incorporate new insights of the food problem - and potential solutions.

The process embodied many of the principles of systems practice, including co-creation and experimentation, and resulted in tangible change on the ground. For example, the chefs from a well-known restaurant planned to work together with the local food innovator to incorporate a local menu at the Hotel's restaurant. An artisan baker promised to build an oven at a community garden in an informal settlement. The latter has been a huge success in growing the community garden as a space for innovation and education about agro-ecological farming, nutrition, and the importance of healthy diets in the community.

Adapted from Pereira, L. (2017). Coming to terms with messiness: What is a "Transformation Lab"? STEPS Centre Blog Series: http://steps-centre.org/blog

How do we identify our frame(s)?

Changing systems does not require perfect knowledge, but the actions we take must be rooted in an understanding of the elements included within our frame. A first step involves stepping back and seeing both our own personal frames (or, how we see the world) and also the frames we use to define the systems we work in (or, how we define our problems).

Once we recognize the frames we are using, we can test different scales and lenses through which we're seeing the world and framing problems. Our frames should also be calibrated to match the scale of action we or our networks are prepared to take. For example, if we embrace a problem that can only be changed through global action, then we must be able to act at that level. Problems don't shrink in size and complexity just because we lack resources to solve them. Creating a deliberate process of identifying frame, and revisiting our frames, can ensure that we are always working with the right frame at the right time.

Tips for framing and re-framing

- Use clear problem statements to ground frames
- Use a tool such as a causal loop diagram to understand the relationships within the problem and the edges of the frame
- Be flexible - frame, re-frame, repeat
- Use multiple frames if needed. A high-level framing of large processes can help clarify a theory of change, and yet another frame may need to be used to understand one part of the system where the work will focus

Daily practice

- For one week, spend at least 5 minutes reviewing headlines or reading an article from a newspaper or magazine on a different end of the political spectrum to that you see yourself on. Reflect on the frame you use, and the frame the author uses. Imagine if you shifted your frame to either a level above or below the current frame, how would the problem be different?

- In your next team meeting when discussing how to address a new problem, ask yourself two questions: (1) How am I defining the boundary of this problem and (2) Who else might define this problem differently?

PRINCIPLE 3: CO-CREATE WITH INTENTION

"Wisdom is like a baobab tree; no one individual can embrace it."
— Akan proverb

We often think we have the solutions to the problems we see, and feel fairly confident we understand the systems (and world) we're working in. It can seem frustrating when other people bring different solutions to the table that we don't feel are "correct" or the most important to solving the problem. Or, maybe we are surprised that others don't jump to join the programs we have already developed. In reality, for any problem, there are often myriad understandings and perspectives, with each person having a different understanding of the systems underlying the problem and likely a different way of speaking about it. We can find two people or organizations using the same words, but meaning different things. For these reasons, it's vital to bring others into a shared process of co-creation to address complex problems over the long term.

What does co-creation mean?

True co-creation is a collaborative process that ensures the active engagement and representation of a diverse set of system actors and their diverse perspectives in a change process (Banerjee & Ceri, 2016). In the process, all co-creators get a say in defining the problem the process aims to address. While each actor will have specific needs, agendas, or outcomes that they are striving for and invested in protecting, the back-and-forth dialogue between actors enabled by a co-creation

process allows individuals to clarify and share their perspective, re-examine underlying motivations and assumptions, and better align activities toward shared objectives. With a full co-creation process, change can be driven in all parts of a system by partners with a strong commitment to seeing long-term change (Drimie et al., 2018).

A deliberate co-creation process relies on the inclusion of diverse actors in the system as early as possible, rather than in a late-stage project consultation where major decisions have already been made. Co-creation can be realized through a range of methods and processes, including focus groups, structured brainstorms, town hall meetings, deliberative polling, conferences, and so on. Unlike a more familiar kind of collaboration, in co-creation, participants work together to create a new understanding or position which reflects larger more diverse perspectives.

Co-creation enables a more holistic view of how a system currently works than can be achieved by a single actor, or type of actor, working alone. A single perspective into a complex system is typically incomplete and biased. Actors in a co-creation process should represent different parts of the system, including "at-risk stakeholders" and "power players", diverse actors from within communities, formal and informal institutions, and natural elements of systems. These more holistic views of how the world works reduce the risks that a siloed intervention will fail to deliver — or worse, deliver negative impacts — due to a misconception on how a system works.

Debunking myths about co-creation

1. Collaboration or consultation does not equal co-creation

Many initiatives are designed with input from consultations with other actors in the system about the specific initiative and intervention points. While these consultation processes can help to generate buy-in from other stakeholders, they often fail to achieve the outcomes of an intentional co-creation process. Co-creation isn't looking for approval of an already designed initiative, it is creating something shared that includes other perspectives from the beginning. Nor is it experts pulling in feedback from others into a strategy developed in isolation.

2. Co-creation isn't a process to validate your model

A co-creation process is not meant merely to vet an existing model. It is used to collectively build a shared and holistic understanding of a system, its behaviors, and the underlying dynamics. Even if you create the best model, without others invested in creating it, you often won't have the support or understanding necessary to create change.

Why does it matter?

The meaningful dialogue among actors enabled by structured co-creation processes is important for a number of reasons. Intentional co-creation reduces misunderstandings between actors, creates a shared holistic understanding of a problem, and helps people and groups align their work and avoid duplication. This is especially important when finding systems-based solutions to complex problems. One actor working in isolation won't be able to see the impact of their actions, yet with more actors at the table the elements, relationships and feedbacks can be better understood by the group.

With different perspectives on the problems being addressed and the solutions needed, it is vital to spend time getting to a shared understanding of the system so that efforts are aligned and working together instead of pulling in different directions. If people are using the same words, we assume that they all have a shared understanding, yet this is often not the case. A co-creation process allows actors to challenge each others' definitions, assumptions, and perspectives. Opposing views, values, and interpretations are seen as opportunities to interrogate the system from multiple sides.

Meaningful co-creation can build structures and create processes that align efforts, reduce duplication and channel tensions from competition and opposition into new opportunities. Early in the process, it can also identify 'quick wins' where one actor is able to immediately and directly address a concern or constraint raised by another actor. Tension, competition, and opposition can actually be useful in co-creation when stewarded carefully and navigated with a sensitivity to power. For example, a collaborative process such as systems mapping can be used to diffuse opposition by encouraging participants to contribute side-by-side to a broader understanding of the system while gaining empathy about each other's

points of view. Together, the actors can use their various strategic or operational positions to drive the system toward the desired behavior.

With diverse actors at the table, interventions can be better designed to meet the range of needs and motivations of various system actors and encourage long-term support and ownership of the initiative, increasing probability of success. The inclusion of end-users or beneficiaries in a co-design process also helps to calibrate expectations about the likely type and magnitude of outcomes an initiative can deliver, as well as the time scales over which these outcomes can be expected to occur. This reduces the risk of realized outcomes falling substantially short of artificially inflated expectations (Gilani et al., 2017).

And finally, the act of co-creation itself begins to activate systems change: transforming people transforms systems. Bringing together diverse voices, organizations, and ideas helps to establish new networks, change the flow and shape of information, understanding, and knowledge, as well as build new, durable forms of relationships (Drimie et al., 2018 Moser, 2016). When we see co-creation as embedded and emerging from within systems, this highlights the fact that any single actor, organization, or idea is necessary but not complete on its own.

How do you co-create meaningfully?

Structured co-creation processes require diverse participation and perspectives to generate an holistic understanding of how the system currently works, a shared vision of a more sustainable future system, and to identify plausible points that may catalyze transformation to a future system. Simply getting everyone in the same room does not equate to co-creation: Often a co-creation process starts long before actors convene, and continues long after.

Ensuring a co-creation process is meaningful and effective, there are five dimensions to keep in mind:

1 **Diversity and power**

From the start, it is important to consider different types of diversity, for example, the gender, ethnicity, economic status, and age of participants. Many of our most pressing sustainability challenges are deeply rooted in systems with complex historical contexts, often deeply rooted in power and politics. Effective co-creation processes should draw together individuals who span a range of disciplines, perspectives, and levels of power to capture the full range needed to generate an holistic understanding of a system while also ensuring the safety and security of all participants involved (Tengö et al., 2014; Pereira et al., 2018). They should reflect both 'insider' and 'outsider' perspectives, and act on different scales in the system.

Take for example, a situation where actors in a system are striving for both food security and forest protection. It is important to have the voice of marginal farmers, land speculators, and the large food companies among the others all heard together, to unravel the multiple dimensions of the problem and possible solutions. A deliberate co-creation process ensures that less powerful voices are heard alongside more powerful ones. This might involve engaging different stakeholders in smaller groups at different times during a co-creation process to ensure power dynamics are kept in check, and following up after the process to ensure the well-being of all participants.

2 **Trust**

Trust is the foundation to successfully implement systems change. Yet there are no shortcuts to developing trust — it takes time. Too often, the term co-creation is implemented in a shallow and limited way to save time, avoiding the process of genuine engagement with all system actors. When this happens, a clear picture of the system is not shared by all, and the ability to effect change across the system is lost. But more importantly, actors aren't fully engaged in the process (and solutions), because they haven't been heard and trust hasn't been gained. In a co-creation process, it is critical to keep in mind how and if power dynamics intersect with or influence trust between stakeholders.

3 **Clarity of purpose**

The process, tools, and nature of co-creation need to be aligned with the purpose of the initiative. The purpose may vary, and could be to understand the dynamics of a system, evaluate critical failure modes, identify opportunities for intervention, flesh out a single intervention strategy, or something else. Each purpose will require a different process for co-creation.

What is a good group size for effective co-creation?

In our experience, it depends:

- Approximately 15-17 for the core representative group
- Up to 40 for the larger group face-to-face meetings such as learning trips
- As few as 3 and up to 7 for small working groups with specific tasks

4 **Empathy**
The ability to understand and acknowledge another's perspective as legitimate is key to generating a nuanced understanding of the system and developing solutions that align with the more invisible layers of the underlying needs. Deeply entrenched mistrust can be diffused with the right kind of facilitation and process. Any co-creation process that fails to create a safe space for open, collective sharing of ideas, concerns, and motivations — and fails to increase the levels of trust — has failed in one of the most essential dimensions of structured co-creation.

5 **Iterate and commit to co-creation**
Co-creation creates a community with an increasingly deep sense of shared convictions, identities, sense of purpose, and connection with others. A good co-creation process results in a shared identity, strong relationships, mutual support, empathy, friendships, and mutual advocacy. Thus iterating on the process is essential to ensure the community can sustain itself.

For example, in early stages of co-creation, individuals who can offer diverse perspectives on the system may be the most important to engage. New members may be included later as the understanding of the system expands and deepens. It is important that individuals brought into the structured co-creation process are willing to co-create — individuals who are resistant to the idea of co-creation may disrupt or obstruct the process.

Co-creation never ends. The facilitator of a co-creation process will always remain the custodian of the trust built in the process. This process asks participants to be generous with their time, trust, and insights. This contribution needs to be respected, and the process should ensure a high degree of value creation across multiple fronts — be it to the system understanding, clarity or alignment of purpose, or fostering of relationships or trust.

Daily practice

- In your next meeting or workshop, identify the different groups of actors present and rank on a scale of 1-5 the level of power each group has to make change in a system. Are there any radical imbalances? Are there any actions that you personally can take to change any power imbalance?
- Take a lunch break with someone you don't usually spend time with. Ensuring that time and space is given for connections to occur to foster co-creation is really important and it's not that hard to do — it can come from simply sharing a meal with someone. Over time, watch how your relationship evolves with this person.

PRINCIPLE 4: SEE TIME AND SCALES

"One must work with time, not against it." - Ursula K. Le Guin

As human beings, we experience time one day at a time. Our first-hand experiences and horizons are often shaped by this seemingly ordered progression forward. In many ways, the richness of our lives are realized through experiences of anticipation, reliving sweet memories, and finding ways to enjoy our immediate moments and interactions (Poli, 2017). With the advent of technology, some of these experiences of time can be extended and re-imagined. In the past a letter would have had to travel long distances via ship, whereas now a text message or email bridges time (and space) in moments. A variety of tools and technologies, such as virtual reality, now exist that allow us to see and contemplate the implications of time and our place in it.

What do time and scale mean?

Everything in the universe transforms over time at different rates and scales: A restaurant might be established and collapse in two years, while some plastics might last for hundreds or even thousands of years. Cultural frames such as patriarchy, societal paradigms such as religion, and institutions such as democracy, might be slow to change, while technology regimes and consumption patterns might evolve in much shorter time frames. There are also time delays between action and change - for example, a government may enact a policy, but it

may be months or even years before change is seen on the ground. The development of "time sensitivity", or an awareness of how time impacts our problems and solutions, is vital to creating the impact we desire.

In addition to the role of time, many of today's sustainability challenges can also be traced back to mismatches in scale between our problems and proposed solutions (Cumming et al., 2006). For example, if a set of actions is taken at a local level in a context with highly diverse ground realities, the chances that they will have the capacity to address issues at a higher scale are quite low. Thus to successfully intervene in a system, we also need "scale sensitivity" that can help explore how scale influences our definition of a system, a problem, and proposed solutions.

Why does it matter?

The environmental and social challenge we face are often at regional or planetary scale, and have been in the making for decades or even centuries (Crutzen, 2002; Rockström et al., 2009). Yet time lags in our global system have prevented large portions of society from feeling the effects of our degraded environment (Raudsepp-Hearne et al., 2010), which has left us with a need to respond to these challenges in extremely short periods of time. Not understanding the role time plays in our actions and the results we see, increases the risk of missed opportunities or unintended consequences.

Scale and time are intricately intertwined. Given that we are almost always working without enough time or at a scale too small for the problems we face, a continual quest for impact at larger scales in less time is to be looked at as an innovation challenge. We need to use scale and time as lenses both when unraveling a problem or challenge, and when identifying solutions. In doing so, we may then discover disproportionately leveraged opportunities.

Often we have assumptions of how time and scale influence the problems we try and solve, yet with complex systems it is hard to fully understand the implications of these factors in our work. The greater our awareness and understanding of time

and scale, the more effective we will be. If we better understand the events we see, and how our actions might reverberate through time and space, we are better equipped to create lasting change.

Revisiting the dynamics of systems through time and scale

Systems change over time: Our view of our environment right now is a snapshot in time. What we see has been deeply influenced by things that have happened in the past, and is on some kind of trajectory to an evolved state in the future. Further, the system will be changed by our actions and the actions of others.

Change happens fast and slow. Systems do not often change in predictable ways. What might start off as steady may suddenly become random, fast, and chaotic. Systems consist of both slow and fast variables (Walker et al., 2012), so it is important to be both patient and on the lookout for tipping points, exponential growth, resource limits, feedbacks, collapses, and regime shifts (Rocha et al., 2015).

Connection is everywhere. Not much exists in isolation in natural and human systems. The classic example is that of a butterfly flapping its wings in Mexico, causing a hurricane in Beijing (Lorenz, 1963). Similarly, the recovery of European forests has resulted in a decrease in forests in South-East Asia as timber production is moved (Lambin & Meyfroidt, 2011). We can't always predict impacts across scales and times, yet considering scale and time horizons when addressing a problem can help us to build more resilient strategies and mitigate unintended consequences.

System structures underlie time and scale. The dynamics of a system across time are a result of the structures underneath them. This creates patterns and cycles of behavior and different frequencies of occurrence. For example, if we consider a herd of bison, the characteristics of that herd are determined by factors such as gestation period, lifespan, and reproductive age. These factors create the structure that determines the behavior of the herd and how fast the herd can change. Likewise, if an organization's budget is set every year or two years, certain behaviors and dynamics will emerge in response that could either limit or enhance capacity to change (Olson & Eoyang, 2001).

Interacting cycles and frequencies. Differing cycles and frequencies are inherent in natural and social systems. For example, the cicadas emerge from the ground in cycles closely associated with prime numbers (every 13 years or 17 years; Williams & Simon, 1995). Overlapping cycles can interact in ways to attenuate, amplify, or pass through only certain frequencies. Understanding the natural or resonance frequencies of a system can be important in order to understand where and how to scale change: Move too fast or at too high a frequency, and energy tends to be absorbed within the system. Move too slow or at too low a frequency, and the system dissipates before it can accumulate in a meaningful way. Select the right frequency, however, and even small changes in terms of amplitude can have dramatic effects.

Avoiding perverse outcomes: The Tacoma-Narrows bridge, located in the northwestern part of the United States, collapsed because small vibrations in the wind resonated with the bridge's natural frequency. This created an amplifying oscillation that ultimately led to a catastrophic collapse. (Photo: Associated Press; NYT July 19, 2010).

How do we work with time and scale?

In many ways we have become masters of collapsing time and bending it to our will. But there's room to improve: Time is inherent in action. Every action takes time. Recognizing this is important when we try and understand the systems we live and work within. Each intervention takes time to set up, build, grow, gain

momentum, lose momentum. The sequencing and timing of different actions is also important.

Working with time and scale is closely tied to other principles of systems practice, such as identifying frames, experimenting iteratively, and seeing ourselves in the system. By developing a time and scale sensitivity, we become better equipped to frame and reframe problems and potential solutions. We can use tools to understand the rate of change and the potential time lags between actions and and change in the world. And we can experiment, learn, and adapt our efforts to take advantage of opportunities to accelerate change or slow down to mitigate harm.

By paying attention to the frequency or rhythm of change that is already occurring within a system, actions can be designed to better join in harmony with a system's existing patterns, feedbacks, and trajectory of change instead of pushing against ingrained patterns of time and scale (Olsson et al., 2006). If technologies are emerging and spreading that you can take advantage of, get in sync with their development. If movements are forming, anticipate and plan to be in the right place at the right time. Ultimately, moving in rhythm is learning to listen to the system around us. By exploring what is already happening in the system, it becomes possible to take advantage of existing momentum from time and scale, facilitating faster and more efficient change. This can also help us attune ourselves to dependencies between ourselves, our actions, and systems which may change over time.

While thinking about how time and scale can help understand problems and develop solutions, there are four things to keep in mind:

1. **Timeliness of timing**. Often problems are not perceived as urgent or relevant to different groups of actors or stakeholders. An important first step is understanding if the impetus to act already exists, or if it would have to be generated. Individuals and institutions often perceive and work with time differently, influenced by things such as culture or field of practice. One of the advantages of adopting a *co-creation* approach to designing change is that you can build desire and motivation for change and better understand the time and scales others are working on.

2 **Opportunity cost**. Sometimes people think that if it's not clear how to tackle a problem in a complex system, we should try and address the whole system all at once. Yet doing one thing means capacity is lost to do something else. We have limited resources, and that includes limited time. It thus becomes important to ask - what is the trajectory of the problem, and how is it changing across time and scale? What would we lose or gain by acting now instead of one, five, or ten years in the future? Where should we choose to place our limited time, attention, and resources? Alternatively, could acting do more harm than good?

3 **Slow down to accelerate**. Are there moments in time when we should deliberately choose to slow down certain relationships, decision points, processes or flows? It may seem counter-intuitive; but delaying a decision or an intervention might trigger faster, greater, or longer-lasting change through aligning initiatives or patterns of behavior (Seijger et al., 2015). By understanding the dynamics of systems, it becomes easier to understand when is it best to slow down and when is it best to speed up. Disrupting existing patterns may in fact help us establish new ones.

4 **Align action to scale**. If a goal is to prevent species from going extinct that range over a large land area, working at a small scale will likely not be sufficient. On the other hand, if an endemic species exists in one small location, your scale of intervention might be very different. Remember that scales can be different in relation to communities, institutions, economies, species, and geographies. It may be important to tailor interventions to multiple scales, or nest programs in multiple connecting scales — such as connecting actions in multiple locations across a country.

Daily practice

- For one month, write down in a notebook a daily observation about the system in which you're working. Every day, make another observation about the same system, but have it focus on a different aspect of the system. Observe over time how the observations of your system add up. And if you like the practice, keep it going!

- Imagine the problem you're working on one year from today. Identify one thing that has changed. Then, write down how that changes the problem or the current solution. Try it for a longer time horizon — 5 years from now, and 10 years from now.

PRINCIPLE 5: FIND SIMPLICITY IN COMPLEXITY

We are continually on the quest for "simplicity on the far side of complexity." - Oliver Wendell Holmes, Jr, Associate Justice of the US Supreme Court 1902-1932

Some parts of complexity are inescapable in their complexity and cannot be reduced to simplicity. Solutions to complex challenges, however, can theoretically be simple. The idea of finding simplicity in complexity debunks the assumptions that complex solutions require greater resources to address than less complex or complicated challenges.

Many people also have an aversion to complexity — accepting complexity involves opening the doors to uncertainty, which brings a range of potential risks. Thus finding simplicity in complexity is both a critical and inherent part of systems change work.

What is simplicity in complexity?

The chances of finding solutions that are both practical and capable of transforming complex systems lie in embracing their complexity — and from that, gaining new clarity about the pathways of change. The idea of leverage points, or places in the system where a small change could lead to a large shift in system behavior (Meadows, 2008) has piqued the interest of social and environmental change makers alike. Yet leverage points are rarely intuitive: It is *through* this

embrace of complexity that allows for the discovery of simpler solutions that work with the system to create change.

That we can find simple explanations for complex behavior in the architecture of a system is a truly fascinating and wonderful aspect of living systems, something that any observer of natural and social systems can find anywhere in the world. Each finding of simplicity is a discovery that is co-created and re-created through engagement with people and nature for a defined purpose. It's the simplicity that allows us to teach our children to value nature, help someone see a different side to a family conflict, or prompt a political leader to believe in the changes necessary for living systems.

Why does it matter?

Most of us have a desire to simplify the world around us and to find ways to control the world we live in. It is also natural to feel overwhelmed with complexity or to brush it aside as a broad concept that can be ignored in favor of immediate actions. We simultaneously need tangible actions we can take amidst the complexity, while not being naive about why our problems are still persisting despite our best efforts to fix them. The design field in particular celebrates the quest for a minimalist solution that gives maximal effect — and continuously iterates ideas until such a solution is found. To equip oneself with the knowledge and tools to navigate through complexity and identify interventions, one must first accept and embrace the challenge.

If a problem domain is complex, and we ignore that complexity, the solutions we come up with will likely only address surface level issues and not create the transformative change we seek. A foundation for finding simplicity is embracing the four phases of system change: Taking the time to build support for change (i.e., 'Lay the foundation'), and understand where we are ('Understand the current system') before we choose how to act. Only with this foundation does it become possible to gain simple insights on the path to change, which can be used to imagine futures ('Envision the future'), and identify leverage points that can lead to lasting change ('Bridge the gap'; Stroh, 2015).

It is important to believe that *there are simple actions we can take on the far side of complexity* that can truly make a difference. We should strive to find these, rather than settle for complicated or impractical solutions that seem easier.

How to find simplicity in complexity

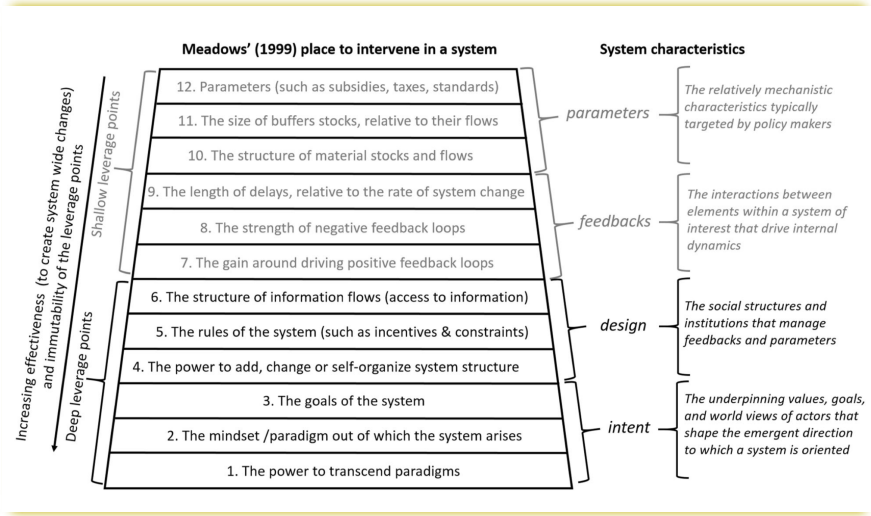
Finding simplicity in complexity involves more than anything, letting go. Recognizing that change happens - with or without your efforts - is a fundamental first step to accepting complexity. Also recognizing that if we are taking action against larger forces of a dynamic in a system, it will be like swimming upstream. Only when we recognize this reality can we start to attune ourselves to the moments of simplicity that happens along our systems journey.

Take for example, the concept of natural resource governance. It is wildly complex - in its formal structures, processes, and power dynamics. But there are ways we can make sense of these complex, and often abstract concepts: Elinor Ostrom, winner of the Nobel Prize in Economics in 2009, distilled eight design principles for natural resource governance from embracing, studying, and unpacking the complexity of social-ecological systems (Ostrom 1990). Through empirically studying communities around the world, Ostrom's eight principles have been extremely influential in building community governance structures which support collective management of natural resources. Developing and adhering to simple principles designed to honor the complexity of the real world is a powerful way to find simplicity in complexity.

There are also more specific ways we can find simplicity throughout the four phases of systems change: For example, through finding leverage points. Leverage points are places in a system to intervene where small changes can have big effects (Meadows, 2008). More often than not, no one leverage point will be a panacea solution to a problem. That said, finding the right leverage point in the right context is truly finding simplicity in complexity.

There are both deep and shallow leverage points. Shallow leverage points are often more obvious, and it is typically easier to tackle these points. Shallow leverage points may include things like taxes, subsidies and standards. Yet over the long

term, these shallow points do not dramatically change the structures that are driving a system generating unwanted behavior (Abson et al., 2017). To achieve enduring change, we need to take the time to uncover deeper leverage points, capable of delivering greater impact. Donella Meadows (1999) identified 12 places to intervene in systems (see the figure below, reprinted with permission from Abson et al. 2017) that range from more shallow points of leverage in a system, such as taxes or subsidies for a particular commodity, to deeper leverage points that involve shifting the mindsets of paradigms that underpin a system, for example, the values we ascribe to nature. It is through addressing these deep leverage points that we may find the highest potential for return.



12 leverage points for systems change (reproduced with permission from Abson et al., 2017)

To find simplicity, we can ask ourselves questions such as what are the common elements that appear across scales in our system? Are there components of the system, such as feedback loops and stocks, that seem influential? Are there particular thresholds or non-linearities in operation? And do elements or feedback loops generate cascading effects? These questions bring us back to the fundamental dynamics driving a system. We may also find that some dynamics are known across systems and repeat in different sectors and contexts. These

repeating relationships are commonly referred to as System Archetypes (Senge, 1990). Archetypes can help identify common behaviors in human systems and help us see potential leverage points which have been witnessed in other systems before. Learning to see patterns in systems helps us avoid reinventing the wheel.

Securing a future for African elephants:

Finding the right leverage point

Each year, at least 20,000 African elephants are illegally killed for their tusks (CITES, 2014). A recent resurgence in demand for ivory, particularly in China, fuels this poaching epidemic. The elephant ivory trade not only threatens the very survival of elephant populations and causes broader ecological consequences, but also endangers the lives and livelihoods of local people and undermines national and regional security. For decades, conservation groups have focused efforts to combat illegal ivory trade on supporting law enforcement efforts and governing trade. While these are leverage points in the system, they do not necessarily address the values and beliefs that perpetuate the cycle of ivory trafficking and consumption.

Yet change is coming: China closed its legal markets in 2018; Hong Kong in 2021; and other Asian countries with open ivory trade and are under substantial pressure to take action. Within this context of policy change, WWF has recognized the importance of tackling the deeper leverage point: the behaviors of individuals who purchase ivory products and the associated societal norms. By understanding the underlying motivations of ivory buyers, behavioral strategies targeting diverse consumers of ivory seek to build a new social norm around ivory consumption. By aligning tactics on human behavior with shifts across scale and time in the national regulation, transforming the system structures that perpetuate demand and consumption of ivory becomes possible.

Daily practice

- Review a set of projects or programs in your organization. Using the 12 leverage points, can you identify what kinds of leverage points the projects are trying to address in your work?
- Draw a simple picture of your problem that you could use to explain to someone who doesn't know anything about it.

PRINCIPLE 6: EXPERIMENT ITERATIVELY

"I never lose. I either win or learn." - Nelson Mandela

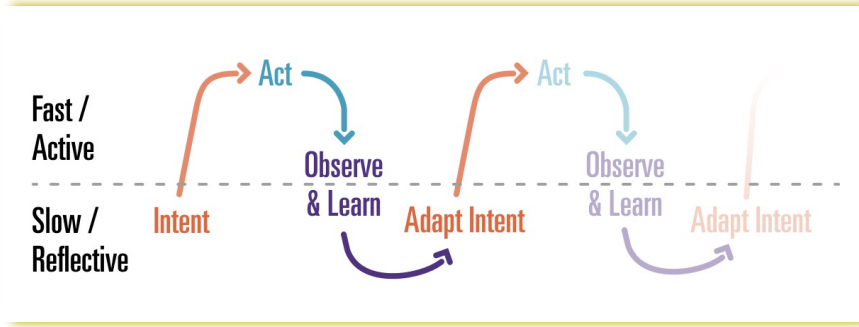
What is iterative experimentation?

Systems are dynamic, living, structures that change and evolve. Systems often have emergent properties, which makes it difficult predicting how our actions may influence change in the world. To take action in a way that can drive meaningful change in a system, it is important to continuously experiment, learn, and iterate.

Experimenting iteratively can simply be described as 'learning by doing.' The process of testing and learning in iterative loops encourages an ethos of exploration and discovery, which supports us in identifying what actions to take. It allows us to use insights from successes and failures to rapidly integrate them into our own understanding of how systems work, and ways to drive positive and lasting change. To venture beyond our usual repertoire of responses to a situation, we can experiment and explore different pathways to change — granting the mental and physical space to try new things without judgement and expectations.

Iterative experimentation involves oscillating between periods of action and periods of reflection, to ensure that testing and learning is built into the process. The period of action involves rapid testing, implementation, and building of momentum; and the period of reflection involves slowing down, learning from the previous actions, and re-adjusting intent and course of action as needed. This type

of experimentation has been used in a variety of contexts — from the Lean Startup methodology (described as a Build-Measure-Learn loop; Ries, 2011), to design thinking (Brown, 2008), to developmental evaluation (Patton, 2010).



Why does iterative experimentation matter?

We know that the systems we work in are complex and ever-changing; and therefore, we may not implicitly know the specific details or exact course of action to achieving long-lasting change. There exists a tension here: despite not knowing every detail required to change a system, we cannot wait until we have thought of every possible course of action and outcome before we act. We have to act knowing that we have incomplete knowledge of a system, recognizing that our understanding of the system will change through time — as the system itself will be changing through time. In essence, applying resilience thinking to a problem, we need to develop 'safe-to-fail' interventions from which we can learn, adapt and repeat (Ahern 2011). Long-term, rigid plans for change often do not build periods of reflection, slowing down enough to let any new changes in the system materialize before making the next move. We experiment iteratively to test and implement actions, observe and learn how they affect the system, and adapt our intent and path forward.

Progress on many system challenges may require changes to things that are deeply embedded — such as core individual and organizational values, beliefs, and attitudes — these can be difficult (and sometimes, impossible) to influence. In addition, our actions may lead to unanticipated feedbacks or emergent system behaviors that could lead us away from the desired outcomes. Constantly testing

hypotheses of what will work is the only way to address these deeply entrenched aspects of change, ensuring that we are continuing to move *toward* our goals — and allowing space for our goals to change as the system changes!

How to experiment iteratively?

Start by setting your intention. The intention should be based on a comprehensive understanding of the system's current state, and a vision for what the desired future could be. This intention provides a simple anchor and alignment to work towards. There will never be complete clarity about what is 'right', so plan for taking the next action. A guiding question could be *what are you aiming to achieve in undertaking the proceeding activities?*

Then, take action. Every action taken is a step towards your desired future. Taking any action, even one based on only an initial understanding of the context, will provide momentum and a basis for learning. Every opportunity to act will provide valuable learning that expands your view of the broader system. A guiding question could be *what will you do and what impact will it have on the system?*

Start to slow down, observe and learn. Action generates new insight, particularly if there are unexpected or emergent effects that emerge. Observe with a learner's mind and active curiosity. Interrogate your assumptions, and capture learning and insights through observing and documenting feedbacks. These insights will inform your next actions and, importantly, should also serve to increase your view of the entire system and its dynamics. Active curiosity and a non-judgmental attitude will serve to promote an uncompromising stance and commitment to and dialogue with curiosity, inquiry, and wonder with and between parts in the system. A guiding question could be *what is the system doing?*

And speed up - adapt and iterate. Based on action and learning, the original intention is evolved and adapted. This serves as a new basis for further action and another iteration begins. A guiding question for this is *how has a new understanding of the system changed the direction of your intention?*

"One of the biggest challenges facing conservation today is our changing climate. The real test on WWF´s ability to tackle climate adaptation is not merely about how well we understand the general principles or conceptual frameworks that govern vulnerability, risk or resilience, but how we can bring this to bear in our practice. In that context, the climate adaptation framework in Colombia is constantly evolving, mostly as a result of "institutional experimenting" — how to, for example, experiment and test our ways of assessing vulnerability, on the ways we assess adaptation priority actions, and most recently, how to transition to supporting resilient landscapes." — Silvia Vejarano, WWF-Colombia

The focus of iterative experimentation is also to try and break or build on habitual ways of acting that have appeared to work well in the past, to strive towards new and innovative ways of making meaning and taking impactful action in the world. There is no need to be an expert to start experimenting. In fact having a beginner's mind can often be a useful starting point for more creative thinking about a problem (Kelley, 2005). Cultivating this curiosity and a willingness to try things out is an essential component of systems experimentation.

Start small and then build to scale. Experimental iteration can occur on the individual level, an organizational level, and even at a systems level. But to begin, we start with small experiments that allow individuals to learn.

Learning from failures: Introducing appreciative inquiry

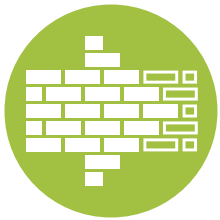
When experiments fail to deliver their intended outcomes, it is an opportunity to work out why this happened, to challenge the assumptions that enabled our expectations, and then to learn from this as we reconfigure how we will act the next time. Making constructive use of negative feedback and failure results in an increase of individual or organizational self-knowledge and supports sustainable learning and change. *Appreciative inquiry* is a method that involves starting with a set of problems and, through discussion, re-framing them into something positive.

An appreciative or positive stance is an approach for finding the learning and intrinsic value in the full range of human experience. It is a stance or perspective that believes that, at their core, individuals and institutions are healthy, resourceful, and capable of change. In any given moment, they are doing the best they can with who they are, and, through iterative experimentation, they can leverage their more developed attributes and attend to their less developed aspects in service of growth and development.

Source: Whitney & Cooperrider, 2011

Daily practice

- Once a month, make a small change in your daily routine. It may be small, such as changing how you run your weekly meeting, how you set your tasks for the day; the point is to plan, try, experience, get feedback, make a choice to do it again, abandon it or improve it for next month.
- Iterate on something for at least 1-2 hours. Go through at least three 'iterations.' Take for example, a talk you are preparing. Take 20 minutes to prepare, and then practice right away (out loud) to a small group of colleagues or friends. Refine, and then give the talk again. And do it once more.



PRINCIPLE 7: ALIGNING STRUCTURE WITH CHANGE

"Don't spend time beating on a wall, hoping to transform it into a door."
- Coco Chanel

In our daily lives, we move between many kinds of roles. Sometimes we are acting entirely on behalf of ourselves, other times we are supporting or nurturing our families, participating in or leading teams, collaborating with others on the sports field or in a band. Some days we are consumers in the economy, or see ourselves as part of a place, a region, or a global network of people. We move seamlessly between these roles internalizing the rules, expectations, and functions that we perform (Biddle, 1986). This is necessary. If we had to consciously think about how to act for every unique role we fill, we would become paralyzed and slow to respond to choices and decisions.

At the same time, we all act and exist in collective ways. We build organizations or networks or communities that hang together around shared visions, ideas of what is 'good' in the world, kinds of things we would like to achieve, or particular rules that inform and order our daily lives. These collective actions sometimes take a while to get started. It takes a lot of energy and enthusiasm to build a new business or center from the ground up, with careful thought going into who does what and why, and in what ways to communicate within and outside of the

collective. Equally, thought must also go into what procedures, guidance, rules, and incentives should exist to remove many of the tiny but complicated decisions you would have to make if you didn't know how to 'belong' or contribute to the bigger goals.

What is aligning structure with change?

In an ideal world, these individual actions and collective structures would reinforce a set of relationships that lead us to a sustainable future. However, our structures also represent the real world outcomes of our internal assumptions, ideas, world-views and the ways we think that things 'should' be done — for example, the ways organizations are set up for either collaboration or competition. If our networks, organizations, or communities were established at a different point in time, they might be informed by thinking and world-views that do not reflect current knowledge or visions for the future. Therefore, we get a mismatch. One that can be hard to reconcile. And, even if we can get out of it — and modify our rules, procedures, guidance, shared visions, or ideas — it can take time to know if the new structure is working better. In some cases, things may get worse first before they get better.

If we are trying to generate new ideas and design new kinds of interventions, we need to make sure that our form matches our function — or, that we are working in ways that are 'fit for purpose'. How can we make sure that we, our organizations and our processes, are fit for dealing with tricky, connected problems and support us in the quest for effective and efficient solutions? Just as the lion is not fundamentally equipped to eat leaves from tall trees, and giraffes can't kill and eat prey, so too, not every person, organization, or network can play the same role.

Why do we align structure with change?

Many of us have sat in project design and inception meetings where a whole range of rules, procedures, forms, and mismatched time-frames are examined in order to generate something impactful or useful. Underlying the mismatch between these things and the problems we tackle is the idea that the world is complicated, rather than complex. Procedures that work in one place, don't completely fit in

another. This is sometimes very obvious when working between different cultures, geographies, points in time, or developed and developing countries.

For example, it may be complicated to oversee the budgeting and financial process for a collaborative project with different agencies and consultants, and among different countries. There are many policies, rules, forms, individuals, bank accounts, and currencies to harmonize. It can be challenging to find ways to make linkages to satisfy the needs of the funding provider as well as make the project viable to implement. Furthermore, within that same project, there may be requirements for 'safeguarding' and a need to standardize what this looks like between different contexts — this is complex. The design of many safeguarding procedures and processes assumes that the world is complicated; that we have a shared set of values, morals, and rules of law; and that people can behave in predictable ways. However, these fundamental pieces vary greatly from place to place and over time. Influencing factors include places of societal conflict, different gender norms, alternative political regimes, fragile circumstances of peace, highly degraded environments, levels of development, health problems, or lack of infrastructure and public services. In reality, the premise of safeguarding has to meet with real-world complexity. The answer to each question becomes: it depends. Here, the structures, procedures, rules, and advice would need a rethink from place to place. In situations of complex problems, rigid projects or systems and generalizations rapidly decay or even make the situation worse. What worked in one place doesn't work in another (Bar-Yam 2004; Funnell & Rogers 2011). This is why it is fundamentally important to get our framing correct and understand the implications of complicated versus complex problems and solutions.

How do we align structure with change?

A fundamental first step in aligning structure with change is building our capacity to see the structures that exist around us — both formal and informal. We can fall into the trap of seeing each role we play in society or in our systems as being bound by these rigid rules, policy, relationships, and processes. We allow these things to define the way we act or make choices. Sometimes it is true that we have limited direct power to change or rewrite these things. But this is only part of the equation. Given that systems are made of many interrelated parts and

connections, it is also possible that we can recombine, absorb, step around, or team up with others to form new combinations of structures and processes (Cleaver, 2010).

There are four ways we can start to align structure with change: Embrace our individual capacities, see and change structure in organizations, foster culture aligned with change, and support structures that foster systems-level change.

Embrace (and use) individual capacities

Sometimes we think that we have to formally be a 'manager' to influence or change policies or teams, or to make decisions. One of the most critical things that we have control over is ourselves and how we work to influence, inform, question, or engage with other people. This is true at all levels. We can model new behaviors, provide reinforcement to new ideas, make suggestions, or advocate for change within our networks.

After reviewing hundreds of social change processes, researchers identified three roles that individuals tend to play when participating in periods of social change: *Agitators*, *innovators*, and *orchestrators*. *Agitators* bring problems into public awareness, *innovators* create solutions to address problems, and *orchestrators* coordinate action across groups, organizations, and sectors to scale solutions. Any pathway to change requires all three (Battilana & Kimsey 2017). A way to align structure with change involves knowing what role you have the capacity to play, and when and how to play it.

For example, if a project funding cycle is disrupting the ability to drive change on the ground due to heavy reporting burden, or rigid spending rules, a grant manager may be well-positioned to raise concerns with a donor during annual grant reporting. Someone from a different sector like finance or business may have ideas on novel funding structures that could be tested. And a senior executive may have the power to mandate an experiment with willing staff to foster learning across levels. This network of individuals working the edges of their capacities allows for transparent learning across silos both within an organization and partner network. It is this combination of roles and actors who push at the edges of our sphere of influence that can break down and build new structures to align with change (Westley et al., 2013).

See and change structures

When planning actions, we need to first be aware of the structures, policies, and institutions that will support activities over the long term, and how their patterns over time influence our ability to make effective change. Structures that influence our actions sometimes obvious, for example, our team structures and reporting lines, while others are less obvious, for example, the subtle shifts that result from leadership transitions, or the behavioral patterns created and perpetuated by staff per diems.

Let's return to our financial example: In many social and environmental change organizations, donor funding from governments, foundations, and individual supporters financially supports efforts to make change in the world. To secure funds, project teams are often required to outline specific activities that will be carried out each year of a grant, with reporting done an an annual or bi-annual basis to promote transparency, and reassurance that funds are being used wisely. As a result, project teams are often made to articulate a vision of the project and linear pathways through which they will achieve that vision. However, this structure does not always provide the space or encourage co-creation, experimenting iteratively, and adapting with time and scale. Funding mechanisms should be designed to support and reward nuanced forms of impact, and building the right individual and organizational capacities. In the spirit of adaptation and learning, they should be less rigid in terms of activities, number of forms, level of detail or kinds of level of acceptable risks.

When implementing change in existing structures, allow enough time for the transition between the old and new ways of operating. Sometimes things will get worse first before change arises. You can start with small experiments - testing new ways of working within one work stream, theme, or opportunity. When experimenting, ensure the experiment spans different scales and perspectives within a system: In an organization this could mean an executive team, project leads, the stakeholders, and ultimately the evaluators. This can help ensure lessons learned don't stay hidden within 'innovation hubs' of an organization, and rather, change permeates the system as a whole, fostering a shift in system behavior, and perhaps eventually, values, attitudes, and norms.

See culture as part of structure - and change that too!

Structure isn't just reporting lines or building architecture. As the saying goes "culture eats strategy for breakfast" (Drucker, 2006). And similar to formal structure, a critical first step is increasing our awareness on culture, and how the patterns that stem from organizational cultural values, norms, and beliefs shape our capacity to act.

With the importance of diversity and social inclusion in the workplace now a mainstream concept, many organizations are putting efforts into policies in the workplace. Adding more formal structures won't necessarily change culture on its own - change will require careful consideration of underlying values and norms.

Practicing 'seeing ourselves in the system' can encourage the reflection needed at an individual level to understand organization norms and culture, and training ourselves to see the symptoms of culture. For example, many organizations emphasis the importance of 'speaking with one voice' on issues. Yet it is rare that all individuals will share the exact value or perception of an issue, so often the 'one voice' is truly the 'loudest voice.' Encouraging a diversity of voices that reflects the diverse values that makes up organizations creates a healthy, honest culture focused on listening and learning. The same goes for attitudes towards failure: For many organizations, demonstrating our successes is a fundamental part of culture for good reason, building trust with those who support our work, and morale in an organization. But creating a 'safe to fail' culture is critical for practicing 'experimental iteration,' and encouraging this mindset of learning. While formal structures can help facilitate the space for diversity and learning, it's often the more subtle shift in the attitudes and behaviors of staff across levels of organization that has the power to build the new norms and values.

Align structures across systems

As we learned in Part 1, system structures shape system behavior. As a result, the broader structures in the social, political, and ecological systems our organizations exist within, have the capacity to either advance or hinder our ability to make change. Like ecosystems, some of us and our organizations are set up better for performance of one kind of a function or another. It's not that our organization has to (or can) tackle hard problems alone.

Returning again to our donor example: A donor may be interested in tackling a particular societal problem, be it the climate impacts of our food consumption, or wildlife trafficking. A thematic call for proposals might be set up to spur the interest and action of implementing organizations, however as many non-profit organizations are keen to support their funding revenues, individual organizations may be more incentivized to pitch to be the organization best positioned to tackle the problem. This could dis-incentivize collaborative approaches to tackling problems that draw on different capacities in different organizations, and inadvertently weaken the capacity for other organizations and institutions to support change-making efforts.

There is no one-size-fits-all to these kinds of systemic dilemmas, but as with all levels of aligning structure with change, the first step is acknowledging that they exist. Lessons from social change work through approaches like Collective Impact have distilled principles of practice [see Box below] that emphasize the importance of working across systems.

Collective Impact Forum: 8 Principles of Practice

Collective impact initiatives are highly structured multi-stakeholder efforts designed to achieve major and lasting impacts on a social or environmental problem (Hanleybrown et al., 2012). These initiatives are characterized by a common agenda, shared measurement systems, a portfolio of mutually reinforcing activities, managed via a dedicated 'backbone' organization which facilitates continuous communication among the stakeholders (Hanleybrown et al., 2012).

The Collective Impact Forum, a community of practice for collective impact practitioners, identified the following principles for *how* to align structures to achieve change:

- Prioritize equity in the design and implementation of the collective impact initiative.
- Innovate with the involvement of cross-sectoral partnerships within the initiative.
- Ensure community members are involved in the initiative.
- Collected data is continuously employed to learn, adapt and improve.
- Recruit and develop leaders with unique system leadership skills.
- Maintain a focus on program and systems strategies.
- Nurture a culture of strong relationships, trust, and respect between participants.
- Customize the initiative to the local context.

Adapted from: Collective Impact Forum (2014)

Daily practice

- Identify a barrier in your organizational structure, identify the capacity you need to overcome it.
- Try being a connector. Bring together two people who don't know each other from different divisions in your organization, who might not normally engage. Join them for coffee, or lunch, and over time, observe how and if their relationship changes over time.

PRINCIPLE 8: ACT BASED ON EVIDENCE

"A little knowledge that acts is worth infinitely more than much knowledge that is idle." – Khalil Gibran

Often extremely urgent action is gated by the absence of sufficient evidence. Systems work involves creating a basis for new evidence as one takes action based on systems insights. Generating and using systems-based evidence implies instrumenting the system to generate information and evidence about the factors and/or states that could affect desired outcomes, and identifying unexpected changes or unintended consequences.

Standard approaches to monitoring, evaluation, and learning (MEL) rarely support systems challenges, emergence, and unknown-unknowns well. For MEL to be effective, it needs to inform, and actively spark, individual reflexive behaviors and the relationships between partners. The process of MEL allows for the tracking of progress and outcomes, health of relationships between actors, and ultimately contributes to a better understanding of the complex systems in which we work.

Well-designed MEL should blend information (quantitative, qualitative, objective or subjective) from an array of sources into the day-to-day conversations between actors, shaping the evolving understanding of the system and triggering improved actions and strategies. Using a systems approach enables monitoring to act as a

'radar', reducing the chances of unintended consequences, and scanning for key changes in system behavior.

Why is it important to measure things?

Put simply, you can't manage what you can't measure. The specific indicators we choose to measure are, by design, the yardstick against which we understand progress and judge success or failure. Consequently, if we focus on inadequate measures of progress, we may head down the wrong path, oblivious to important dynamics that will influence our ultimate impact (Pressey et al., 2017). However, all too frequently, monitoring efforts start and end with the selection of a long list of indicators designed to track the status of specific components of a system, or to identify whether or not a specific result has been achieved. With these efforts comes the risk of ending up with overwhelming quantities of information, or information ill-suited for the decisions that need to be taken.

Effective monitoring requires tracking not only the actors within and dynamics of the system in which a program or project takes place, but also the elements relevant to the specific changes implemented by those actors. Monitoring within a given system can be thought of at happening at three nested levels (Preskill et al., 2014):

1. System level: a collective measurement system (i.e., one that is co-created by, and accessible to all system actors) allows different actors to have a common understanding of key trends in the system, or track progress of specific actions.
2. Organizational level: organization-specific monitoring that tracks attributes of interest to a specific organization and its role in the system.
3. Project level: measurement systems specific to the individual interventions or projects that actors employ to achieve systems change.

While these levels are not necessarily mutually exclusive (in fact they can be mutually reinforcing), it is important to allow monitoring at each of these levels to be tailored to the specific decisions that need to be taken, rather than forcing a

single, unified protocol across all layers in the system. We must respect the different information desired — and needed — by different actors and at each level of operation at different times. As we also work to see ourselves in the system, we need to be aware of how the act of collecting information — and the effort required — will have its own impact on our projects, in our organizations, and within the broader world.

Most importantly, as we decide *what* to measure, we need to focus on *why* we want to measure it, and *how* the information it provides will be used to support evidence-based reflection and iteration.

What do we measure?

A good indicator provides information needed to take action on an appropriate time and spatial scale, in an accessible format, and with the appropriate levels of precision. It can be quantitative, qualitative, objective, or subjective; and its appropriateness is defined by whether it tells us the desired information about the specific system component, relationship, or behavior.

Poorly designed indicators fail to do one or more of these things. At best, they are simply not useful to decision-making; while at worst, could lead to wrong decisions and eventually, to perverse outcomes (Pressey et al., 2017; Barnes et al., 2018). Where an indicator does not closely track the phenomenon of interest, implementation can shift toward maximizing the value of that indicator, rather than creating the desired future system (known as Goodhart's Law; Goodhart, 1983).

When what you measures drives your mission:

Image © Shauna Mahajan

For decades, a major strategy in conservation has been setting land or ocean aside for nature. Around the world it is now common practice to simply count the total hectares or square kilometers that have been set aside for conservation, as a proxy for the protection of nature implicitly assumed to occur (Pressey et al., 2015). Yet, research has shown that as the total quantity of land set aside for nature has increased substantially, biodiversity declines continue to accelerate (Green et al., 2019). Ensuring a biodiverse world relies on much more than total quantity of space, and an indicator only looking at quantity of space incentivizes the creation of *larger* protected areas, rather than protected areas that have maximum *conservation impact* (Barnes et al., 2018).

Measuring stocks and flows

It is important to consider the relationships and dynamics in our complex world when choosing what to monitor. The idea of stocks and flows may seem abstract, yet they are important concepts when looking at and selecting data. To refresh, stocks are accumulations of "things" within a system — which could be, for example, elephants, water, trust, or carbon. Flows are what increase or decrease a stock and they are measured as rates of change over time. In the United States and many countries around the world, Gross Domestic Product (GDP) has been used as a sign of health and growth of an economy (Costanza et al., 2009). GDP is a measure of products and services produced over time — a flow. Taking an extreme example, if more caskets are produced and more funerals paid for and held, GDP will rise. Yet that doesn't tell the whole picture of human life or human well-being, which are both stocks.

We see similar patterns when we consider forest conservation. Deforestation is often measured as the rate at which the forest is being cut down, but doesn't include how much forest there is. Consequently, if we only monitor tree loss, without also understanding forest extent (i.e., the stock), we are blind to tipping points in which forests may undergo a regime shift to other habitat types (Dakos et al., 2014). Likewise it may be important to consider what goes into creating more forest, such as rate of replanting or tree forest recovery rates. We often measure rates of change, without being intentional about how this relates to the accumulation in stocks, feedbacks and thresholds. If we place too much reliance on only one type of variable, we may miss some important tipping points and thresholds where systems will shift (Dakos et al., 2014).

And finally, it's also important to pay attention to the relationships and structures that change those variables. In a complex world, relationships change — they could shift completely or grow or weaken in strength. Well-designed monitoring may help us track these changing relationships directly, or intuit the changes based on unusual or unexpected runs of events.

Measure better indicators, not more indicators

Typical project or program measurement tends to focus on gathering as much data in spreadsheets as possible. This ignores the relationships behind the changes in those data points; it misses what causes those numbers, and what relationships are changing because of action. A focus on 'spreadsheet variables' can leave hidden hidden from discussion and attention assumptions about what's changing these variables and how they're related to the larger system. This is a serious oversight (Hennessy, 2018). Synthesizing data into evidence that can inform reflection and iteration is critical. Measuring 'better' indicators may involve dedicating more resources to a smaller set of indicators that provide highly relevant information about a system compared to diluting resources across dozens of poorly designed indicators with low informative value.

One way to think about measuring 'better' indicators is through the frame of 'lead and lag' indicators, which provide information on both the outcomes we seek and how we get there (Kaplan & Norton,1996). A lagging indicator measures the ultimate goal or outcome we are trying to accomplish, such as number of

elephants or trees in a forest — yet it takes a long time to begin detecting change in the measure. Leading indicators are actionable and predictive, and are set as actions which will create change in that lag measure. Leading indicators aren't as easy to determine as the lag indicator; but without lead indicators, it's difficult to know how to influence your long-term goal. Developing good lead and lag indicators requires a comprehensive understanding of the system's state, relationships and feedbacks, and potential trajectories of change.

As time goes on, the relevance of specific indicators may wax and wane. It is important to recognize when specific indicators are no longer useful, and let them go. Other times, it's about realizing that an indicator's importance has increased, in which case we would choose to stick to it. For instance, data that spans several decades may exist a particular variable, collected, for example, through a national population census. As time goes on, we may improve our ability to measure that variable. Switching to the new, better method of data collection may seem like the best choice, but if we do this, we lose our ability to compare our 'new' data with the old. Rather than throw out the old indicator entirely, we may want to see if there is a way to retain the ability to use our existing data to measure long-term trends— even if we include a way to measure that variable.

How to monitor and learn for systems change?

A more meaningful way to identify the knowledge needs of all actors in a system is by understanding what their key questions or motivations are, or by exploring upcoming opportunities to act. Gaining this perspective from different actors in the system can help identify where the synergies are for information across different parts of the system; and it informs a collaborative, coordinated monitoring effort that meets the needs of many.

The blend of monitoring, evaluation, and learning approaches needed to inform decision-making will evolve over time. In the early stages of a change process, the focus could be on the relationships between the various actors involved in the effort (Preskill et al., 2014), and on a program or initiative's governance (Patton, 2010). These may be supported by a handful of coarse scale indicators, more qualitative in nature. As the efforts mature, the emphasis shifts toward process indicators which capture the dynamics, inter-relationships, and feedbacks in the

system, targeting those influenced by the specific actions undertaken (Preskill et al., 2014). The inclusion of "outcome" indicators, which track whether or not the system is producing the desired results, is important, although change may take a long time to be seen.

Reconciling reductionist approaches to monitoring and evaluation with systems change

Many monitoring approaches come from a reductionist standpoint and seek to simplify the complexity of systems into simpler or more fundamental building blocks. Reductionist approaches can still play an important role in tracking systems change efforts, as long as implementation teams are aware of the assumptions underpinning each approach.

Impact evaluation, for example, seeks to understand the cause-and-effect relationships that exist between an intervention and an outcome (Gertler et al., 2016). Unless implemented with considerable care, impact evaluation tends to oversimplify systems complexity and ignore the differing perspectives of actors in a system. However, impact evaluation can still play an important role in tracking how systems change interventions, if the evaluation team understands system dynamics, draws on multiple perspectives and takes a nuanced approach to delineating system boundaries (Williams, 2015). Similarly, qualitative impact evaluation methods, such as Bayesian Contribution Tracing (Befani & Stedman-Bryce, 2017) can be easily employed in a systems context, as their origins lie in generative approaches to causal inference.

The most important component of monitoring for systems change is the creation of regular opportunities to synthesize and reflect on the information gathered (in accessible forms), inclusive of all actors in a system (Patton, 2010). These evidence-based discussions allow individuals to understand current system dynamics, and track the progress of systems change. Individual reflection, prior to group discussion, allows for diverging disciplinary perspectives to emerge and later be discussed and debated. In some cases, diverging perspectives on what the data mean may be reconcilable, and in others not. While divergent views may persist, agreement does need to be reached on appropriate paths forward. Without the opportunity to synthesize, reflect, and refine a course of action based on knowledge, the act of monitoring has little value.

Daily practice

- Look at a set of objectives for a project or program you are involved in. Ask yourself some questions: What assumptions have been made about cause and effect? And what evidence has been used (or not used) to back up these assumptions? And once you've challenged your assumptions, ask — what evidence would show you've reached your goal? And how long would it take to change these variables?
- Pick a stakeholder in your system and ask yourself — what kind of evidence would actually influence them to change the course of action? What information do they need to make decisions? What factors limit their actions and decisions?

PART III: LIVING THE ART OF SYSTEMS PRACTICE

THE ROAD AHEAD

"Leave the door open for the unknown…that's where the most important things come from, where you yourself came from, and where you will go."
- Rebecca Solnit

As we strive to create a future in line with our hopes and aspirations, we must both see and create our path forward. Many of the philosophies, ideas, and tools in this book may not be entirely new to you or your sectors of practice. What will be new is practicing these principles with collective intent. It is this collective intent and commitment to seeing and working with systems that will allow us to transform. What this adds up to is our first phase of change — a new foundation.

For our planet to survive, we must create systems that operate differently, reward different behaviors, and produce durable, 'better' outcomes for people and nature. In order to do this, we must first honestly assess, work to understand, and accept the world as it is today — including our own role in it. This may mean both a collective and personal journey towards new ways of seeing, facilitated by tools, methods, and a community of systems-focused professionals who already exist. Within understanding and accepting systems — phase two of change — will lie the untapped potential for new experiments, innovations, combinations of new choices, and a broader range of leverage points than may have been available before.

While we find our way through this phase, we will see that our frames matter — what we include and exclude will shape our problem formulation and the kinds of solutions that emerge. Bringing an open and learning mindset to this phase (and all of them) opens up who is at the table and the kinds of questions and solutions that become available to us. However, this won't happen by magic. The process of designing the ways in which we co-create systems understanding, explore space

and time, and look for simplicity within the complexity, need to be deliberate acts, empowered by skilled, committed people, a suite of fit-for-purpose tools, and the structures and organizational mandates that support people on their undertakings.

As we call for change in our ways of thinking and doing, it's important to remember that we don't need to stop and start over. Our journey can begin by simply sharpening our awareness of what behaviors, actions, and approaches serve our goal in changing systems — and which do not. Once we open our eyes to how we should be and act, we can let go of old practices and build new capacities that can help us 'see wholes,' work ethically, learn collaboratively, and iterate to drive change. As we sharpen our internal capacities, we will be better equipped to change the systems around us — our communities, organizations, ecosystems. Importantly, we will not act once, but over and over again. Being part of living systems means that we must be open to an evolving journey where our vision for the future is informed by continual learning, our experiences, new evidence, and enhanced co-creation. The methods and skills that we bring to envisioning a new future — our third phase of change — are just the beginning. Our commitment is not to a particular project cycle or short term organizational strategy; it is to the end goal of a flourishing world where new patterns of behaviors between society and nature result in sustainable life.

While the fourth phase of our systems efforts — activating change — will be best achieved if we design the first three with intention, it is also the foundation for our efforts, and returns us to the beginning. It is our *why*. Why think about our work differently? Not only to identify where we want to go, but also what is not working for us now, and how to have the right mix of human talent and resources to get us there — these are necessary in order to move us forward right now. We live in a particular moment in time when we know enough, where ideas around empathy, humility and learning are drawing attention to how we can act collectively, and where there is still time to activate change. We must remain in love with our 'why' and not the particular means of getting there. The world of systems practice will continue to move on; and as we iteratively work together, new tools, knowledge, evidence, and people will help us do better. Importantly, we must play both the long and short game in this phase — taking measures to change structures that no longer serve the future we imagine is a long term goal. This is coupled with finding

the short term mechanisms that allow society and nature to absorb the costs of systems change.

Herein lies the art of systems practice for a sustainable future: Accepting certain dilemmas and trade-offs (choices between short- and long-term investments with limited resources), embracing paradoxes (seeing ourselves in systems while also trying to describe them and act outside them), and participating in continual learning and change while seeking evidence that is relevant now and reflective of diverse ways of knowing. And finally, knowing that the sustainable future we want is a new set of patterns of nature and society, rather than a hard, fixed, final state. It is as simple and as complex as that.

First, begin. Then, persist.

We can no longer ignore that the future of humanity and the planet are at risk. How we go about our work must be in intentional service of the lasting change we seek to make.

Welcome to the systems journey.

GLOSSARY

Balancing feedback loop: a loop of cause-and-effect that will counter any change in the system with a push in the opposite direction (also called a negative feedback loop) resisting change over time.

Bayesian updating: a method of statistical inference in which Bayes' theorem is used to update the probability for a hypothesis as more evidence or information becomes available. In layman terms, it's a way of updating your beliefs or guesses based on observations.

Causal loop diagram: a causal diagram that aids in visualizing how different variables in a system are interrelated. The diagram consists of a set of nodes and relationships (represented by arrows between nodes). Nodes represent the variables (often stocks) and arrows between them represent the causal relationship between the two variables.

Causality: what connects one process (the cause) with another process or state (the effect), where the first is partly responsible for the second, and the second is partly dependent on the first.

Collective Impact: Collective Impact refers to a specific approach characterized by highly structured, multi-stakeholder efforts that are designed to achieve major, and lasting impacts on a social or environmental problem. Collective Impact initiatives have a common agenda, shared measurement systems, a portfolio of mutually reinforcing activities, managed via a dedicated 'backbone' organization which facilitates continuous communication among the stakeholders.

Contribution tracing: a method of statistical inference, based on Bayes' theorem, used to quantify the degree of confidence that an intervention has contributed to an outcome.

Dynamic equilibrium: defined differently across disciplines, dynamic equilibrium in ecology often refers to an ecological balance within a community of organisms in which genetic, species and ecosystem diversity remain relatively stable, subject to gradual changes through natural succession.

Emergence: in systems, emergence typically refers to *emergent behaviors* which are system behaviors that arise from the interactions between components, where those behaviors and properties would not exist in isolation.

Feedback loops: a closed chain (or loop) of cause-and-effect that creates coupling between components of a system.

Flow: the rate of change or activity between components of a system.

Frames: frames can be defined in two ways: The first is as the lens through which we see the world, often described as our 'mental models.' The second - while often influenced by the first - is as the boundary we use in defining the problem we are trying to solve.

Intentionality: something done deliberately, by intention or design.

Leverage points: places in a system where a small change could lead to a large shift in system behavior.

MEL: monitoring, evaluation and learning.

Mental model: A model that exists in someone's mind as a small–scale understanding of how (a part of) the world works.

Nonlinear: a sequence that does not progress or develop smoothly from one stage to the next in a logical way. In mathematics and science, a nonlinear system is a system in which the change of the output is not proportional to the change of the input.

Qualitative impact evaluation: an impact evaluation that uses narrative causal statements elicited directly from intended project beneficiaries.

Reductionism: the process or approach to analyze and describe a complex phenomenon in terms of its simple or fundamental constituents.

Reflexivity: an actor's awareness of an analytic focus on his or her relationship to the system; the ways that cultural practices involve consciousness and commentary on themselves.

Regime shift: large, persistent, and usually unexpected changes in ecosystems and social-ecological systems.

Reinforcing feedback loop: a loop of cause-and-effect in which an action in the system influences more of the same action, accelerating either growth or decline (the opposite of a balancing feedback).

Resilience: the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.

Scenario planning: an approach that encourages the framing and re-framing of possible futures to shape the understanding and actions of individuals or groups.

SDGs: the United Nations' Sustainable Development Goals.

Social network graph: a graphic representation of actors in a system and how they are related through social ties.

Spatial map: a visual representation of how a system is or can be organized in space.

Stock: a quantity of something, measured at one point in time.

Stock-and-Flow Diagram: a visual representation of the flows and accumulations in a system, and how they are related through one or more feedback loops.

System: A set of things — people, cells, molecules, or anything — interconnected in such a way that they produce their own pattern of behavior over time.

Theory of Change (ToC): a comprehensive description and illustration of how and why a desired change is expected to happen in a particular context.

Threshold: the critical point in a situation, process, or system beyond which a significant and often unstoppable effect or change takes place. A situation in which an ecosystem experiences a shift to a new state, with significant changes to biodiversity and the services to people it underpins, at a regional or global scale.

Time delay: a lag between a change in one stock and a related stock, or in other words, the delay between 'cause' and 'effect'.

Transformative space: the experience of space in contrast to defining space as static shape or built enclosure.

Unintended consequences: a result that was not intended as an outcome.

WWF: the World Wildlife Fund, also known as the World Wide Fund for Nature.

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ANNEX 1

INFLUENTIAL TEXTS

The following texts we consider to be 'seminal' reading on systems thinking and systems change. These texts were foundational inspiration for this book.

Gunderson L and Holling C. S. (2002). *Panarchy: Understanding Transformations in Human and Natural Systems*, Washington, DC: Island Press

Berkes, F., J. Colding, and C. Folke. (2003). *Navigating social-ecological systems: building resilience for complexity and change*. Cambridge University Press, Cambridge, UK.

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Sterman, J. (2000)*Business Dynamics: Systems Thinking and Modeling for a Complex World*, Cambridge MA: McGraw Hill

Stroh, D. P. (2015). *Systems Thinking for Social Change: A Practical Guide to Solving Complex Problems, Avoiding Unintended Consequences, and Achieving Lasting Results*. White River Junction, VT: Chelsea Green Publishing.

SUGGESTED READING

The following texts are suggested reading that demonstrate well the idea of 'systems change in practice,' grounded in real-world examples from across sectors.

Clearfield, C. and Tilcsik, A. (2018) Meltdown: *Why Our Systems Fail and What We Can Do About It*. Penguin Press. ISBN-13: 978-0735222632

Crutchfield, L. (2018) *How Change Happens*. Wiley. ISBN-13: 978-1119413813

Green, D. (2016) *How Change Happens*. Oxford, UK. Oxford University Press

Harford, T. (2016) *Messy: The Power of Disorder to Transform Our Lives*. Riverhead Books. ISBN-13: 978-1594634796

Patton, M. (2011) *Developmental Evaluation: Applying Complexity Concepts to Enhance Innovation and Use*. New York, NY, The Guilford Press. ISBN-13:978-1606238721

Scharmer, O. (2007) *Theory U: Leading from the Future as It Emerges*, Cambridge, MA: Society for Organizational Learning. ISBN: 1626567980

West, G. (2017) *Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life in Organisms, Cities, Economies, and Companies*. Penguin Press. ISBN-13:978-1594205583

Westly, F. Zimmerman, B., and Patton, M.Q. (2006) *Getting to Maybe: How the World Is Changed*. Vintage Canada. ISBN-13: 978-0679314448

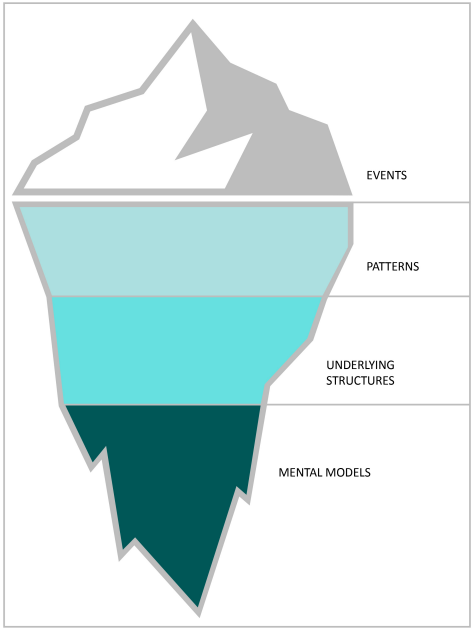
ANNEX 2. TOOLS FOR SYSTEMS PRACTICE

'Tools' for systems practice are typically methods and approaches that support groups during a systems change process. Tools can help, for example, test our individual and collective assumptions about systems or bolster our understanding about relationships in a system. They can help create transformative spaces and a place for dialogue about systems, model how change might play out in the future, and help us think radically differently about futures — just to name a few.

Here we provide simple 'how-to' guides for a small sample of tools that you may choose to use on your systems journey. This sample of tools is by no means comprehensive. Some tools listed here are more broad, while others are narrow and specific. Some require advanced capacities or skills, while others are easy to pick up and try. And some of these tools may not be entirely new to you, but when used wisely, can encourage a subtle shift to this new way of working with systems to foster change.

For each tool, we introduce what it is, what the tool can help you achieve, how to use it, how long it takes, how to use it, tips from our experience, and suggested reading or resources.

The Iceberg Model



What is it?

The Iceberg Model (introduced in *What is a complex system*) is a metaphor that can be turned into a short, participatory exercise. The iceberg model can be used in a group setting to identify patterns related to a problem, the systems structures related to those patterns, and the ingrained thinking that creates the structures.

What do we use it for?

The iceberg exercise helps ourselves and others identify what causes the events we see around us, including our own mental models. By changing the way we think, we change the way we act, and therefore can create the systems transformation that we seek. The iceberg model can be simply used to introduce ideas from systems thinking, or it can be used in a strategy of planning session to explore the underlying patterns, structures, and mental models of a problem.

How do we use it?

Before using the Iceberg Model, it is important that a clear problem statement is identified. It is also important that the stakeholders in the room participating in the iceberg model exercise have a good understanding of the problem.

Basic instructions:
Write the categories "Events," "Patterns," "Structures," and "Mental Models" on a large piece of paper, with "Events" at the top and "Mental Models" at the bottom. Describe each of these categories as shown below. Then ask group members to write ideas for items that fit into each of these categories on Post-It notes and add them to the appropriate sections on the piece of paper.

- **Events**. An event is a discrete action. It could show up as a newspaper headline. Events answer the question, what happened?
- **Patterns**. Patterns are essentially trends—events that repeat over time. Patterns answer the questions, what's been happening? Or, what's been changing?
- **Structures**. Structures are rules, norms, policies, guidelines, power structures, resource distribution, etc. that influence behaviors. They answer the question, what might explain these patterns?
- **Mental Models**. Mental models are the ideas, dogmas, and world-views that support a system's structures. These deeply held assumptions and beliefs drive behavior.

Tip for participants:
The more we can understand what is happening under the surface in a system and make it explicit or visible - especially where it relates to structures and mental models - the more likely we will be able to influence how it works.

How long does it take?

30 minutes to 1 hour

Useful references

The Iceberg Model by M. Goodman, 2002. Hopkinton, MA: Innovation Associates Organizational Learning.

Scenario planning

What is it?

Scenario planning is an approach that encourages the framing and re-framing of possible futures to shape the understanding and actions of individuals or groups. Scenarios have been used by major companies, governments, and others to explore possible futures under conditions of substantial uncertainty. While different methods and tools exist for scenario planning, most share the common elements of defining issues, identifying drivers, stakeholders, trends, constraints and other important issues and ranking of these items by importance and uncertainty, and using this information to inform different understandings of the future (Amer et al., 2013). Scenario processes are designed to encourage learning, and when done well, focus on placing the 'learners' at the center of the process (Ramirez and Wilkinson, 2016).

What do we use it for?

Scenarios can be facilitated on different scales for different purposes. Scenarios can, for example, convene diverse stakeholders to explore potential trajectories of change across a broad system (e.g. IPBES, 2016) or help staff within an organizations make decisions at critical points in time (e.g. Ramirez & Wilkinson, 2016) Scenarios can also be used to consider the potential impacts of a specific action or process, for example, the impacts of climate change (IPCC, 2014).

How do we use scenarios?

For the purpose of the book, we focus on two broad categories of scenarios: 'top down' - referring to the use of existing scenarios and models to frame possible futures for a problem or system, and 'bottom-up' - creating scenarios tailored to a particular problem or system.

‘Top-down’ scenarios.

The use of large-scale scenarios to inspire thinking about the future can be traced back to the 1970s, yet emerged with a greater diversity of approaches in the 1990s (Raskin, 2005). Many of the large-scale, global scenarios blend approaches, using quantitative modeling approaches alongside qualitative narratives (e.g. MEA, 2005; IPBES, 2016). ‘Top-down’ scenarios can address a range of diverse issues. Two common issues that scenarios address include broad global change and more specifically, climate change:

- **Global scenarios** Many global scenarios used to understand general societal change from the last several decades converge around four distinct archetypes: Futures shaped predominately by policy reform, market forces, fortress world (isolationism), and a new sustainability paradigm. Each archetypes differs in how they describe ‘STEEP’ change, or change in social, technological, economic, environmental and political (STEEP) drivers (Hunt et al., 2012). The latest set of global scenarios from the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) explored multiple futures, a process which demonstrated the importance transformative change in policy and individual action to mitigate the threats to both people and biodiversity (IPBES, 2019).

- **Climate scenarios**. Scenarios used to understand possible futures under climate change often use global climate models to explore how variables of interest might be impacted under different climate projections (IPCC, 2014). But similar to more general scenarios, climate scenarios can also explore different pathways of change - answering how different human actions might create different climate futures.

‘Bottom-up’ scenarios

Developing context-specific scenarios - referred to here as ‘bottom-up’ scenarios - has been used to guide strategic decision making under conditions of uncertainty for decades, by, for example, the military and private sector actors. By asking strategic questions about how trends and patterns may change in the future, an organization is able to tailor its planning to account for future uncertainty. ‘Bottom-up’ scenarios place a similar emphasize on broad ‘STEEP’ trends and patterns in the world, but leave the creation of models and narratives up to the

scenario team. Developing 'bottom-up' scenarios is often led by a facilitator (or facilitators) over a set period of time, and typically involves collaborative workshops where scenarios are identified, co-developed, and used to collaboratively inform decision-making.

How long does it take?

Depending on the method, a scenario process can up to anywhere from a few days, to a few months, to in some cases, a few years. Typically 'top-down' scenarios take less time, as a team's work is focused on fitting either scenario narratives or models to a particular sub-system. 'Bottom-up' scenarios can often take longer, as they require creating new models or narratives that help an organization, team, or group of individuals understand a situation and potential paths forward.

What capacities are needed?

Scenario planning requires specialized skills. Consulting with an experienced scenario facilitator can help ensure the right method is chosen to fit the problem, the 'learners' that the scenario process is designed to support, and the types of decisions a group might want to make. The right method will also depend on the amount of time and resources a team has to put towards a process.

Useful resources

Amer, M., Tugrul, T.U., and Jetter, A. (2013), A review of scenario planning. *Futures*. 46: 23-40

Auer, C. Climate Change Scenario Primer. Potsdam Institut für Klimafolgenforschung (PIK). Accessed May 14, 2019 at https://www.climatescenarios.org/

IPBES, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services. Intergovernmental Science-Policy Platform

on Biodiversity and Ecosystem Services. Retrieved from https://www.ipbes.net/sites/default/files/downloads/spm_unedited_advance_for_posting_htn.pdf

IPBES (2016). Summary for policymakers of the methodological assessment of scenarios and models of biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Ferrier, K. N. Ninan, P. Leadley, R. Alkemade, L.A. Acosta, H. R. Akçakaya, L. Brotons, W. Cheung, V. Christensen, K. A. Harhash, J. Kabubo-Mariara, C. Lundquist, M. Obersteiner, H. Pereira, G. Peterson, R. Pichs-Madruga, N. H. Ravindranath, C. Rondinini, B. Wintle (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. 32 pages.

Intergovernmental Panel on Climate Change (2014). *Synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change*. Geneva, Switzerland: IPCC

Kahane, A. (2012), *Transformative Scenario Planning: Working Together to Change the Future*. Berrett-Koehler Publishers, Inc. San Francisco, USA.

Ramirez, R. and Wilkinson, A. (2016). Strategic Reframing: The Oxford Scenario Planning Approach. Oxford University Press. NY, USA.

Raskin, P. D. (2005). *Global Scenarios: Background Review for the Millennium Ecosystem Assessment*. Ecosystems 8:133–142.

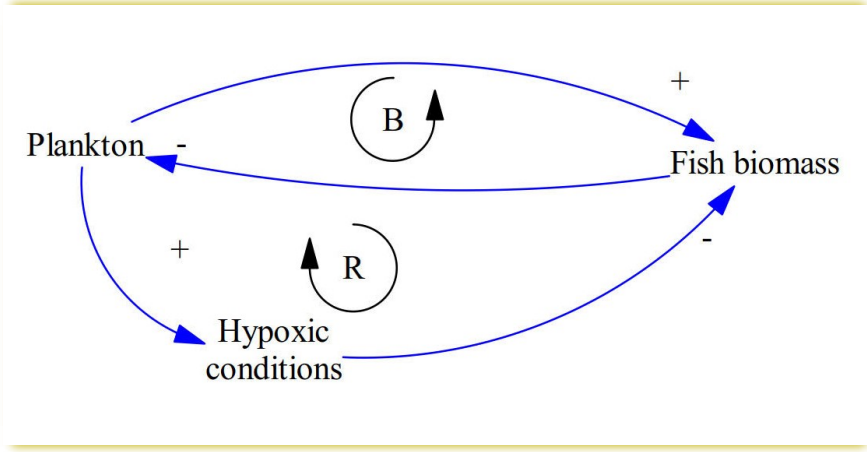
Causal loop diagram

What is it?

A causal loop diagram (CLD) is a visual tool that can help disaggregate and make explicit the interrelationships and feedback structures between variables in a system (Sterman, 2000). CLDs are made up of system variables, the causal relationships between them, the relationship types, and the feedback loops the relationships create (Lannon, nd). The feedback loops created by the variables and causal relationships indicate the behavior the system will produce. They can be 'reinforcing' (as one variable increases, it causes a chain of reactions which cause the starting variable to increase more) or 'balancing' (if one variable in the loop increases, the related changes through the loop cause a decrease in the starting variable). See page 15 in *What is a complex system* for more on feedback loops.

Why do we use it?

CLDs help unpack the variables and relationships within a complex problem, challenging assumptions about systems and why certain events and patterns are observed. By drawing the perceived variables and relationships within a system, the assumptions made about a system, its relationships, and feedback are made explicit. This tool improves understanding, challenges assumptions, and can help identify leverage points. CLDs can also serve as the basis for computational models, such as stock-flow models, that can explore behavior over time in the system and test how different policies might change outcomes.



An example of a balancing (B) and reinforcing (R) feedback loop, produced in VENSIM PLEx32 software. This simple relationship is an excerpt from a CLD illustrating a regime shift from high fish biomass to low fish biomass in the Northern Benguela Marine System (see page 23 for more details)

How do we use it?

Here we outline the basic steps for drawing a causal loop diagram. It will also be important to consider who is engaged in the process of drawing the CLD, as this process could be repeated with individuals or groups. Different people will have different understandings of the system, so it is important to be mindful of the frame you and others hold.

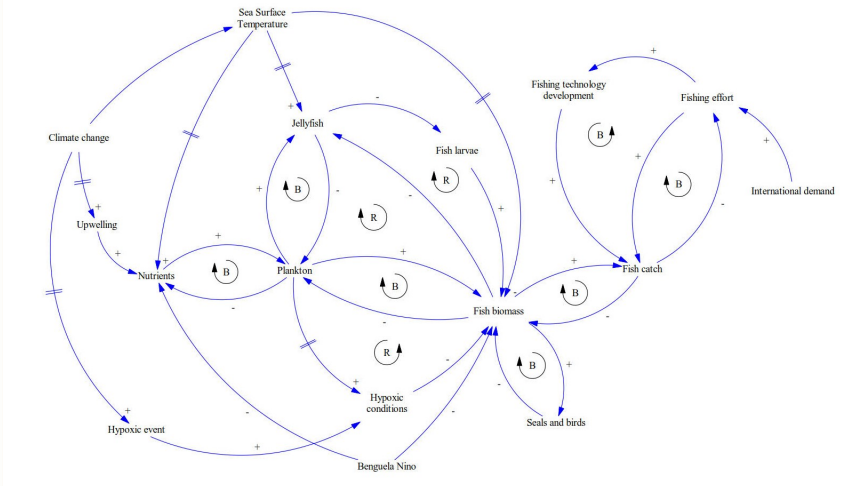
1. **Develop a clear problem statement.** The best way to start a causal loop diagram is by developing a clear problem statement. A clear problem statement helps set bound the frame of the diagram, and explicitly recognizing the scale in which the diagram depicts the problem. For example, the problem statement for the sardine causal loop diagram was "the Namibian sardine fishery experienced a regime shift from high fish biomass to low fish biomass." As a result, the CLD was developed to understand and communicate how the relationships and feedbacks in the system contributed to the regime shift.

2 **Identify your variables.** Once the bounds of the problem have been defined, the variables in the system can be identified. Variables are nouns representing stocks in the system — things that move up and down. In the sardine example, fish biomass was the most important variable to start with, and from there other variables that affect fish biomass were identified, such as fish catch, and plankton. Phrase variables in a neutral way without a direction. For example, fish biomass is a good variable, but "high fish biomass" would not be. More qualitative variables such as trust, fear, or demand, can also be captured in a CLD.

3 **Draw relationships.** After variables are identified, the different relationships between them can be drawn. Think of the relationships as the flows between stocks (often described as a verb), which cause a variable to rise or fall. Each relationship is depicted as an arrow from one node to another. Reinforcing relationships are typically indicated with a "+" symbol, while balancing relationship is indicated with a "-" symbol. In the sardine example, an increase in fish ("fish biomass") in the ocean will decrease the amount of plankton and is labeled with a "-". To start to create these links, it may be helpful to pick a variable and work backward, asking "what causes this?" The process of identifying variables and relationships will also start to become iterative, as new connections and variables are identified and made.

4 **Find loops**. As relationships are drawn, feedback loops will emerge. A feedback loop is when several relationships connect to create a 'loop' that feeds back on itself. Labeling these loops as balancing or reinforcing can help provide a clearer picture of how the system behaves over time. Loops can also be thought of as small stories within the system. It may be helpful to ask what loops might exist in the system, to ensure all are accounted for.

5 **Use your CLD**. While the process of creating a CLD itself is a helpful exercise for understanding a problem and related systems, a simplified CLD can be a useful tool for communicating complexity to different stakeholders. A fundamental first step is learning how to tell the 'story' of the causal loop diagram, and talk through how the different relationships and feedbacks link together. Standard presentation tools such as PowerPoint or online platforms such as Kumu.io can be used to create virtual walk-throughs of the CLD that break down the different relationships, and explain how they all fit together.



A complete CLD illustrating the dynamics of a complex social-ecological system state-shift. For more see chapter *What is a complex system*

How long does it take?

A coarse sketch of a CLD can be done in just 1-2 hours. However, refining a model takes more time. CLDs can be revisited and updated as knowledge about a system evolves. It is helpful to bound the amount of time one spends on developing a CLD, based on its intended purpose.

What capacities do we need?

Having an understanding of the basic concepts of systems thinking is an important capacity for developing a causal loop diagram. Having knowledge about the problem and the system it is embedded within will also ensure that the model is good representation of the real-world dynamics. It may be helpful to get outside expertise to create a CLD with a group, as developing the art of asking the right questions and framing variables and relationships does take some time.

Depending on the intended use, additional capacities may be required to build off of a CLD to a larger model. For example, if running simulations on how dynamics might change over time, given shifts in system structure and relationships, computational skills in system modeling will be required.

Useful references

Lannon, C. Causal Loop Construction: The Basics. In *The Systems Thinker*. Accessed May 13, 2019 at https://thesystemsthinker.com/causal-loop-construction-the-basics/

Sterman, J. (2000), *Business Dynamics: Systems Thinking and Modeling for a Complex World*, Cambridge MA: McGraw Hill

Mindfulness group practice

What is it?

Mindfulness practice can be described as an approach that uses awareness of body and breath to help quiet the mind. Mindfulness can be practiced in a number of ways, and typically involves periods of quiet, inward-looking reflection, typically structured by guiding prompts.

Why we use it:

Mindfulness practices have been around for centuries, manifesting differently across cultures and traditions. Mindfulness practice has many individual benefits – including helping to reduce stress, anxiety, and improve focus. In systems work, individual mindfulness practice can help people develop an awareness on how individual thoughts and actions impact and reverberate through the systems around them. Practices such as yoga, meditation, Tai Chi, and Qigong all in various ways, tap into the body and breath to connect better to the mind. This helps us better link 'heart and gut' wisdom to our actions, making us more present and available to those around us.

How do we use it?

In a group setting, such as a workshop or meeting, mindfulness practice can be used to get a group connect at the start of a day, or as a break in the middle of the day. Typically, an experienced facilitator or individual guides the meditation and "holds the space" for the process.

Basic instructions for mindfulness exercise:

- These instructions are for a simple 5-minute guided meditation that can be given by a facilitator to a group.
- Before you start the mindfulness exercise instructions, take a moment to relax and breathe yourself so that you are prepared to guide the process.

- As you give the instructions below, take your time to pause as feels appropriate.
- At the end of the instructions, give participants a few minutes to just be and sit in silence, before asking them to open their eyes and return attention to the group.
- Depending on setting, the facilitator could decide to add more to the meditation to tie it back to the group's purpose, by asking participants to attend to those in the room with you or lightly reflect on the purpose of the gathering.

Instructions for facilitator to read to a group:

Sit or stand in a comfortable place in the room that is peaceful for you
Once you have found this place begin to settle in
You may offer that participants may keep their eyes open or close whatever is more relaxing or comfortable.
Simply take a few deep breaths… noticing your long slow exhales
Feel your feet solidly on the floor, and if seated, your behind in the seat
Notice your shoulders softening down
No need for you to make any effort, just relax any part of your body not required for holding yourself up
Let that part of your body rest and relax
Lengthen the back of your spine, find the point between will and surrender
Take in your space through your eyes… ears …. and nose
Take a moment to notice your surroundings
Take a moment to notice your body
As you are slowing down, what are you noticing about:
Yourself?
Your breathing?
Your body?
Where is your mind?
What is your energy level?
Where is your attention?
What are you observing?
Take a few moments to relax and just be
To end the meditation, instruct participants that they slowly open their eyes (if they were closed) and take their time on "re-entry" back to the room.

How long does it take?

Mindfulness exercises can take as little as 5 minutes or can be extended to serve the needs of the group. Mindfulness exercises can be done ad-hoc, or weekly, or even daily.

What capacities are needed?

Mindfulness practices are best led by an experienced facilitator with training in a form of mindfulness practice. Often times, inner reflection can prompt emotions or sensations that can be overwhelming for individuals, so working with an experienced facilitator or teacher can help ensure the comfort and wellbeing of participants are attended to.

Useful references

Kabat-Zinn, J. (2013). Full Catastrophe Living. Delta, Reprint Edition

Kabat-Zinn, J. (2005). Wherever you go, there you are. Hachette Books; 10th edition

FOUR WAYS OF TALKING AND LISTENING

What is it?

Otto Scharmer (2007) identifies four distinct conversational modes that groups enter: downloading, debating, reflective dialogue and generative dialogue. These categories help us understand how we communicate within and between groups:

Downloading: This refers to saying what is expected and polite. This is almost an automatic process where "we merely repeat the story that's already in our heads, like downloading a file from the Internet without making any change to it" (Kahane, 2004).

Debating: In this mode, the listener is judging whether they agree with the speaker. They are actively seeking out facts that run counter to their own narrative, different perspectives and a variety of options can be generated in this conversational mode. The speaker will embody a general willingness to challenge the ideas within the group and feel empowered to 'speak their minds'.

Reflective Dialogue: Listening and speaking from a place of empathy and self-reflection, Kahane (2004) believes this conversational mode is "the root of the potential for change and creativity". The listener is trying to understand where the speaker is coming from, while the speaker is trying to communicate authentically to the best of their ability.

Presencing: Defined by a moment of deep, shared understanding of the group's higher purpose, this conversational mode requires the full presence of the group to unlock a state of "flow" wherein generative dialogue makes space for "welcoming the new and transforming the old".

Why do we use it?

Kahane (2004) argues that if you want to solve complex problems and affect systemic change, you need both the "awareness of these different ways of talking and listening and the capacity to move among them". In order to organize across a system, it is important to authentically engage with diverse stakeholders and we do this through conversations. These conversations can be difficult to navigate, but understanding all the modes helps bring clarity to the quality of the conversations. If a group is stuck in one mode, it can severely limit the effectiveness of the group so the ability to recognize the different modalities is critical to moving conversations forward to a place where singularity of understanding and purpose breeds innovation and coherence.

How do we use it?

Knowing the different conversational modes is the first step to using this tool. According to Scharmer (2007) there are conversational modes for individuals, groups, institutions and global systems. Once you are armed with the knowledge that they exist, it is possible to identify the modes and facilitate a group through them in a deliberate manner.

'Sentence starters' can be used to sense what it feels like to be in the four different ways of talking and listening. These can be practiced on your own, or use as prompts in meetings to explore the 4 different ways of talking and listening:

- **Downloading.** "The truth is..."
- **Debating.** "In my opinion..."
- **Dialoguing.** "In my experience..."
- **Presenting.** "What I am noticing here and now is..."

How long does it take?

This depends entirely on the group. Group dynamics are shifting and unique things that depend on a number of factors such as culture, trust and cohesion (Rutan et al., 2007). Scharmer (2007, 10) also notes that the further along his continuum (individual, group, institutions, global) the more time it will take to move through the modes. This makes sense when you think of an individual's ability to recognize and pivot their conversational mode, compared to shifting the hulking mass of an institution.

A skilled facilitator can move a group through the modes and recognize when the group has stalled.

What capacities are needed?

Skill facilitation is needed to guide a group through the four ways of talking and listening to ensure a safe space is created, and power dynamics and issues around equity are given attention. Participants also must engage in active listening.

Useful references

Kahane, A. (2004). *Solving Tough Problems: An Open Way of Talking, Listening, and Creating New Realities*. San Francisco, CA: Berrett-Koehler.

Rutam, J.S., Stone, W.N., Shay, J.J. (2007). *Psychodynamic Group Psychotherapy, Fourth Edition*. Guilford Publications.

Scharmer, C.O. (2007). *Addressing the blind spot of our time: an executive summary of the new book by Otto Scharmer" Theory U: leading from the future as it emerges"*. Social Technology of Presencing,

The Three Horizons Framework

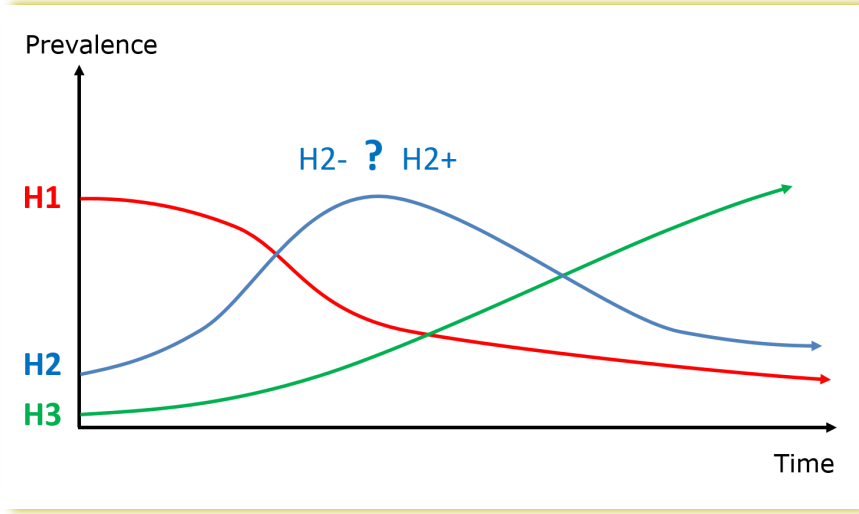
What is it?

The Three Horizons Framework (3HF) is a simple and intuitive framework for thinking about the future (Curry & Hodgson, 2008; Sharpe, 2013). When applied, the practice typically involves a facilitated conversation with diverse stakeholders to assist sense-making and strategic action (Sharpe et al., 2016).

The **first horizon** – H1 – is the dominant system at present. It is the system that we want to transform *from* and represents 'business as usual'. It is our starting point on the roadmap to transformational change.

The **second horizon** – H2 – are the necessary changes to (i) break the current dominant patterns of the system we want to transform *from* and (ii) support beginnings of the system we want to transform *into*.

The **third horizon** – H3 – represents the system that we want to transform *into*. It develops from disruptive innovations in the present that introduce completely new ways of doing things and that are much better designed for adapting to the system we want to transform *into*. (Aguiar et al., 2019)



An illustration of the 3 Horizons framework, reprinted from Sharpe et al., 2016

The primary function of the 3HF is to show participants how the three horizons exist simultaneously in the present moment. Meaning – evidence about how the future may unfold is available through observing the behavior of systems in the present (Sharpe, 2013). While grounded in theory, the Three Horizons Framework itself is considered more of a practice to guide action (Sharpe et al., 2016)

Why do we use it?

The Three Horizons Framework helps individuals develop a better sense of complexity by seeing more clearly how patterns in the world relate to their individual concerns and aspirations for change. It also allows participants to see themselves in the system and understand their individual role in changing either other actors or the system itself. it can encourage conversations that focus on the future between those who are responsible for the patterns of our 'current' system and those who want a different future (Sharpe et al., 2016). The framework itself serves as a roadmap that guides a participatory process striving for change (Aguiar et al., 2019).

How do we use it?

The 3HF introduces the horizons in this order: H1 – H3 – H2, but H1 and H3 are interchangeable in sequence. It is presented in this way as it is typically easier to first identify the challenges and barriers that define the current system (H1), before envisioning a future system that addresses the challenges and barriers to change we face today (H3). The last step is to identify the transformational change needed (H2) to move from the current system to the ideal future system. However, sometimes it can be preferable to start with H3 in order to get participants to engage with the future in a way that is not directly related to the present way of doing things (Pereira et al., 2018).

How long does it take?

The 3HF is designed to unfold within a short amount of time and with a considerably large group of diverse stakeholders. The framework itself can be explained in just a few minutes (Sharpe et al., 2016). Applying the framework in a diverse group context could take anywhere from a few hours, to a day, or up to three days. The 3H framework is almost always used in a facilitated workshop or meeting setting (Sharpe, 2013).

What capacities are needed?

The Three Horizons Framework requires a skilled facilitator knowledgeable about the framework, who has the capacity to guide large, diverse groups through the entire process, who can ensure less powerful voices are heard alongside more powerful voices. It is an extremely adaptable tool to think about transformative change and how to engage action towards a more desirable future.

Useful references

Aguiar, APD; Collste, D; Galafassi, D; Harmackova, Z; Houngbedji, K; Mesfin, M; Ndahiro, D; Pereira, L; Selomane, O; van der Leeuw; S (2019). *The Second African Dialogue on the World In 2050: How to attain the SDGs within planetary boundaries: Agriculture and food systems*. Report on a Multi-Actor

Dialogue for TWI2050, 30–31 October 2018, Kigali, Rwanda. Sustainable Development Goals Center for Africa and SwedBio/Stockholm Resilience Centre at Stockholm University.

Curry, A., & Hodgson, A. (2008). "Seeing in Multiple Horizons: Connecting Futures to Strategy." *Journal of Futures Studies* 13 (1): 1–20.

International Futures Forum Online Toolkit. Accessed May 15, 2019 at http://www.iffpraxis.com/3h-approach

Sharpe, B. (2013). *Three Horizons*. Triarchy Press.

Sharpe, B., Hodgson, A., Leicester, G., Lyon, A., & Fazey, I. (2016). Three horizons: a pathways practice for transformation. *Ecology and Society* 21(2):47.

Nothing remains constant except change itself. Harnessing this wisdom is critical to taking advantage of new opportunities as they arise, and to creating a sustainable future for people and nature.

Yet, the alarming rate of global environmental change invites a moment of collective reflection: With all our efforts, why have we not yet reversed the trajectory of global change? There's no easy answer, but it starts by accepting that the world is complex. Enabling lasting change requires embracing this reality and working with greater intent to transform the systems that perpetuate the unsustainable trajectory of our planet.

This book lays out a vision and an actionable plan for seeking sustainable solutions for our planet. In Part 1, we outline the fundamental tenets of systems thinking, the behavior of complex systems, and the implications for our understanding of the world. In Part 2, we outline a set of eight guiding principles for working to achieve long-lasting solutions to tackle our most pressing environmental and societal challenges. Finally, we lay out a map for the road ahead, and for the individual journey into systems practice that each of us is embarking on.

The Art of Systems Change is not designed to be prescriptive. It does not lay out a specific set of tools to guide the design and implementation of interventions. What it does do is seek to provide a collective roadmap for navigating toward a sustainable future, by embracing the complexity of the challenges we face, creating space for diverse ways of knowing, and providing ways of working that reflect the dynamics of the systems we strive to influence. We can no longer ignore that the future of humanity and the planet are at risk. How we go about our work must be in intentional service of the lasting change we seek to make. Welcome to the systems journey.