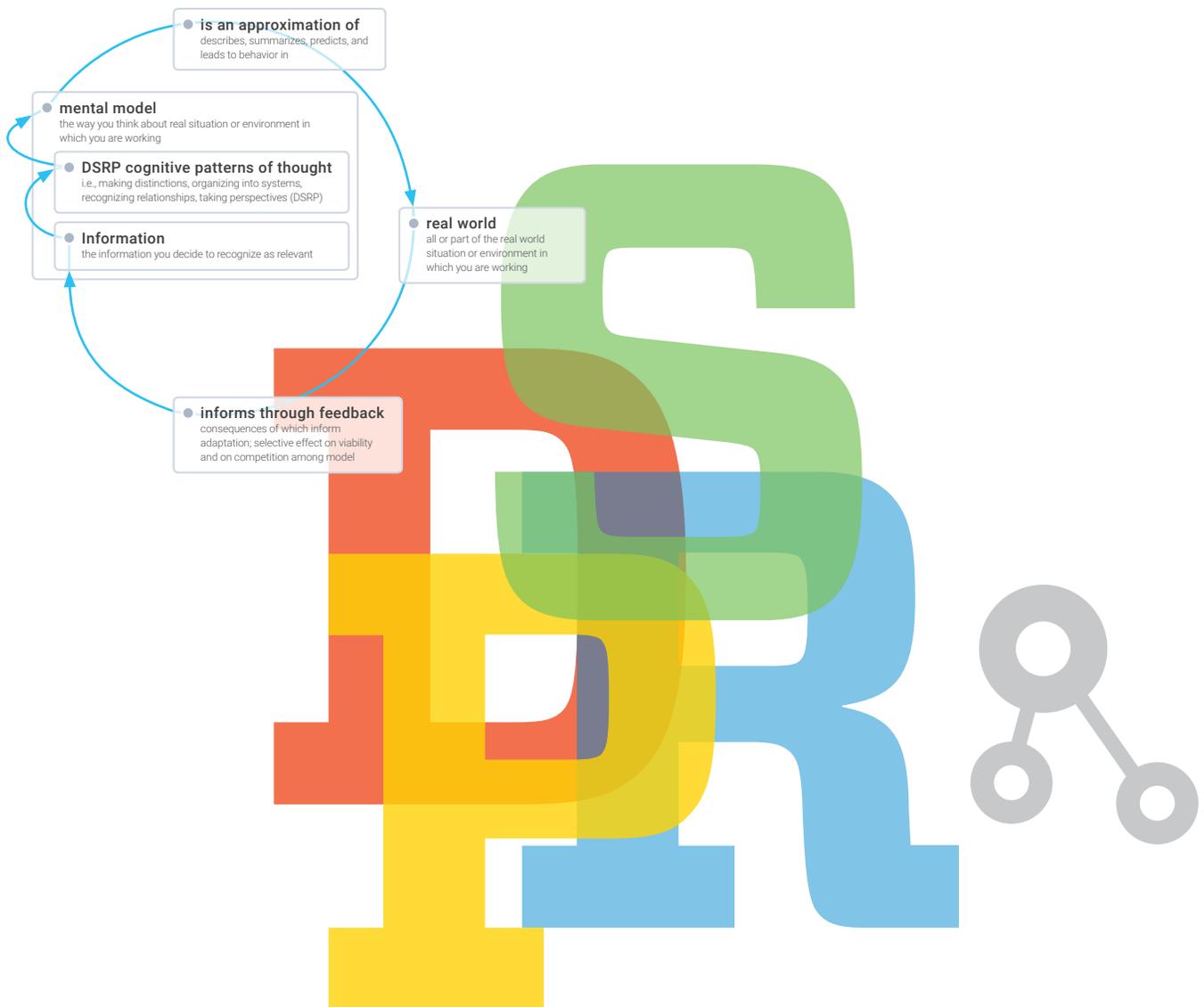
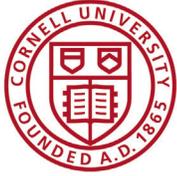




SYSTEMS THINKING

The Crux of Organizational Learning





An organization's ability to learn, and translate that learning into action rapidly, is the ultimate competitive advantage.

— Jack Welch

In organizations, individual employees must think (and rethink) about various systems in order to constantly improve them. Systems thinking drives organizational learning. Experts in systems thinking and cognitive science, Drs. Derek and Laura Cabrera have revolutionized the systems thinking field with the identification of four underlying cognitive skills that are universal to all systems thinking frameworks: making Distinctions, organizing part-whole Systems, recognizing Relationships, and taking Perspectives (DSRP). Beyond their academic work on systems theory, the Cabreras' research lab has developed methodologies, tools, and technology to simplify and amplify the systems thinking process. The backbone of an organization's ability to learn and evolve is individual learning. The backbone to individual learning is systems thinking. This white paper offers a brief review of the Cabreras' work within systems thinking and systems leadership, the topic of their research, their semester-long courses at Cornell University, and their groundbreaking mapping tool, Plectica.

Think Differently

The success of any organization is dependent on its ability to adapt to feedback from the environment and thrive in the face of change. In short, the organization has to learn. But in order for an organization to learn, its people have to learn. And when learning, people think. So how do people think, anyway? How can they think smarter? And what can organizations do to help them think smarter?

Most of the organizational problems we face result from the difference between how we think organizations work and how they actually work. The real world works in systems—complex networks of many interacting variables. Systems thinking attempts to better align how we think things work with how they actually work in the real world. The first step in addressing this disconnect is to take an honest look at how we think, as individuals, managers, and leaders.

Systems thinking goes deeper beneath the surface details of dialogue, events, or problems. It leads to the identification of patterns, structures and eventually mental models. Figure 1 (below) shows;

- When we see surface *events*, we can only *react*.
- When we see the repeating *patterns* that underlie these events, it gives us the ability to *predict*.
- When we go deeper still, we see the systems *structure* which determines the system's behavior. This gives us the ability to *design* new or leverage existing system structures to bring about the behavior we desire.
- But when we go deeper still to consider how we are thinking about things (our *mental models*), it gives us the ability to *reframe* the way we think about these systems.

Reframing how we think about systems by understanding our mental models has always been the goal of systems thinking efforts. The problem was, prior to deeper studies in neuroscience and cognition, we didn't really understand *how* mental models were built nor how they aligned with real-world systems. Today, we have much better insight into how these underlying patterns of systems thinking work. When we see the underlying *cognitive code* that structures our mental models, we can *transform* how we frame, design, predict and react. We can think differently.

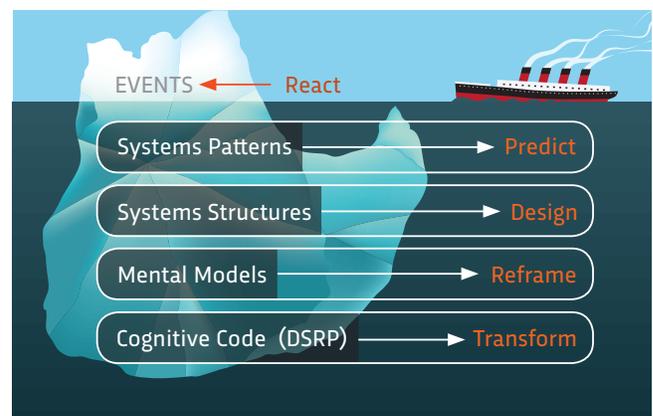
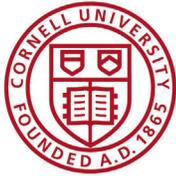
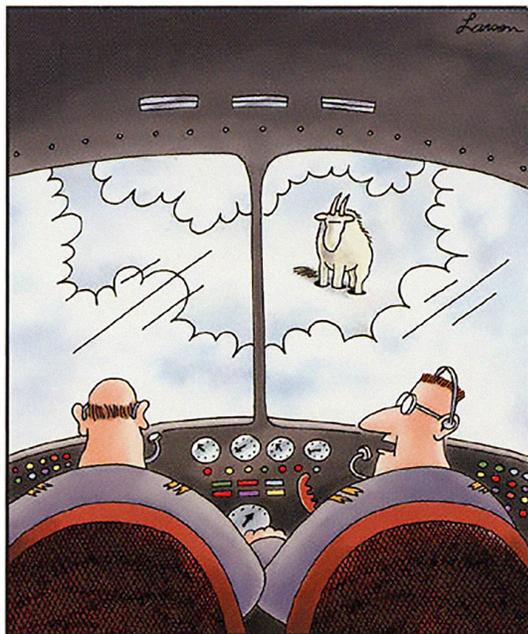


Figure 1: Think differently — Thinking systemically



Mental Models

Mental models are ubiquitous and are often biased. Over 100 cognitive biases have been identified. For example, *confirmation bias* is when someone focuses on information that confirms what they already believe and ignores information that doesn't. *Framing bias* is when we approach an issue or situation with a perspective that too-narrowly frames it. There are many causes of cognitive biases: emotional motivations and belief systems, "noise" in the information we receive, the limitations of brain processing, and social influence.



"Say ... what's a mountain goat doing way up here in a cloud bank?"

Figure 2: Our reality bias can be quite strong

But the cognitive bias that is at the root of all cognitive biases is called "*reality bias*"—our faulty belief that we experience the real-world *directly*. Instead, we perceive the real world *indirectly* through *mental models*—unique filters that highlight some things, ignore others, and add interpretations.

A mental model is our understanding of the world—an approximation of reality based upon our ideas, beliefs, and current and past experiences. If we notice when our models do not match reality, we can use that discrepancy to improve them. This feedback cycle represents the learning process.

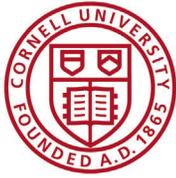
Even when presented with facts to the contrary, we may still choose to conform reality to our mental model and look for entirely different reasons for what would otherwise be obvious. It also illustrates (albeit in a humorous way) how dangerous reality bias can be. Mental models shape our understanding of everything around us—from simple to wildly complex phenomena. Our mental model in turn shapes our behavior, generating real-life consequences.

VUCA vs LAMO

We live in a VUCA World—a world characterized by Volatility, Uncertainty, Complexity and Ambiguity. VUCA was coined by the military to describe the climate that we now live in (and we need not say much more on VUCA, because it's the world we live in everyday). The root problem is that while the real-world is VUCA, we tend to think about the world in Linear, Anthropocentric, Mechanistic, Ordered (LAMO) ways. This mismatch has several implications:

VUCA World	LAMO Thinking
The real world is nonlinear...	but, we think in linear ways.
The real world is agnostic about human endeavors...	yet, we tend to look at things through a human-centered (anthropocentric) lens.
The real world is adaptive and organic...	yet, we tend to think mechanistically (e.g., the metaphors we use reference machines; universe is like a clockwork; mind is like a computer).
The real world is networked and complex with a sprinkling of randomness...	yet, we think of things in ordered categories and hierarchies.

Table 1: VUCA World vs LAMO Thinking



In short, our thinking is biased in ways that don't align with objective reality. We project this bias onto the world and often miss the critically important feedback the world is giving us—feedback from a multitude of sources. And feedback is critical to our fueling our learning, development, and adaptation, as individuals and as organizations.

Systems thinking is a bridge between our mental models (how we think the world works) and reality (how it actually works).

Here's an example of this mental model mismatch in modern organizations. Figure 3 shows a mental model we often use to illustrate how we think organizations work—an org chart. In actuality, the system works quite different. While the people in an organization may be organized into a direct-reporting hierarchy, in reality this formal hierarchy sits within an informal distributed network based on social ties and influence.

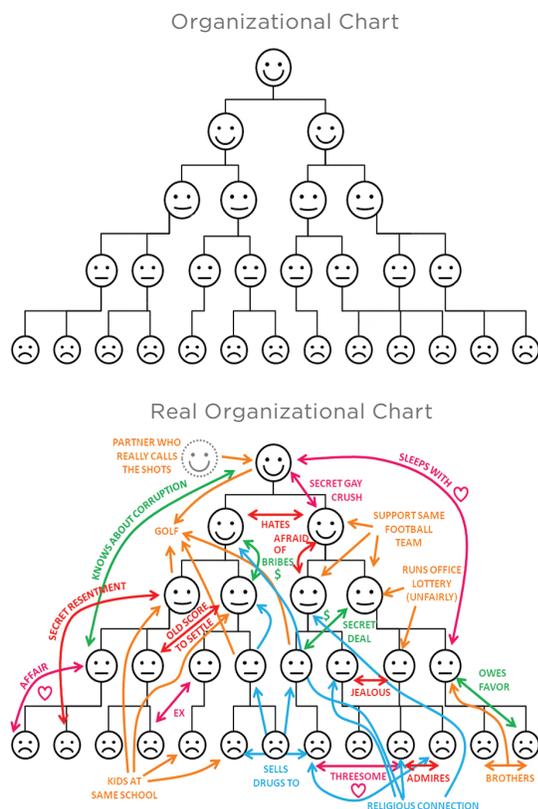


Figure 3: Formal-hierarchical vs. Formal-hierarchical/ Informal-networked mental models

We use mental models to approximate the real world. In turn, the real world gives us feedback in the form of information. In order to understand how actual organizations function, we must first consider that these are mental models that are changeable, adaptable, malleable. Organizations we work with have realized the benefit of introducing mental models into their culture by introducing the following elements:

- the concept of mental models
- the language of mental models
- the skill building, sharing, and evolving of mental models
- and, the technology to support mental model building (organizational learning/innovation)

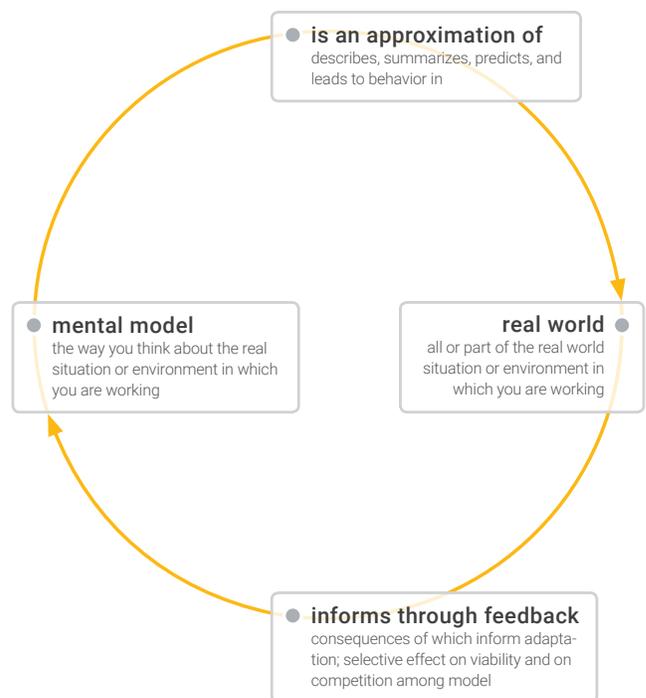


Figure 4: Learning: The Feedback Loop Between Reality and our Mental Models

If you want an adaptive organization, then you need organizational learning, which is optimized with systems thinking. Systems thinking enables us to (1) be more aware of the flaws in our mental models and (2) consciously build better mental models.



The Hidden Structure of Mental Models

Information comes in the form of feedback from the real world—in the signals from the marketplace, in the feedback from our customers, in reactions to things we say and do. We structure this information to make meaning of it. This meaning is our mental model. The structuring or organizing of information is called *thinking* (cognition). Being aware about how we structure or organize information—thinking about thinking—is called *metacognition*.

$$m = i + t$$

Mental model (a.k.a., knowledge, ideas, concepts, theory, science, meaning)	Information (a.k.a., data, content)	Thinking (a.k.a., cognition, structure, organization)
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Figure 5: Simple formula for mental models

We know that mental models exist, and that sometimes they get in the way of our success. In order to evaluate whether our mental models need fixing, we need to look at them more closely—we need to take them apart and figure out how best to put them back together again.

A problem often arises when leaders think that simply conveying information leads to their organization *knowing* it. Those who teach and train others often make the same mistake. They think that because they presented the material, students understand it. Rarely is this the truth. Although we can transfer information, we can't transfer knowledge. If a CEO just states their vision in a town hall meeting, do the employees truly get it? Of course not. Like anyone, they have to figure out how to understand it to the point where it is intuitive, a touchstone for their every decision.

So how do you structure information to facilitate the identification and creation of mental models? How do you help your team think in order to learn? Throughout many years of research, we have identified four simple, logical rules for structuring information: make **distinctions** and identify **systems**, **relationships**, and **perspectives** (called DSRP).

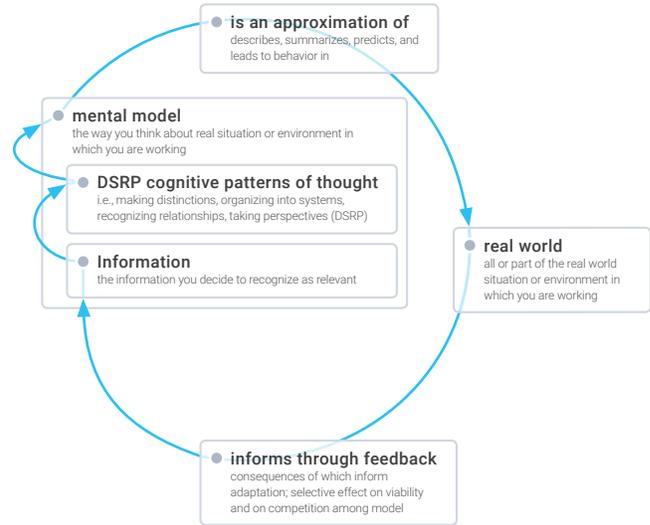


Figure 6: Learning: The Feedback Loop Between Reality and our Mental Models

DSRP provides employees with a simple set of rules for how to do systems thinking. Applying each rule to any problem enables us to explore yet unmade distinctions, systems, and relationships, and perspectives not yet taken. This facilitates “predictive analytics” that enable employees to perform cognitive activities critical for organizational learning: brainstorming, innovation, and forecasting.

Thinking through distinctions, systems, perspective and relationships provides a universal language for communicating mental models. This is necessary at any scale of an organization: from startups to the largest and most complex and occupationally differentiated multinational firms. It also allows for shared metrics on learning and collaboration that enables leadership to compare learning across groups with different functions and foci.

DSRP is Dynamic, Recursive, and Recombinant Thinking

In order to explain these four DSRP patterns for the first time here, we look at them individually. In practice DSRP patterns are dynamic, recursive and recombinant. DSRP is like the DNA of systems thinking/cognition. Consider how only four base pairs of DNA which can combine to create organisms ranging from a platypus to a giraffe. In an analogous way, the DSRP rules can be



combined and recombined in infinite ways to form myriad complex conceptual structures and systemic thoughts.

In other words, DSRP are the building blocks of mental models, the underlying structures of how we turn information into meaning. It is the recursive mixing and matching, combining and recombining of these simple elements that leads to solving very complex problems.

How We Work with Organizational Leaders to Train Systems Thinkers

We have developed a family of frameworks and hands-on technologies and tools to make systems thinking understandable and doable. Through keynote talks, trainings, webinars, online training, individual assessments using our Systems Thinking and Metacognitive Inventory (STMI), and application of our systems modeling software (Plectica), we provide systems thinking skills (DSRP) to organizations and apply it to customized content.

These various tools and technologies allow us to provide customized systems thinking courses for executives and scaleable systems thinking training and tools for the entire organization. The ability to measure systems thinking with our STMI provides a baseline indicator of individual development of skills and behaviors. And, our Plectica software provides an organizational learning platform for companies who want to practically apply systems thinking to address real organization challenges.

The 4th Wave of Systems Thinking

Three elements significantly differentiate DSRP systems thinking for organizations.

DSRP Benefits Both EQ and IQ

Systems thinking is a field characterized by a baffling array of methods and approaches. We argue that DSRP offers a unifying and organizing principle for the field of systems thinking and an indispensable analytical tool for solving complex problems. At the same time, the meta-cognitive practice of applying these rules has significant psychosocial implications, such as increasing self-awareness, empathy, and a sense of belonging, while decreasing stereotyping and self-harming and other-harming orientations. As such, DSRP has the potential to create advanced analytical thinkers with prosocial orientations. The underlying DSRP rules lead to both analytic and emotional intelligence.

DSRP Is Universal to All Systems Thinking Approaches

Systems thinking research has evolved over time and its history is rich and complex. But a brief understanding of its history can yield a deeper understanding of the power of DSRP/Systems thinking today. Historically, systems thinking has gone through 4 “waves” or periods which were characterized by different types of models and methods (some you may be familiar with).

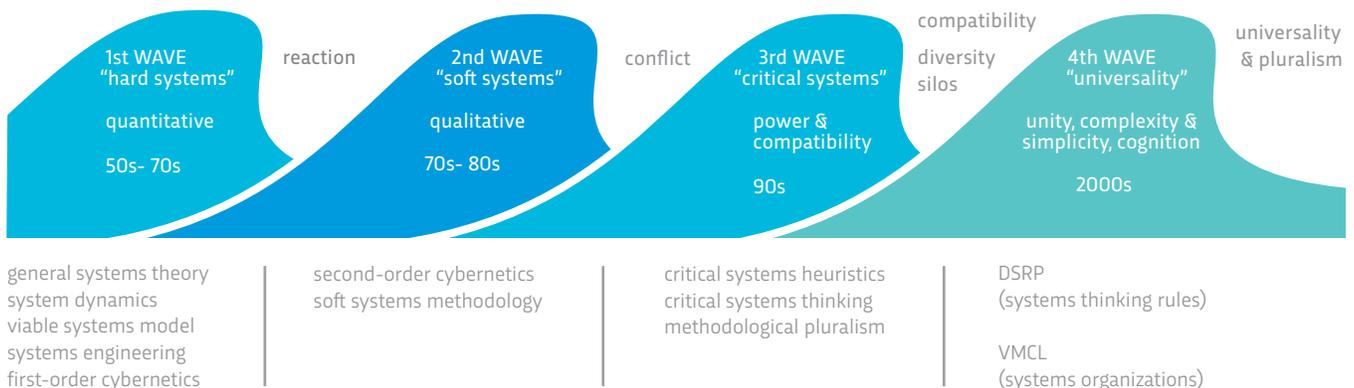


Figure 7: The Four Waves of Systems Thinking



The first wave was mostly influenced by engineers, technical folks, or “quants.” Systems engineering and system dynamics are still-popular models that exist from this time. The second wave arose as a reaction to what they perceived was missing in the first. Namely, the idea that these technical systems were embedded in a social context, which was itself a complex and dynamical system (Soft systems methodology (SSM)). The second wave spawned many models and methods that could be used (along with first wave frameworks) by social scientists, business leaders, and for social applications. The third wave arose to add two new insights to the mix. First, that the political dimension needed to be considered (i.e., *who* is at the table). Second, that the only way to define systems thinking in light of its now burgeoning number of methods and models was to embrace what was called *methodological pluralism*. In other words, that the answer to the question “what is systems thinking?” must necessarily be vague because there were hundreds (if not thousands) of different approaches. Systems thinking as a field had undergone its own kind of Cambrian Explosion. The fourth wave arose as a result of Derek’s research into universal patterns that underlie all methods and models of systems

thinking. Today, DSRP is widely accepted in the field as universal to the methods and models of the prior waves.

The fourth wave has some important benefits to organizational leaders. In particular it means that there is a single framework (DSRP) that can bring it all together. What this means is that the systems thinking that your engineering team uses and the models that your human resources department uses are compatible and can share a common language, universal skills and measures.

Mapping Matters

The unique formalism and structure of DSRP/Systems Thinking makes it imminently tangible, providing a formal basis for mapping any idea. Developed in the Cabrera Research Lab to be a dynamic systems mapping tool, Plectica software provides a platform for employees and leaders to map ideas, systems, and problems of any kind, to collaborate synchronously or asynchronously with teammates, and to share and evolve their mental models over time. This creates a meaningful atlas or knowledgebase of ideas. Many organizations struggle with knowledgebases that hinder

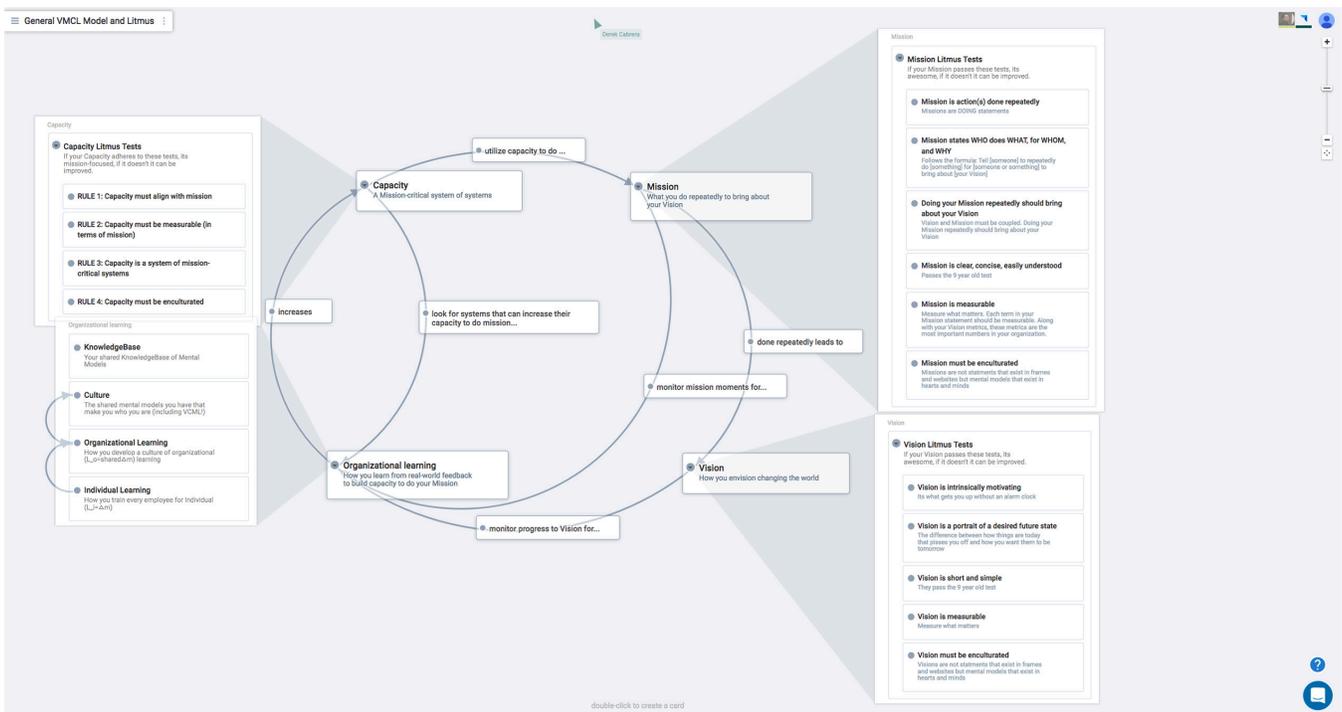


Figure 8: Plectica software provides dynamic contextual maps that can be shared, evolved, and collaborative



two important functions. First, people want to “not lose” their complex ideas. They should be searchable, shareable, and discoverable. Mapping things out on a whiteboard or sketch pad is useful, but capturing sharing them by taking photos in a way that makes them re-discoverable is difficult if not impossible. Second, static photos of whiteboards or text-based wiki articles makes it difficult to “use it.” Plectica provides dynamic contextual maps that can be shared, evolved and collaborative.

From Cornell to Corporate

Derek and Laura teach two 16 week graduate courses in Systems Thinking and Systems Leadership. There executive education programs bring the best of these courses to organizations. The following table describes some of the ways they can engage to help you leverage systems thinking in your organization.

Training & Tools	Offerings & Engagements
Keynote Address	Sound the keynote for an initiative and get everyone on the same page (1-2 hour dynamic and insightful talks).
Systems Thinking Training	Get executives & key personnel trained in systems thinking (DSRP) & modeling. Can be offered as full days; half days; ongoing cohorts; or, offsites in Ithaca, New York.
Systems Leadership Training	Get executives & key personnel trained in systems leadership (VMCL) & modeling. Can be offered as full days; half days; ongoing cohorts; or, offsites in Ithaca, New York.
VMCL Consulting	Develop systems leaders & design an adaptive organization; create a clear measurable vision, mission, cultural & capacital systems, & learning metrics.
Online Training (MOOC)	Create systems thinkers at all levels within your organization at a scaleable price point.
Ongoing Webinar Series	Achieve customization & scale through a live webinar series for continuous learning; can be offered in cohorts or as a small group support, as needed.
Systems Thinking & Metacognitive Inventory (STMI)	An edumetric baseline measure of participants’ system thinking skills & abilities in four critical & foundational domains; engages & motivates them to increase their score through ongoing training.
Books & publications, prework & media, posters, & videos	Provide training participants with a tangible take away for immediate implementation of systems concepts in their daily work, and to support systems thinking initiatives in organizations.
Systems Modeling Software	Enables employees to model any system for deeper understanding, & analyze complex problems to meet complex organizational challenges & develop potential solutions.

Table 2: Popular Systems Thinking Engagements



Johnson
Cornell
SC Johnson College of Business



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For further info about these offerings contact Erik William Michielsen: ewm64@cornell.edu