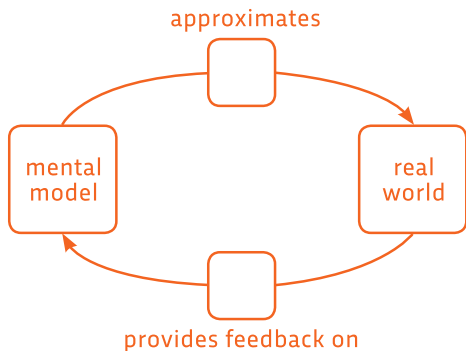


Cover page
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REALITY BIAS

systems thinking

A **mental model** is our understanding of the world—an approximation of reality based upon our ideas, beliefs, and past experiences. “Reality bias” refers to our belief that we experience reality directly. Instead, we perceive the real world indirectly through mental models—unique filters that highlight some things, ignore others, and add interpretations.



If we notice when our models do not conform to reality, we can use that discrepancy to improve them. This feedback cycle represents the learning process.



REALITY BIAS

systems thinking

Mental models shape our understanding of everything around us—from simple to wildly complex phenomena. Our understandings in turn shape our behavior, generating real-life consequences. The goal of systems thinking is the continuous improvement and refinement of our mental models such that they more closely reflect the real world. The closer the mental model to reality, the more useful it is to us.



The evolution of mental models

We can use DSRP to interrogate our mental models of the world and their degree of conformity to reality. Being ever mindful that our understanding of the world around us is an approximation can help avoid costly errors. This type of awareness of our thinking (metacognition) can make us better thinkers, communicators, decision makers, and group members.

This ongoing series of systems thinking cards highlights key concepts related to the four underlying rules of systems thinking as explained in *Systems Thinking Made Simple* (Cabrera & Cabrera, 2015).



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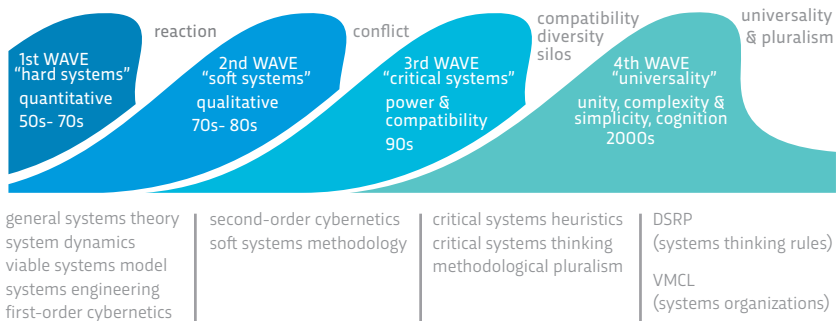
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THE FOURTH WAVE

systems thinking

The transdisciplinary field of systems thinking is widely applied across the physical, natural, and social sciences and the public and private sectors. Prominent scholars in the field of systems thinking recognize four historical waves.

The diagram below depicts the waves and a sample of associated methods, theories, and approaches.



While the first three waves differed from each other in terms of philosophical approach, associated theories, and methods, the fourth represents a simultaneous simplification and unification of the field, making systems thinking more accessible to specialist and novice alike.

THE FOURTH WAVE

systems thinking

The **first wave** included “hard,” expert, or technical systems and mostly quantitative methodologies.

The **second wave** of systems thinkers reacted to what they perceived as a failure to account for the wider social context and the participation of multiple, diverse stakeholders, and focused more on qualitative methods, collaboration, and facilitation.

The **third wave** criticized this paradigm war and emphasized methodological pluralism while adding consideration of power relations. This pluralism has had the unfortunate side effect of “silofication” of the field into subspecialities. This diversity makes it difficult for newcomers to grasp the field and for seasoned scholars and practitioners to move the field forward.

An emerging **fourth wave** of systems thinking unifies and advances the field by identifying four simple rules—making distinctions and recognizing systems, relationships, and perspectives (DSRP)—underlying the diversity of the three waves. Incorporating the modern cognitive sciences, the fourth wave arose from the discovery that systems thinking is a complex adaptive system (CAS), an emergent property of DSRP patterns.

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SIMPLE RULES

systems thinking

Complex adaptive systems (CAS) are bottom-up phenomena in which individual “agents” follow simple rules that lead to complex, macro-level outcomes called emergent properties.

The agents of a CAS could be organisms, people, organizations, economies, etc. A CAS adapts to survive in its environment. To understand the complexity that emerges in a CAS, we need to discover the simple rules that govern the micro-level behavior of its constituent parts. In many CAS there is no leader or leadership.

AN EXAMPLE OF SIMPLE RULES OF A SUPERORGANISM

- Maintain a certain distance from your nearest neighbors
- Adjust direction relative to nearest neighbors
- Avoid predators



SIMPLE RULES

systems thinking

There are many examples of complex adaptive systems (CAS) in nature, such as ant colonies, and large flocks of birds or schools of fish that move quickly in perfect unison. Humans themselves often constitute complex adaptive systems, in that their simple actions can generate incredible complexity. Society is a CAS. Any group or organization is a CAS. The stadium wave is a CAS. Inanimate objects can also form complex adaptive systems. The internet is a CAS. Economic markets are CAS. The human brain is a CAS. Systems thinking is also a CAS, an outcome that emerges from application of four simple rules: making distinctions and recognizing systems, relationships, and perspectives (DSRP).



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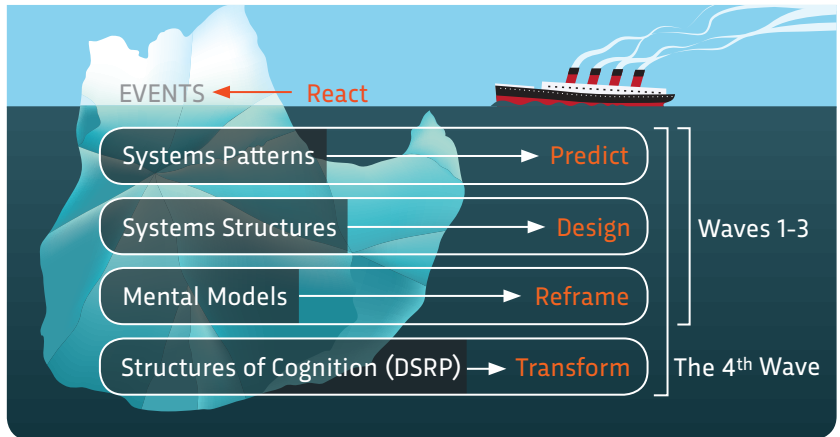
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THINK DEEPER

systems thinking

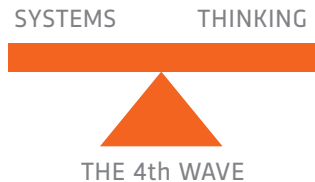
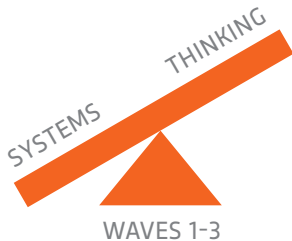
How can we avoid the costly problem of constantly reacting to events? The first three waves of systems thinking encourage us to think deeper. First, to identify the patterns underlying systems so that we can anticipate or predict events. Next, to seek out systems' structural properties, which enables us to design systems to produce desired outcomes since "system structure determines behavior." Then, to understand the significance of mental models. The fourth wave of systems thinking goes deeper still.



THINK DEEPER

systems thinking

The fourth wave delves into the cognitive structure of mental models, showing us the four patterns underlying all thought—making distinctions and recognizing systems, relationships, and perspectives (DSRP). Applying DSRP allows us to recognize the pervasiveness of mental models so we can deconstruct them. It expands our thinking by identifying new perspectives to take and yet-to-be-made distinctions, systems, and relationships. In this way, the fourth wave achieves a newfound balance between both the systems and the thinking aspects of systems thinking.



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A UNIVERSAL COGNITIVE CODE

systems
thinking



Dr. Derek Cabrera identified four simple rules (or patterns) that underlie the multiple approaches and methods that characterize the field of systems thinking. These rules are making distinctions and recognizing systems, relationships, and perspectives (DSRP). As the building blocks of human cognition, they form a universal cognitive code.



Each rule consists of two co-implying elements. This means that the existence of one element implies the existence of the other (e.g., for the systems rule, a part implies the existence of a whole and vice versa). While we treat each rule separately to facilitate understanding, in reality the four rules operate simultaneously and in no particular order. Neither D, S, R, nor P exists in isolation. For example, recognizing a system of parts, or the relationships among those parts, or a perspective, all entail making distinctions. So too, a single relationship can be a whole system made up of parts.

4 Patterns and 8 Elements

Simple Rule or Pattern

Distinction (D)

System (S)

Relationship (R)

Perspective (P)

Element 1

identity (i)

part (p)

action (a)

point (ρ)

Element 2

other (o)

whole (w)

reaction (r)

view (v)

Four simple rules produce collective dynamics that in turn emerge as systemic thought.

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DISTINCTIONS

systems thinking

One of the rules of DSRP is making distinctions. It is innate for humans to distinguish one thing from another—what is variable is how conscious we are of this process. Distinctions consist of two co-implicating elements: the **identity** (the thing or idea that is the focus of attention) and the **other** (that which is *not* the identity). Distinction-making consists of defining what the problem/issue/thing is, and what it is not, which is an act of boundary making that entails opportunity costs—a critical idea in systems thinking.



How we draw or define the boundaries of an idea or a system of ideas is an essential aspect of understanding them.

DISTINCTIONS

systems thinking

For example, if you are going to do a job, the first task might be to distinguish what is (identity) and is not (other) entailed in the job. By drawing a boundary around the identity (here, job), you focus on some things and omit others.



When you engage in conscious, systematic application of the distinctions rule, you can increase the clarity and precision of your thinking, eliminate redundancy, and promote awareness of perspective (since what we focus on is always a matter of perspective).

On the other hand, unconscious distinction making can lead to marginalizing the other and lack of awareness of the sources and the consequences of our boundary making.

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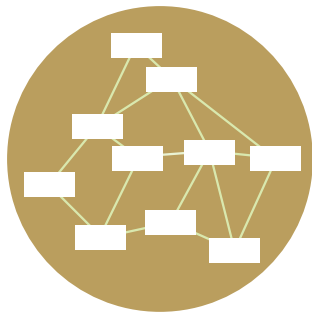
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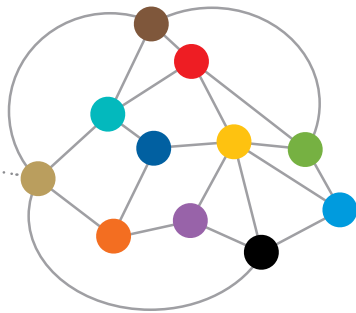
SYSTEMS

systems thinking

Consideration of systems is probably the greatest commonality across systems thinking scholars and practitioners. The systems rule—any idea or thing can be split into parts or lumped into a whole—consists of two co-implying elements: **part** and **whole**. Applying this rule simultaneously incorporates reductionism (splitting things into their constituent parts) and holism (seeing everything as part of a larger whole). When we apply the systems rule, we recognize that what is a part of one whole can also be a whole in itself composed of different parts. We also are mindful that the way we organize parts into wholes is influenced by perspective and can change the characteristics of the system.



United States economy

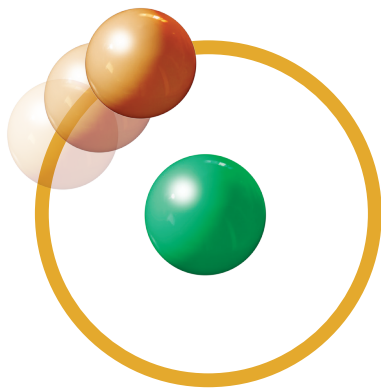


Global economy

SYSTEMS

systems thinking

For example, the universe was once considered the entirety of a system (i.e., it was a whole and not a part of anything else), but we now know it is one of many universes that make up a meta-universe. Similarly, we once thought the atom was the smallest unit of matter, yet we now know that it, too, has parts.



Hydrogen atom



Observable universe

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RELATIONSHIPS

systems thinking

Relationships are a central focus in systems thinking (e.g., the idea of feedback loops). The relationships rule—any idea or thing can be related to any other idea or thing—is characterized by two elements: **action** and **reaction**. When problem solving, we often look for relationships of correlation, some of which may involve cause and effect. Systems thinking often emphasizes the complexity of relationships, seeking out webs of causality rather than single, linear causes.



earth



ocean tides



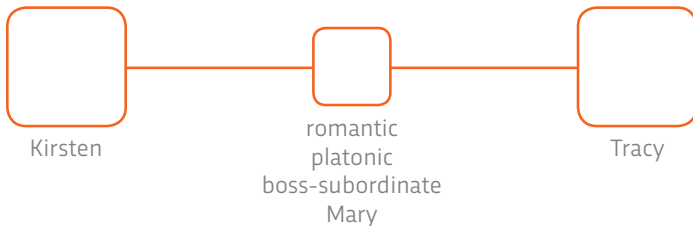
moon



the earth's gravity the moon's gravity

the earth's centrifugal force the moon's cycle

Thorough application of the relationships rule entails identifying the relationship. For example, global warming could be identified as the cause of rising sea levels. Alternatively, the relationship between two people might be identified as romantic, platonic, boss-subordinate, or perhaps “Mary” (if Mary introduced them). Much of the complexity and many of the unique properties we see at the group level are attributable to the relationships among the constituent parts of a whole. Since they are often the hidden dynamics of systems, identifying the relationships among parts of the whole is critical to systems thinking.



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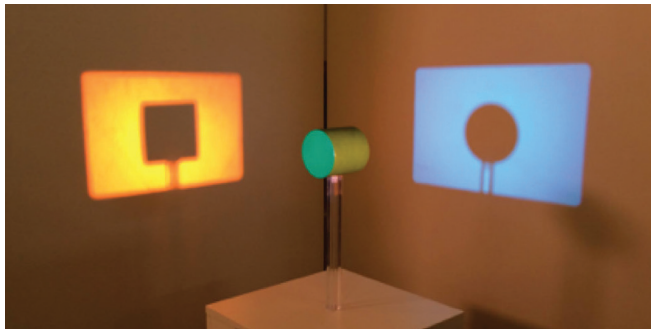
PERSPECTIVES

systems thinking

Perspectives are integral to the systems thinking concept of mental models. The perspectives rule states that any thing or idea can be the point or a view of a perspective. This rule entails two elements: a **point** (that which is doing the seeing or focusing) and a **view** (that which is being focused upon or seen). Conscious application of the perspectives rule requires that we acknowledge that what we *perceive* as reality is really a mental model—just one of many ways to frame information—and proceed to identify the perspective(s) that make up that model.



Perspective taking is entailed in every distinction we make and every system and relationship we identify. The ability to identify the perspectives implicit in all information we encounter—and to consider and apply alternative perspectives—is a tremendous aid in problem solving and consensus building. In other words, we need to look at how we and others frame issues, consciously or unknowingly. When we change the way we look at things, the things we look at change.



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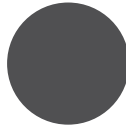


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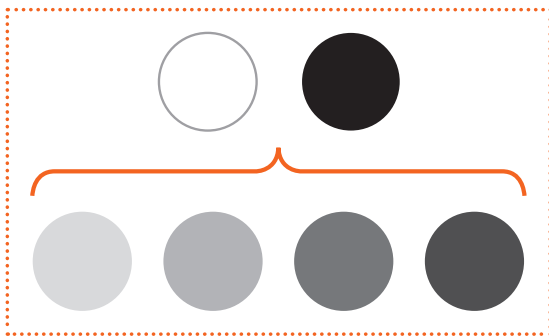
A NEW LOGIC

systems thinking



Systems thinking, as with all thought, entails the application of logic, which can be thought of as (often unconscious) guiding principles. Two opposing forms of logic are bivalent and multivalent logic. Bivalent logic entails "either/or," dichotomous, "black and white" thinking (e.g., right vs. wrong). While easy to apply and useful for simplification, bivalent logic is often inadequate to understand the complexity of the real world. Multivalent logic recognizes multiple outcomes and nuance ("shades of grey" rather than black and white), and is conducive to systems thinking.

DSRP allows for a new, “both/and” logic that embraces both styles by situating bivalent logic within a multivalent frame. Making distinctions is a bivalent act (identity vs. other), but that distinction making occurs simultaneously with application of the relationships, systems, and perspectives rules. For example, applying DSRP entails recognizing that our distinction making occurs from a particular perspective (that of the identity), and that we could easily take instead the perspective of the other.



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THINKQUIRY

systems
thinking

Thinkquiry is a systems thinking tool that provides a structure to organize information for deeper understanding and analysis. Systematically answering Thinkquiry questions helps us apply the simple rules underlying systems thinking (DSRP)—which are also the building blocks of cognition—to deconstruct any problem or issue. Flip this card over to see some basic questions to ask yourself (applying perspectives and systems rules as an example) when considering any topic.

See all the DSRP Thinkquiry questions at: www.thinkquiry.us



Systems

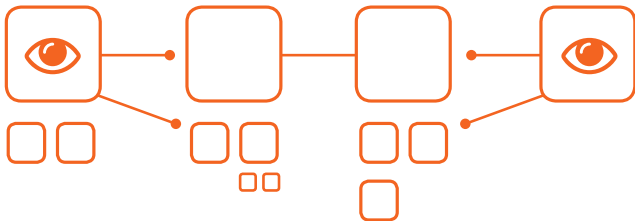
What are the parts of ____?

What is ____ a part of?

Can you name some of the parts of the parts of ____?

What are the parts of the relationship between ____ and ____?

What are the parts of ____ when looked at from the perspective of ____?



Perspectives

Can you think of ____ from multiple perspectives?

When looking at ____, can you identify the perspective it is viewed from, and the subparts of that perspective?

How are ____ and ____ related when looking at them from a new perspective?

What are the parts of ____ when looked at from multiple perspectives?

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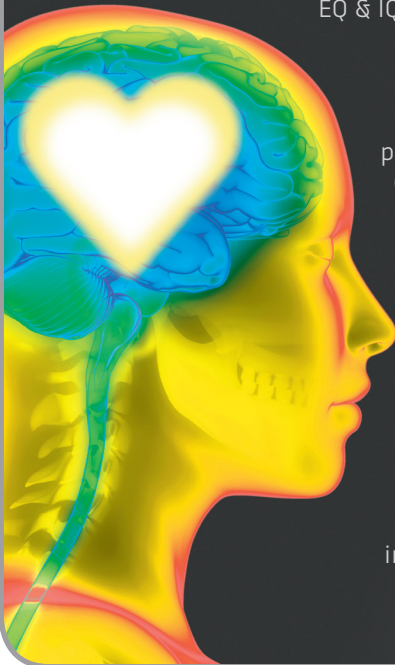
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EQ & IQ

systems thinking



EQ & IQ: EMERGENT PROPERTIES OF DSRP RULES



There is consensus that emotional intelligence (“EQ”) is critical to success in all realms—including education, work, psychological development, social life, and citizenship—but less is known about how to generate EQ. Practicing DSRP entails conscious use of the four building blocks of cognition, and such awareness of our thinking is called metacognition.

Metacognition is associated with intelligence and critical thinking skills (“IQ-type skills”), but there are similarly positive implications for emotional intelligence (“EQ-type skills”). In short, being aware of the distinctions we make and the perspectives we take, the systems of which we are part and our interrelatedness makes us better thinkers, but also better people. EQ is an emergent outcome of applying the DSRP rules.

Systems thinking has often been associated with increases in IQ-type skills (analytical intelligence). Here are some examples of how practicing DSRP increases emotional intelligence:

- Conscious distinction making (recognizing both the identity and the other) decreases our tendency to marginalize others.
- Realizing that we are part of a larger system helps us consider our own interests as aligned with the groups to which we belong, reducing self-centeredness.
- Seeing how we are related to others, including how our actions impact other people, can make us more thoughtful and compassionate.
- Learning to recognize multiple perspectives, and realizing that within any group there are a diversity of viewpoints, reduces stereotyping and increases open-mindedness.



INFORMATION +STRUCTURE

systems thinking



We construct mental models (i.e., meaning, knowledge, concepts, ideas) from information and structure. To illustrate this concept, consider language, where information is represented by words. However, the way we structure these words—using mechanics (punctuation) and syntax (which includes word order)—can give different meaning to the same set of words. Consider these two examples:

Woman, without her man, is helpless.

Woman! Without her, man is helpless!

Miranda says she wants to eat only dessert.

Only Miranda says she wants to eat dessert.

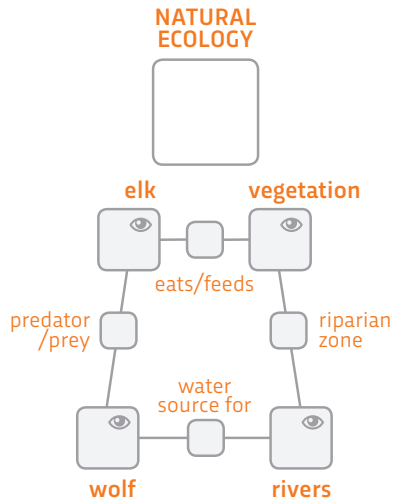
Structured through differing use of punctuation and syntax, the same set of words can produce entirely different understandings or mental models.

INFORMATION + STRUCTURE

systems thinking

In systems thinking, information includes words, numbers, symbols, images, and data. Structure is the underlying cognitive patterns: making distinctions and recognizing systems, relationships, and perspectives (DSRP). Becoming a systems thinker entails seeing both the information and the structure.

In verbal and written communications, there is a tendency to focus on information, which impairs our ability to convey meaning. Meta-Map software (www.metamap.me) is an effective way of organizing information that emphasizes both structure and meaning.



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SOLVING WICKED PROBLEMS

systems
thinking



The real promise of systems thinking lies in its utility for addressing trans-disciplinary “wicked problems”: seemingly intractable, complex issues that involve competing interests and multiple systems (e.g., economic, social, political). Systems thinking has long been applied in academic disciplines, communities, government, industry, and all sorts of organizations.

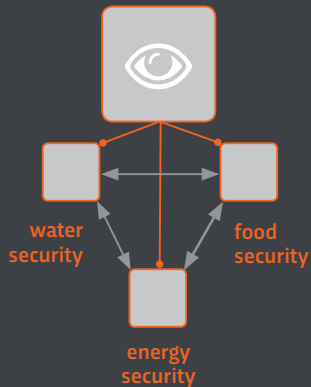


SOLVING WICKED PROBLEMS

systems thinking

A promising current example of how systems thinking can be applied to an entire sector is ThinkWater, a national movement of educators, students, managers, stewards, scientists, and citizens who think and care deeply about water and believe that systems thinking is key to a secure water future. Funded by the US Department of Agriculture and led by University of Wisconsin-Extension and Cabrera Research Lab, ThinkWater's mission—vision is to Engage, educate and empower 7 billion systems thinkers to solve wicked water problems. It does this by teaching systems thinking to enhance existing water-related efforts in education (in schools and communities), Extension, and research. For more information, go to www.thinkwater.us.

NEXUS PERSPECTIVE



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THINKWATER

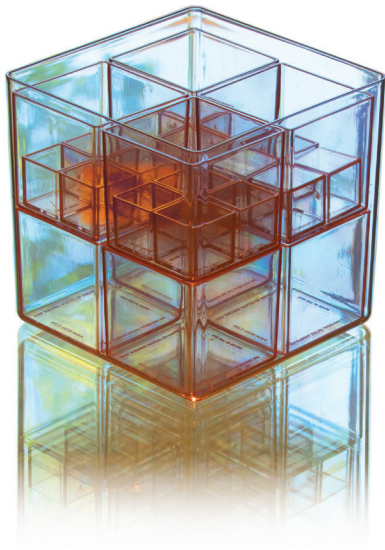
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HOLD THAT THOUGHT

systems
thinking

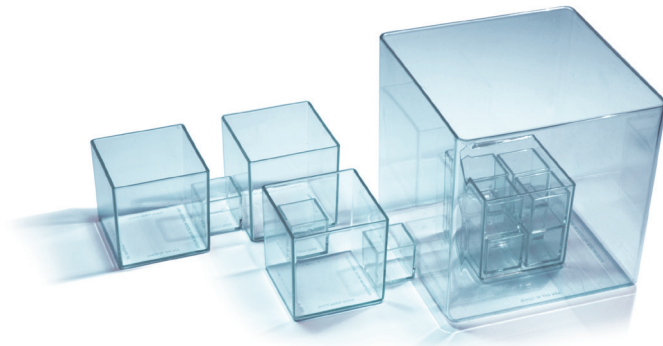
Systems are complex and problems are wicked, so systems thinkers use visualization and object manipulation to model and therefore deeply understand the challenges they face. 3-D representations of systems are particularly useful for deconstructing and analyzing complexity. ThinkBlocks are an educational tool, a tactile manipulative much like those popular in teaching mathematics and in Montessori schools. Tactile or “kinesthetic” learning is effective because the human mind is wired to understand through touch, gesture, and object manipulation. Human cognition is embodied, with many sensory neurons allocated to both the eyes and the hands.



HOLD THAT THOUGHT

systems thinking

ThinkBlocks are 3-D, dry-erasable, nested, relational, and perspectival blocks that help people do systems thinking in groups, using their hands to move ideas around to build shared systems models and understanding. Essentially 3-D versions of DSRP maps, the blocks facilitate distinction making, organizing systems of parts, making relationships between parts (and systems), and altering all of the former based on different perspectives.



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THINKWATER

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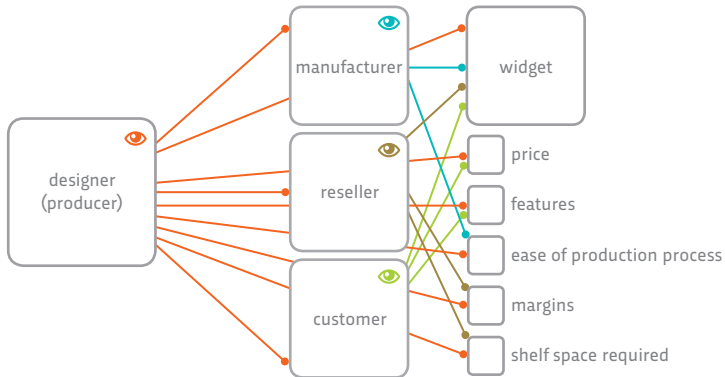
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MAPPING SYSTEMS

systems thinking

Systems thinking often uses visual models because they are efficient and powerful ways to convey the complexity of systems. Because all mental models (i.e. concepts, ideas, etc.) are made of information (data) and DSRP structure, Cabrera Research Lab developed software to create two-dimensional maps that use DSRP to structure any data. These maps are content agnostic and can be as simple or complex as the user requires.

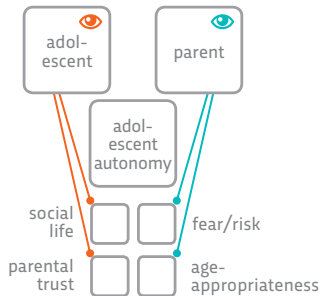
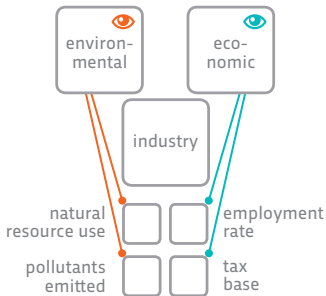


Every node in a DSRP diagram (shown above) can be a distinction (an identity or an other), system (a part or a whole), relationship (an action or reaction), or perspective (a point or a view).

MAPPING SYSTEMS

systems thinking

Such software (or drawing out maps by hand) allows us to visualize systems of any kind by encouraging us to recognize and define these systems, identify their parts and the relationships among them, and specify the perspectives we employ. In other words, we make visible the structure that underlies and gives meaning to information.



The diagram above shows a simple example of two different sets of information with the same structure. Both maps show an object being viewed from two perspectives. Note that while the structure of these maps is the same, the information content, and therefore the meaning of the maps, differs.

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VUCA

WORLD

systems
thinking

Developed in the military to characterize conflicts in the post-Cold War era, VUCA is an acronym denoting a context characterized by volatility, uncertainty, complexity, and ambiguity. The term is used by strategists and in managerial circles, and is readily applied across different levels of scale. It is often applied in institutional and organizational contexts, as both are subject to VUCA threats. At the same time, volatility, uncertainty, complexity, and ambiguity generate wicked problems and thereby impede individual progress on issues ranging from personal to professional, societal to governmental, etc.



Advances in technology and communications and the globalization of an increasing array of phenomena mean we all live in a VUCA world. Volatility, uncertainty, complexity, and ambiguity are all different phenomena, but together they necessitate a new approach to organization, problem solving, and planning. The fourth wave of systems thinking—inclusive of its new logic (bivalent nested in multivalent), its focus on simple rules to deal with complexity, its universality and associated content agnosticism, and its focus on metacognition for deeper understanding and emotional intelligence—enables us to tackle VUCA head-on.



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