Defining Learning: A Change in Mental Model

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Defining Learning
A Change in Mental Model

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Abstract: Learning needs little in the form of justification—it is the basis of human discovery and organizational success. But, it does need more precise definition. It is often confused with closely-related but different terminology such as: knowledge, mental models, concepts, information, ideas, organizational learning, culture, behavior, education, memorization, school, and many more.

Learning | individual learning | organizational learning | mental model | knowledge | culture | schema | information | memorization

1. Defining Learning

Despite the massive role that learning plays in our daily lives, it is ill-defined. There is often confusion about what learning is, likely due to its conflation with what occurs in schools, educational institutions, or what is sometimes called "academic" learning. Most of what is being referred to in these cases is *memorization of information* which is a form of superficial learning. For example, if one remembers the string of symbols 1234, it is a form of superficial learning (i.e., memorization of information). This is *not* the same as knowing that that string of numbers is the combination to a lock, which is also not the same as knowing *how* to unlock a lock using this string of numbers. These are easily conflated learnings, but they are not the same.

1. You can *learn* and therefore *know* the string exists;
2. You can *learn* and therefore *know* the string is the combo to a lock; and
3. You can *learn* and therefore *know* how to use the string to open the lock.

Most people would read this list of three things and conclude that #3 is the application of the knowledge in #2. However, the application is another form of knowledge in and of itself. In other words, there is additional information needed to actually open a lock, beyond the basic concept of the combination. One also needs to understand how to rotate the dial, how to recognize the "tactile click" when the dial has arrived, and how to "pull through" the initial resistance of the lock as it is opened.

Learning is a *change in knowing* and *knowledge* is synonymous with a *mental model*. A mental model is *information meaningfully organized by thinking*. Thus, Learning ($\mathbb{L}$) is any change ($\triangle$) in a mental model ($\mathbb{M}$):

$$\mathbb{L} = \triangle\mathbb{M}$$

Note that learning is often associated with something good or positive, but the change need not be "positive" or "negative." It only needs to be a change in meaning. In other words, it is possible—indeed quite common—that we learn "negative" things (i.e., incorrect, false, untrue, or "bad" things).

This learning occurs at both an individual and organizational (group) level. We differentiate between individual learning ($\mathbb{L}_I$) and organizational learning ($\mathbb{L}_O$)[*] by adding the "shared by agents[†]" variable (α) which is characterized as whatever mental model changes, multiplied by the agents in an organization. Importantly, organizational culture ($\mathbb{C}$) is different from organizational learning ($\mathbb{L}_O$), as culture is defined as *shared mental models*. Thus we get:

$$\mathbb{L}_I = \triangle\mathbb{M}$$

$$\mathbb{L}_O = (\triangle\mathbb{M})\alpha$$

$$\mathbb{C} = \mathbb{M}\alpha$$

For example, say that you have 10 individuals in your organization and you want to change the culture of how they do meetings from the old paradigm (e.g., presenter presents then people ask questions) to the new paradigm (e.g., group reading time then discussion)[‡].

- First, we understand that in order for the culture to change, a mental model must be held by the some relatively large part of the organization (say 6 of the 10 people), thus;

- In order for a mental model to be held, the old mental model must change to the new mental model for at least 6 people, thus;

- In order for a mental model to change, learning must occur.

These definitions for Learning are *predicated* on the definition of mental model ($\mathbb{M}$), which is defined in Table 1. The crux of understanding this definition is realizing the many synonymous terms that are used for mental model, information, and thinking.

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[*]By organizational learning we mean "group" learning. That is, any learning that is taken on as a shared property of a system or group. The "organization" need not be a formal "company," but could alternatively be an informal collection. It also need not be "human," but could alternatively be any grouping of agents.

[†]We use the term "shared" to mean *held in common*. If a manager shares a memo/email, for example, that is not a shared mental model. If various people in the organization generally interpret the contents of that memo/email in the same way, that is a shared mental model.

[‡]Here again, you must differentiate between: (1) *knowing* the conceptual difference between the old and new model of meetings, (2) *knowing* how to *do* meetings in this way, and (3) **knowing** the difference between 1 and 2. But for the purpose of keeping the example simple, we do not distinguish these different knowings and learnings.

Table 1. Mental Model

Mental Model ($\mathbb{M}$)	=	Information ($\mathbb{I}$)	Thinking ($\mathbb{T}$)
A mental model is synonymous with knowledge, meaning, construct, model, schema, idea, concept, etc.		Information is synonymous with symbolic variables, content, data, labels, words, language, materials, etc. And, can also be understood as the fundamental function of the material world (e.g., to transport information)	Thinking refers to both noun-like structures (a thought) and verb-like processes (a thinking process). It is synonymous with encoding, organizing, or structuring content in order to give it meaning.

Or, simply, a mental model ($\mathbb{M}$) is the same as Information ($\mathbb{I}$) meaningfully organized by Thinking ($\mathbb{T}$) [which requires a compound product ($\otimes$)][§]:

$$\mathbb{M} = \mathbb{I} \otimes \mathbb{T}$$

Systemic Thinking ($\mathbb{T}$) is a complex and adaptive phenomena borne of a universal set of simple rules[1–4]. DSRP Theory can be expressed as a complex adaptive system or CAS, in which the agents are informational variables and the simple rules are DSRP patterns and their co-implying elemental base-pairs (see Table 2). The DSRP structure of 4 Patterns and 8 base-paired elements is given in Table 2

Table 2. Basic Structures

Patterns	Elements		
Distinctions (D)	identity (i)	$\leftrightarrow$	other (o)
Systems (S)	part (p)	$\leftrightarrow$	whole (w)
Relationships (R)	action (a)	$\leftrightarrow$	reaction (r)
Perspectives (P)	point (ρ)	$\leftrightarrow$	view (v)

The 8 elements and four patterns of DSRP are akin to the DNA of thinking. In other words, DSRP is to the formation and evolution of cognition as ATCG (the nucleotides of DNA) is to the formation and evolution of biology (life). Systems thinking is described as a continuous and recursive loop borne of DSRP processing of information seen in Figure 1.
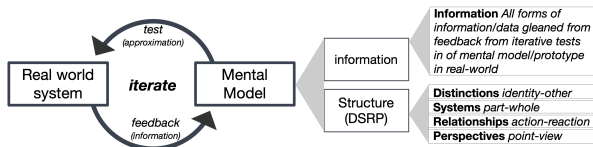

Fig. 1. The ST Loop

The simplified formula for mental model ($\mathbb{M} = \mathbb{I} \otimes \mathbb{T}$) is further explained in the following equation:

$$\mathbb{M}_n = \bigoplus_{\mathbb{I}} \bigotimes_{j \leq n} \mathbb{T}\left\{: D_o^i \circ S_w^p \circ R_r^a \circ P_v^\rho :\right\}_j$$

Which is explicated in Figure 2:

[§]By *compound product* we mean that the information and the DSRP structures are iterative and recursively applied.
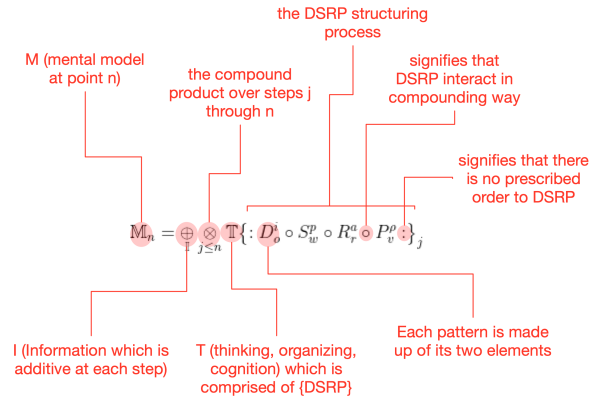
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Fig. 2. Notations on Formula for Mental Models

This formulation provides a basis for what is meant by change ($\triangle$), which is an essential concept in the definition of Learning. What do we mean by change? The formula for mental models makes it quite clear. A change in a mental model is any change in the information ($\mathbb{I}$) OR the DSRP organization ($\mathbb{T}$) or both.

Thus, DSRP drives mental models which drives individual and organizational learning and culture. Of course, the process is not linear, and there are multiple feedback loops.

$$DSRP \leftrightarrow \mathbb{M} \leftrightarrow \mathbb{L}_I \leftrightarrow \mathbb{L}_O \leftrightarrow \mathbb{C}$$

Therefore, defining learning requires a corollary understanding of how we build, share, and evolve mental models. It is this evolution—or change—in our knowledge that lies at the core of individual and organizational learning.

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