

Metapatterns for research into complex systems of learning

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Synonyms

Patterns; Systems Thinking; Abduction

Definition

The word *metapattern* was coined by Gregory Bateson (1979/2002, p. 10). According to Bateson a *metapattern* is a pattern of patterns; a vast generalization; a pattern which connects. In this case, *meta-* refers to the sense of over-arching or transcendent. A metapattern is then an over-arching or transcendent pattern.

Theoretical Background

The use of “metapatterns” as tools for research is into learning, discourse, and cognition is the primary focus of this article. However, such an approach is applicable to a wide range of other

phenomenon, such as teaching, classroom communities, schooling, policy, and institutional dynamics. Metapatterns are ubiquitous functional patterns or principles that are widely evident throughout the scope of biological evolution, as well as throughout cultures, technology, and cognition. From a complexity sciences point of view, metapatterns are the embedded and emergent patterns in the natural world. The extension into culture and technology are a result of this natural or biological origin.

The core list of metapatterns and their some of their key functions and qualities include: (a) *spheres* – containment, strength, equanimity; (b) *tubes* – linear transport or flow, linear strength, connection; (c) *sheets* – capture, 2-dimensional movement, maximized surface area; (d) *layers* – organization, stability; (e) *borders and pores* – separation, barrier, regulation of exchange or flow; (f) *centers* – organizational stability, attraction, control; (g) *binaries* – simplest level of complex relationships; pairings; (h) *arrows* – flow, movement, growth, sequences, directional relationships or connections; (i) *breaks* – change, transformation, divergence, branching; (j) *calendars and time* – a binary of movement and memory, stages, as arrow or cycle, progression; and (k) *cycles* – repetitions, maintaining a systems, feedback looping, circulations.

In addition to these eleven patterns, other possibilities exist and have been identified by other scholars. However, the central characteristics in determining whether a particular pattern or principle can be utilized as a “meta”-pattern are that the pattern appears in multiple contexts or disciplines and has a set of core functional properties that are useful across scales. Metapatterns, as relatively scale-free principles, concepts, or patterns can be used to see and explore connections across diverse contexts.

The functional qualities, meanings, and metaphorical aspects of these patterns are of central importance in their use in research and learning. For instance, binaries are the simplest form of complex relationships. The joining or clustering of two or more “things” generates a new whole that

is greater than the parts and, at the same time, produces a whole with significant new properties.

Binaries are associated with unity or separation, duality, tension, and complementarity. For instance, two senses organs, such as eyes or ears, provide a significant new functionality as opposed to having on one sense organ. Two eyes provide for depth perception and a greater field of vision that is not available with one eye. On the other hand, multiple lenses in the two eyes of a housefly provide the housefly with a greater field of vision (with two eyes) and a vastly increased sensitivity to movement (with multiple lenses).

There are three fundamental uses of metapatterns. The first use focuses on the subject matter of the metapatterns themselves, as well as related scale-transcending principles.. Since metapatterns appear across multiple contexts and subject matter disciplines, they can provide a greater sense of relevance, meaning, and interconnectedness of knowledge. Returning to the example of binaries, such functional patterns appear in the arts (e.g., synergy of light and shadow), science (e.g., DNA paired pairs, symmetry, positive and negative ions), social sciences (conflict, double binds), mathematics (e.g., numerical systems, positive—negative), literature (e.g., protagonist vs. antagonist), and culture (e.g., gods—devils, four directions and their qualities in aboriginal cultures). In each case, the binaries (or larger number systems) create a greater whole with significant new properties or meanings. The development of understandings of such fundamental patterns provides for the ability to transfer knowledge across disciplines. Even though the specific details of each pattern may differ across contexts, the core meaning or functionality is still present.

The second use involves using metapatterns as analytical tools for investigating phenomena with the aim of providing new insights into the structure and dynamics of the phenomena. Since metapatterns commonly appear throughout and across contexts (from the natural world to technology to culture and to mind), they can be used to identify various patterns and their interconnections and interactions. For example, a video recording of an intense student argument

along with a transcript and other observational data can be analyzed using metapatterns, in the following way: *Arrows* can represent the thematic and conceptual development, while *binaries* can be used to represent conflicting points of view. As the conceptual theme develops it can branch off or *break* into subthemes. Any ongoing phenomena or system must have one or more *cycles* occurring to maintain the system. In an argument, these cycles involve student talk as well as student cognition as they continue to develop their particular conceptual stance. The *triggering* (another possible metapattern) of the argument probably occurred as a conflicting *binary*-based *center*, which consists of some sort of conflicting problem or point of view. Figure 1 shows an example of a metapatterns-based model of student argument.

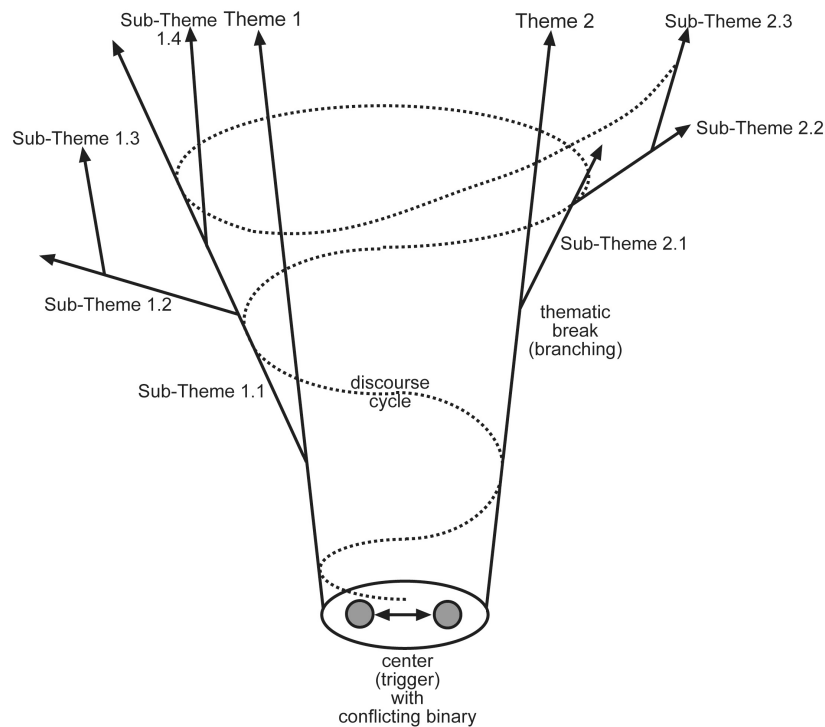


Figure 1. Example metapatterns-based model of a student argument.

The third use involves using metapatterns as design and modeling tools, with a focus on representing concepts as imagery. In addition to the conceptual (function and meaning) characteristics, these patterns also lend themselves to visual representation. As a consequence,

explanatory and representational models can be created. In figure 1, as noted, metapatterns can be used to analyze a particular phenomenon. However, they can be used as design tools, such as in the design of a classroom community that accounts for both the physical and social dimensions of such a community. The physical layout can be conceived as a metaphoric sphere (containment of the community), even though it is box-shaped, with various centers (attractors for various activities, clustering (another potential metapattern) of seating to optimize relationships (binaries and greater), flow pathways (arrows) for moving between different activities, and so forth. The social dimension may be conceived of as a holarchy (concentric spheres) of layers of participation, where the teacher is mentor and primarily occupies the center layer. Students move toward the center as they develop as participants in the learning, inquiry, and/or knowledge producing community.

Thus far the discussion of metapatterns has focused on their use as tools for the study of basic principles of form and function, for analysis of complex phenomena, and for design. Many of these uses are suitable for students in communities of learning, discourse, and engagement. The key point involves a promotion of pattern thinking. The viewpoint of pattern thinking includes: (a) the embedded and emergent patterns in phenomena; (b) the functions and meanings of patterns ; (c) the similarities and differences among patterns across scales (d) the adaptive value of patterns in evolutionary systems, from biology to culture; (e) the roles of parts as individual and interacting components within the complex wholes of systems; and, ultimately, (f) the structure of knowledge and methods of obtaining knowledge across contexts (or subject matter disciplines).

Based on these characteristics of pattern thinking and a metapatterns viewpoint, a research model for complex systems of learning is comprised of three basic components: (a) depth, (b) abstraction, and (c) extent or abduction. The fundamental approach in utilizing this model is one of recursion. One may begin by inquiring “downward” into depth, while examining the meanings and relationships among parts of systems and various patterns in learning, thinking, discourse, learning

communities. As we engage in this process, we begin to formulate explanatory principles, generalizations, and models “upward” through what is called abstraction in this model. Finally, at the same time, we can explore “horizontally” in an abductive manner to build bridges to related patterns across other contexts and different scales. In this abductive dimension, the patterns involved in bridging will usually have different contexts, such as learning and thinking in schools, in the trades, in corporate settings, across cultures, and so forth. At the same time, this expanding of extent by the abductive use of metapatterns can be applied to testing the human fit of understanding across levels, such as how what we may find with one student fits other students in the class all the way up to people in general.

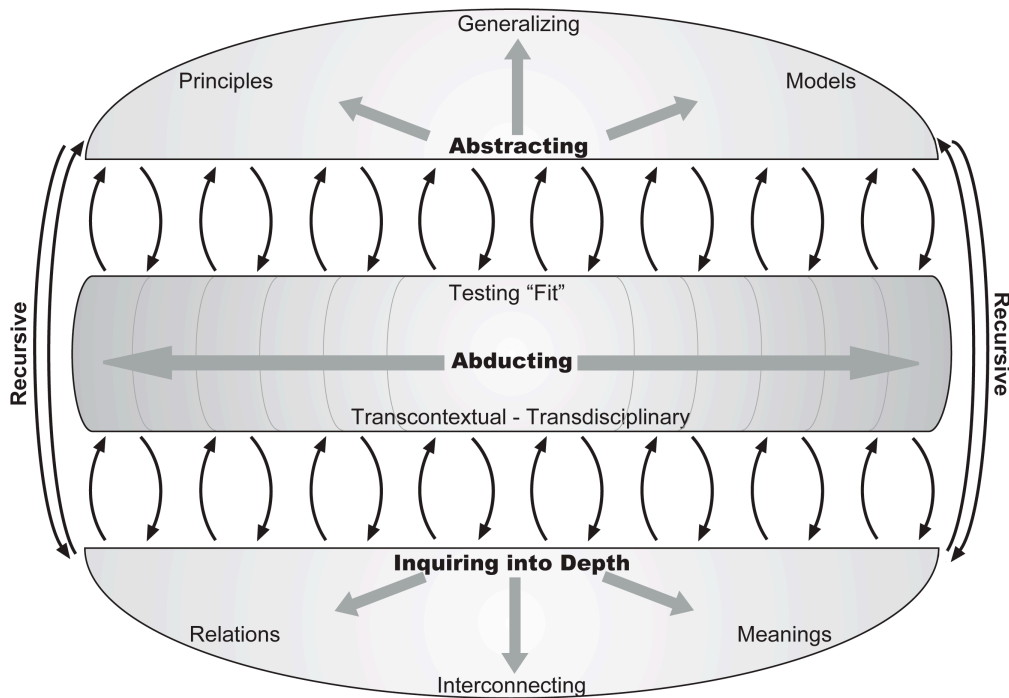


Figure 2. A model of complex learning and thinking.

This model of depth-abstraction- and –extent (or abduction) can use metapatterns or any other pattern-concept that appears or can be applied across contexts. The benefits of this model include the potential for increasing rigor in qualitative research. In particular, the abductive dimension of

metapatterns provides a means for determining the limits or borders for any claims about various patterns of phenomena, while providing for the establishment of justifications for any explanatory claims. Such a process also provides for a means to formalize scalable explanations, where the complete explanation in all detail is applicable to the phenomenon originally investigated, but where degrees of applicability fit across different scales or contexts.

This model also can be used as a model for learning. As applied to classroom instruction, children can inquire into depth, formulate abstract explanatory principles, and develop transcontextual and transdisciplinary understandings of fundamental patterns and concepts through abductive processes.

Important Scientific Research and Open Questions

To what extent can this model be utilized across paradigms of research?

How can degrees of rigor be developed for the application of this model?

Do researchers find this model more useful and fruitful than some others for the investigation of various phenomena, and if so, which others?

Cross-References

- Abductive learning
- Abductive reasoning
- Abstraction in mathematics learning
- Complex learning
- Complexity of learning functions with bounded variation
- Constructivist learning
- Critical thinking and learning

- Cross-disciplinary learning
- Cybernetic principles of learning
- Deep (vs. surface) learning
- Deuterolearning
- Ecology of learning
- Inquiry learning
- Patterning as learning
- System dynamics and model-based learning
- Transfer of learning
- Transformational learning

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Definitions

Abduction or *abductive thinking* – A process of reasoning that examines how certain ideas, such as patterns and their functions, “fit” across contexts (or subject matter disciplines).