

Human-Centric Functional Modeling and the Unification of Systems Thinking Approaches

A Short Communication

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Abstract: Where systems thinking approaches are often different and sometimes irreconcilable because they are based on the reasoning of one individual or another, Human-Centric Functional Modeling aims to become universal through looking inwards to the way all human beings perceive. HCFM provides a methodology that enables first person observations within each of the senses of the body or within the emotions, mind, or consciousness as functional systems to be represented as forming mathematical spaces that in turn enable all possible systems thinking approaches to be represented. This creates the possibility of comparing all systems thinking approaches to determine which is most “fit” in each context in which it is used, and it radically reduces the barriers to reusing the best components of each approach.

Keywords: Human-Centric Functional Modeling | DSRP

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1. Introduction

In Human-Centric Functional Modeling living systems such as the human organism are modeled as having a set of human-observable behaviours (functions). When all the states accessible through these functions occur within a given domain of behaviour, these states form a "functional state space," which the system acting in that domain moves through. All the states accessible through those functions, and represented by the “functional state space” then reflect all possible behaviors of the system. This functional state space can potentially be virtual and abstract, such as in the case of the cognitive system which can be represented as moving through a space of concepts (a “conceptual space”) (1), or it can be physical, such as the sensory-motor space the body can be represented as moving through. If this functional state space represents all possible behaviors of the system then all methods of thinking about the system (i.e. all approaches to systems thinking) must define behaviors that are confined to that space, at least wherever those models represent actual functionality that can be executed within the capacity of the system.

When applied to understanding human systems such as cognition, a human-centric approach allows systems to be understood through first person observation (observations that can be validated within the individual’s observation of their own awareness), as opposed to observations requiring third party validation (i.e. measurements made by external tools or assessing validity in terms of consistency with some theory defined by some third party). In understanding human systems like cognition in which many of the functions cannot be externally measured, a first person approach is essential.

2. Survey of Systems Thinking Approaches

A comprehensive survey of the literature in systems thinking found:

“There are many scattered and different definitions, perspectives, methods, applications, and approaches that exist related to systems thinking. This divergence emanates from the systems thinking literature, which is a fragmented compilation of the use of the term “systems thinking” by practitioners and scholars from different domains. Because of the diverse applications of systems thinking, the existing scope

Significance and Public Understanding: This article makes a simple but potentially powerful theoretical argument in support of the validity of the DSRP model as a method for navigating all systems thinking approaches.
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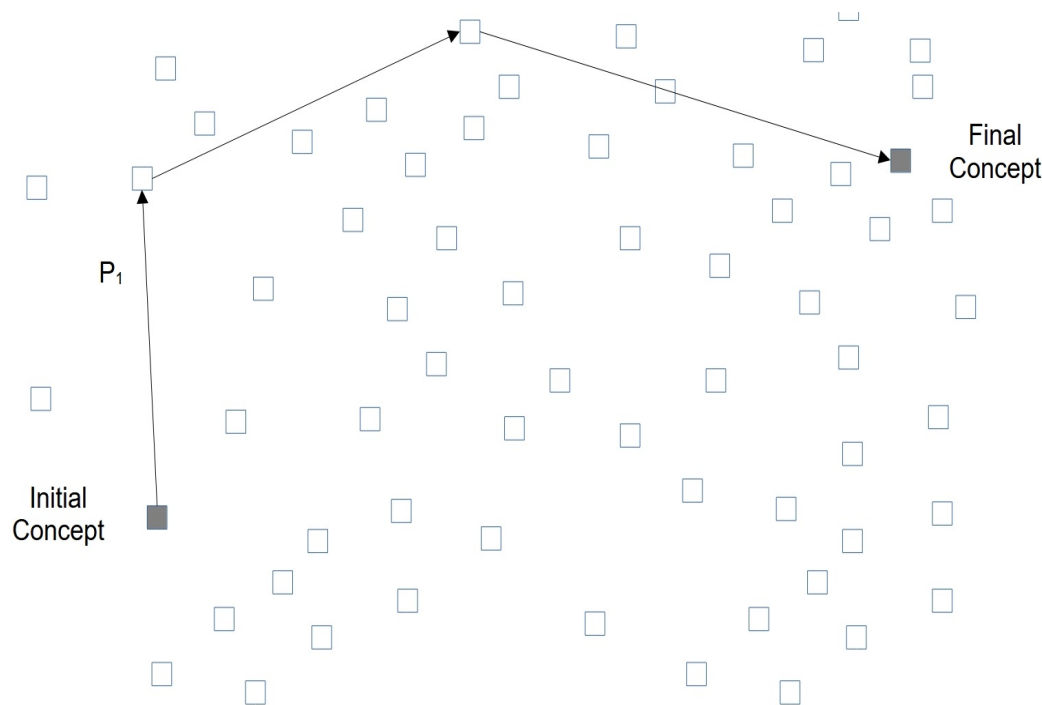


Fig. 1. A single systems thinking approach applied to a single problem.

and dominant pattern of thought of systems thinking often vary, and as a consequence, there is no unified and comprehensive perspective and method that all researchers agree” (2).

At the same time, the number of publications in this area continues to rise.

This same survey provides a list of clusters that according to the author’s analysis, all papers on systems thinking tend to fall into. The publications in the first cluster are dominated by the development of theoretical frameworks and methods of systems thinking. The second cluster’s publications mainly discuss the development of systems thinking tools and techniques. The third cluster consists of publications with different perspectives and viewpoints toward systems thinking approaches. The fourth cluster of systems thinking publications is devoted to diverse systems thinking applications and approaches. Since in conceptual space each problem is the lack of a path between an initial concept and a final concept, and since a solution is the reasoning that provides this path, then each single systems thinking approach applied to a single problem might be represented by a single path through conceptual space. Multiple systems thinking approaches will be represented by multiple paths as illustrated in Figures 1 to 4.

A generalized systems thinking approach might then be represented by a region in conceptual space containing concepts and reasoning related to that approach as in Figure 5.

The importance of this insight is that if each systems thinking approach can be represented as a solution to some generalized systems thinking problem, then the relative fitness of that approach in solving the problem in each different context can be assessed. All efforts to assess all systems thinking approaches then become part of a single larger effort.

3. Human-Centric Functional Modeling as a Universal Canonical Model

Even where systems thinking approaches tackle the same problems, the differences between systems thinking approaches might be irreconcilable because they are based on different reasoning frameworks that don’t translate. Human-Centric Functional Modeling aims to become universal through looking inwards to the way all human beings perceive. In defining the cognitive system as being confined to a functional state space HCFM provides a methodology that enables first person observations within the cognitive system to be represented as forming a mathematical space that in turn enable all possible approaches to systems thinking to be represented. This meta-model creates the possibility of comparing all models of decision-making with all decisions to determine which model is most “fit” in each context in which it is used.

By defining systems thinking approaches in terms of the same basic components of human perception, HCFM enables all systems thinking approaches to potentially be decomposed into the same functional components. Each component of each approach can then potentially be reused to understand many other systems where it has greater fitness than others in representing the behavior of the system. Without such a universal approach the difficulty and work involved in separately comparing every combination of two approaches in the great diversity of approaches currently existing (2), as opposed to comparing all approaches to a single canonical one, might ensure that less popular approaches are excluded from consideration for reasons other than merit. With such an approach however, considering all possible systems thinking approaches in a way that reliably converges on a single optimal approach might be reliably achievable. With General Collective Intelligence (GCI) to organize groups so they are able to execute a coherent collective reasoning process (3), that collective process might converge on the systems thinking

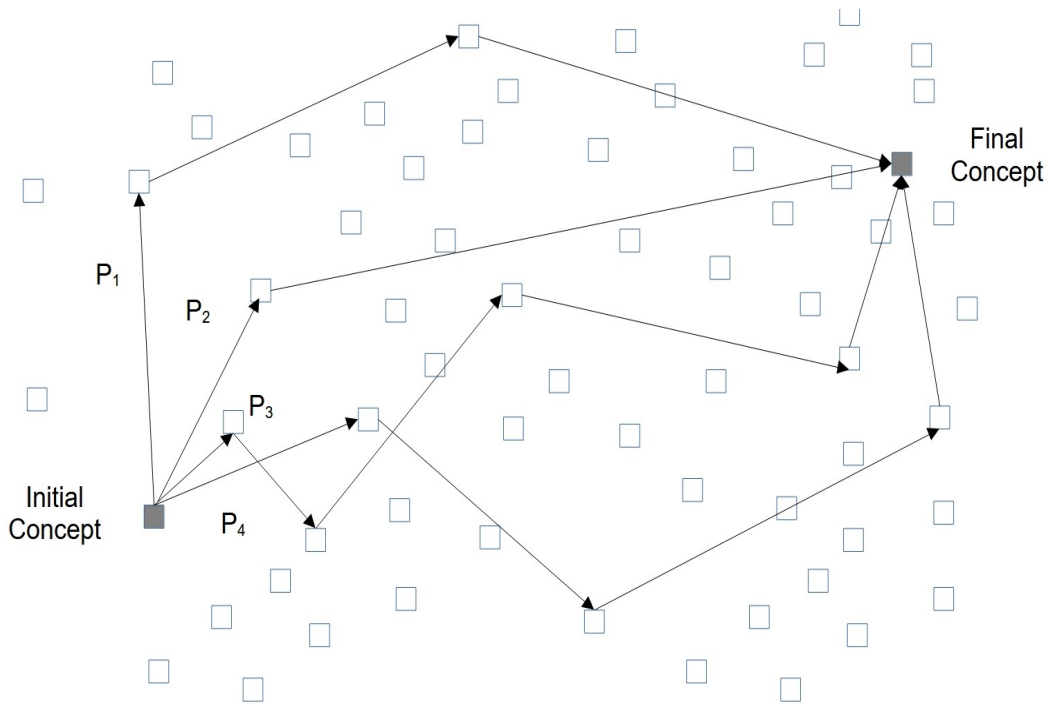


Fig. 2. Multiple systems thinking approaches applied to a single problem.

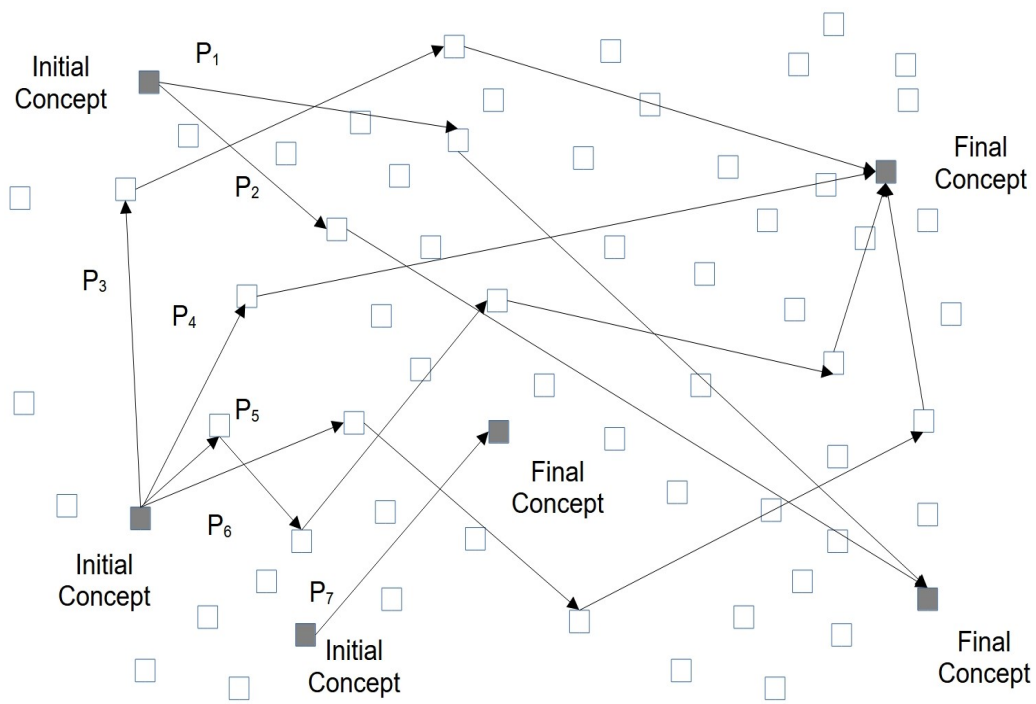


Fig. 3. All systems thinking approaches applied to all problems.

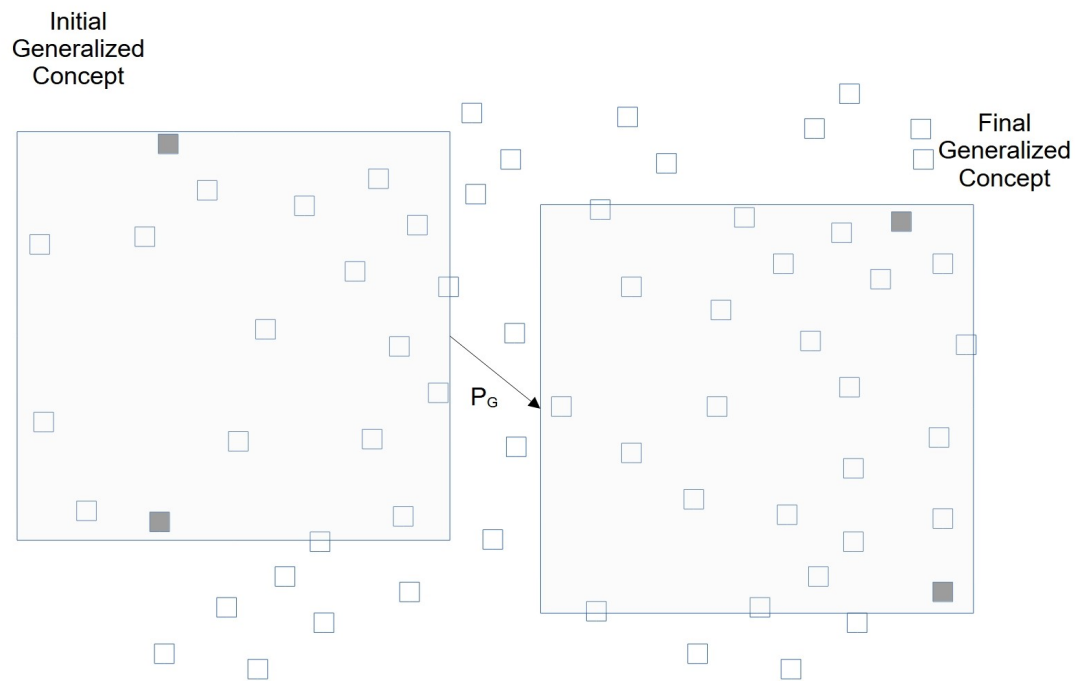


Fig. 4. A generalized systems thinking approach.

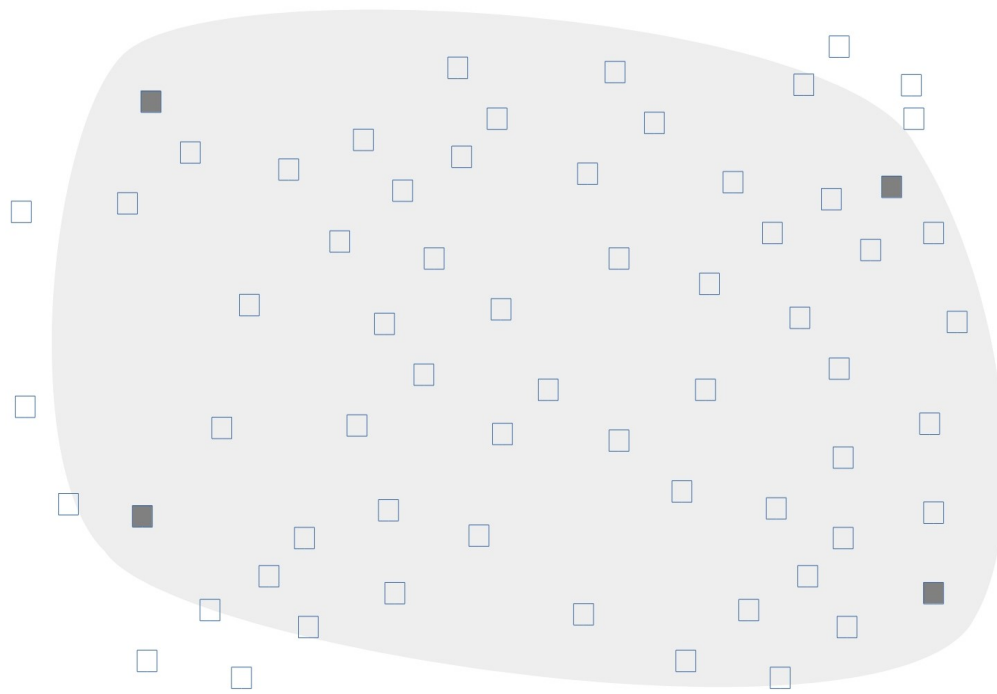


Fig. 5. Region of conceptual space occupied by generalized systems thinking approach.

109 approach that is most fit in optimizing collective outcomes in
110 each context.

111 4. Comparison with DSRP as the Fourth Wave of Sys- 112 tems Thinking

113 In HCFM a system is an entity whose behaviors are confined
114 to a single functional state space in that any behavior begins
115 with a state in that space and leads to a state that remains
116 within that space. As an example, the cognitive system begins
117 with a concept and executes reasoning that leads to another
118 concept. In HCFM, systems thinking is any approach that
119 facilitates potential consideration of the entire set of behaviors
120 in the functional state space of the system rather than being
121 restricted to considering behaviors related to a narrow range
122 of problems, and therefore being limited to considering a
123 restricted region of functional state space. To incorporate
124 the highly objective first wave of systems thinking identified
125 by Cabrera et al. (4) the behaviors considered might be
126 those that can be defined objectively as a composition of
127 shorter paths (for example in conceptual space type 2 or
128 rational methodical reasoning is a composition of reasoning
129 processes). To incorporate the second wave of systems thinking
130 the behaviors considered might be those defined subjectively
131 as a direct path (an example in conceptual space is type 1 or
132 intuitive reasoning). Both might be included to incorporate the
133 third wave of systems thinking, and incorporating techniques
134 to ensure the entire functional state space is being navigated
135 might be included to incorporate the forth wave of systems
136 thinking.

137 HCFM defines a theoretical model of a system and of sys-
138 tems thinking that is useful to compare to other approaches
139 towards achieving universality and diversity in systems think-
140 ing. One is DSRP, a heuristic approach towards navigating
141 all of the different systems thinking approaches. DSRP aims
142 to provide a bridge between the different mental models of
143 any given system and the existential reality of the system
144 which includes all possible models of it. The DSRP Theory
145 identifies four universal patterns that are hypothesized to un-
146 derlie systems thinking: making identity-other Distinctions
147 (D); organizing part-whole Systems (S); recognizing action-
148 reaction Relationships (R); and taking multiple point-view
149 Perspectives (P). These 4 patterns are hypothesized to connect
150 all of the frameworks of systems thinking which have been col-
151 lectively called the Midgley, Francois, and Schwarz (or MFS)
152 universe (4–9). HCFM appears to validate this hypothesis.
153 Using HCFM to represent systems in terms of their behavior
154 in different functional state spaces, DSRP appears to facilitate
155 the use of any systems thinking approach required to navigate
156 any behavior of any system. The identity-other Distinctions
157 (D) pattern incorporates all systems thinking approaches that
158 distinguish one system with one functional state space from
159 another. The organizing part-whole Systems (S) pattern in-
160 corporates all systems thinking approaches that distinguish a
161 system with its own functional state state space from the larger
162 super system and larger functional state space which contain
163 it. The recognizing action-reaction Relationships (R) pattern
164 incorporates all systems thinking approaches that distinguish
165 one path through functional state space from another, where
166 that path might occur in reaction to whatever the system
167 is interacting with. And assuming that perspective in func-
168 tional state space is defined by the point in functional state

space from which paths are navigated, the multiple point-view
Perspectives (P) pattern incorporates all systems thinking
approaches that distinguish the navigation of a path from one
perspective as compared to another.

5. Conclusions

The repeating pattern with HCFM is modeling systems in a
way that is innate to human perception so that any description
of systems that are made in such a way don't require any
tools or knowledge of other theories to understand if one
understands the underlying problem. Having defined such a
representation of systems means that the goal of all systems
thinking researchers can become defining their ideas in terms
of that representation in order to increase the opportunity
for others to reuse their ideas. This is hypothesized to have
the effect of taking many problems being tackled by a great
many individuals who each have finite capacity to address
their specific problem, and abstracting them into much fewer
problems, or even a single problem, so that cooperation can be
orchestrated to solve that problem far more powerfully where
it might be true that no coherent picture is reliably achievable
otherwise. If GCI has the potential to drive an exponential
increase in general problem-solving ability of groups where
that ability is not reliably achievable in any other way, then
GCI might be the greatest potential source of impact on every
problem, including the problem of maximizing our collective
capacity to converge on a single optimal understanding of
systems thinking.

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