Existing and Emerging Methods for Integrating Theories Within and Between Disciplines

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ABSTRACT

For natural systems or service systems most research may be categorized as inductive or deductive. While these are good for "normal" science, more interesting revolutions in science may occur when a deep thinker considers two theories and seeks to compare, contrast, and combine them. Galileo and Einstein both began with this kind of approach. Because of the paradigmatic revolutions they triggered, we all lead much richer lives. Were they unique in their ability to seek and find new insights from existing theories? Or, is this an approach that we all may use? In this paper, we will investigate multiple methods for integrating theories to determine which ones might be more useful. The results suggest that more rigorous methods provide a more useful and more systemic approach to integrating theories.

Keywords: Metatheory, Robustness, Critical Integrative Metatheory, Propositional Analysis, Reflexive Dimensional Analysis, Formal Grounded Theory

INTRODUCTION

Some may argue that we cannot integrate theories of service systems with theories of natural systems. Such a limitation may be claimed because the two kinds of systems are at differing levels of complexity or are focused on differing topics. Such concerns may have some legitimacy given the difficulty that physicists have faced when attempting to create a unified field theory. Yet, in order to prove that such a thing cannot be done would be trying to prove a negative – something that is notoriously difficult. Further, and in a more positive direction, it seems that we may legitimately investigate theories of the natural and social spheres using the same tools and insights because both sets of theories rely on causal propositions (Wallis, 2010a). In short, because theories of service systems and theories of natural systems are made of the same "building blocks" it may be possible to integrate them on the level of theory.

As scholars, we like to think that we are good at evaluating theories and deciding the extent to which those theories might be useful or effective for research and/or practice. Unfortunately, while we humans tend to be good about evaluating the work of others with some level of objectivity, we are not very good at evaluating ourselves (Dunning, Heath, & Suls, 2004). Worse, those who are low-performers, at the bottom ranks, do the worst job of self-evaluation (Ehrlinger, Johnson, Banner, Dunning, & Kruger, 2008). That same relationship seems to hold true in the social sciences, in general. Here, we are all low performers. By that I mean no disrespect for any individual scholar. Instead, I mean that the social sciences, in general, appears to be a "low performer."

For example, public policies frequently fail (Wallis, 2011), organizational theory seems to have failed (Burrell, 1997), psychology is not held in high regard by other professionals (e.g. Kovera & McAuliff, 2000), and social change theory does not seem to be effective (Appelbaum, 1970; Boudon, 1986). Indeed, the promise of the social sciences is "largely unfulfilled" (Spicer, 1998). This creates an additional level of challenge because we are trying to integrate the low - performing theories of the social sciences with the more reliable theories of the natural sciences – although they too are sometimes held in low favor (Smolin, 2006).

The systems community strives to take a new view – but there is no guarantee that our views will be any more effective than previous ones. Mainly, our community looks at natural systems and/or service systems using a systemic view to better understand the world around us. Few scholars study systems of thought. This is an important concern because our systems of thought determine how we understand and engage the world around us. Those systems of though are our theories, models, mental models, schema, policies, and so on. In the present paper, I will use the term "theory" to refer to a system of thought.

Like those schools of thought that have passed before us, most systems research may be broadly categorized as either inductive (begin with data and move toward creating a theory) or deductive (begin with a theory and then conduct experiments to test that theory). Each approach involves a bit of the other – and a dose of abduction (that surprising "a-ha" moment of emerging understanding). These are well and good for "normal" science because they lead to the creation of theories, data, and insights.

In contrast to those investigations of the world, interesting revolutions in science are caused when deep thinkers consider two (or more) theories and seek to compare, contrast, and combine them. Galileo and Einstein both began with this kind of approach – and we are all lead much richer lives because of the paradigmatic revolutions they triggered through their results. Were they unique in their ability to seek and find new insights from the integration of existing theories? Or, is this an approach that we all may learn and use?

In this paper we will identify and discuss a range of existing and emerging methods for integrating theories within and between a wide range of academic disciplines. These include soft approaches such as "ad-hoc," "cherry picking," and "intuitive" methods. Soft methods have been used from the beginning of the social sciences, without impressive results (as noted above). Next, we will give more attention to more rigorous methods including: Formal Grounded Theory (FGT), Reflexive Dimensional Analysis (RDA), and Integrative Propositional Analysis (IPA). We will also be discussing key ideas related to these methods including "structures of logic" and "scale of abstraction" for insights that that may help us to develop better theory.

To demonstrate these methods, I will integrate two theories. One theory is from the study of service systems while the other theory is from the study of natural systems. The various versions of integrated theory will also be analyzed to see if (and to what extent) each might be considered an advancement of the field.

I expect that this paper will provide a better understanding of how to create more effective theories. Finally, the integrative effort and resulting conversation of this paper is expected to engender new learning and new insights into bridging the theory-gap between natural and service systems through a deeper understanding of theory-systems.

DATA SET – TWO THEORIES

In this section, I simply present two sample theories. All of the subsequent analyses will refer to these two theories as the data source for their analyses.

A Sample Service Systems Theory

A Complex Adaptive Systems Model of Organization Change From: (Dooley, 1997, p. 82 Drawing on Thietart and Forgues, 1995)

1. Organizations are potentially chaotic.
2. Organizations move from one dynamic state to the other through a discrete bifurcation process (second-order change).
3. Forecasting is impossible, especially at a global scale and in the long term (unpredictability).
4. When in a chaotic state, organizations are attracted to an identifiable configuration (order out of randomness).
5. When in a chaotic state, similar structure patterns are found at organizational, unit, group, and individual levels (fractal nature of chaotic attractors).
6. Similar actions taken by organizations in a chaotic state will never lead to the same result.

A sample Natural Systems Theory

From: (Allison & Hobbs, 2004, drawing on Guderson et. al, 2002)

1. The organization of regional resource systems emerges from the interaction of a few variables.
2. Complex systems have multiple stable states. Complex systems can exhibit alternative stable organizations.
3. Resilience derives from functional reinforcement across scales and functional overlap within scales.
4. Vulnerability increases as sources of novelty are eliminated and as functional diversity and cross-scale functional replication are reduced.

These two theories (one of natural systems, the other of service systems, and both based in systems/complexity field) may be integrated in many ways. You, the reader, may be now considering one or more ways that the two might be combined and otherwise integrated to provide a more useful, more comprehensive model. The next section presents multiple methods for integrating these two theories.

METHODS OF INTEGRATION

In this section, I will apply multiple methods for integrating the two theories presented in the previous section. This is intended to be a set of examples for these methods of integration. Because the focus of this paper is on the level of metatheory, the focus is on the concepts within the theories, rather than on the actual application of the theories or the research from which the concepts were derived. The goal here is to present and explain as a path for highlighting some strengths and weaknesses of each method.

Here, I will present soft methods of integration including ad-hoc, cherry-picking, and intuitive methods. Then, I will present the more rigorous methods of Formal Grounded Theory (FGT), Reflexive Dimensional Analysis (RDA), and Propositional Analysis (PA).

Soft Methods

There are a variety of soft methods available. For example, Mintzberg (2005, p. 361-371) suggests that personal characteristics are key to developing good theory. He suggests the benefit of creativity, intuition, and bravery. Unfortunately, there is no good way to test the bravery of a theorist! Ritzer (2009) suggests personal reflection while Hall (1999) suggests that social construction is a good path. Here again, it is difficult or impossible to say how much reflection is applied (or needed) to create or integrate theory.

The opacity of these approaches suggests the need for an alternative, more focused, perspective. And, certainly, they have not proved useful in improving theory development so far. Therefore, for this paper, I will adopt a structuralist perspective. That is to say, I will focus on the concepts and causal relationships within each theory to see how they change as different methods of integration are applied.

Cherry Picking

Cherry picking is quite simply the process of choosing specific elements from two or more theories and combining them to create a new theory. While it is expected that the scholar will use some form of reasoning to support the choice of concepts, it is understood that alternative reasoning would lead to alternative choices. For example, drawing on the above two theories, we might combine: “Resilience derives from functional reinforcement across scales and functional overlap within scales” with “Organizations are potentially chaotic.” The derived theory might be stated as: For chaotic organizations, resilience derives from functional reinforcement across scales and functional overlap within scales.

This may have created a theory that is (to some extent) true and/or useful; however, it is important to note here that the derived theory is smaller, less complete, than either of the two source theories. In short, cherry picking is reductionist. Additionally, in creating a cherry picked theory, there has been some fragmentation of the field as a new theoretical focus has been created. Finally, there is the question of how we decide which part of a theory to separate from the remainder of the theory. Here, there are no rules in the academic world except that the choice should be supported by some rational argument. That, however, is a weak standard as anything may be rationalized. In short, it is problematic and inappropriate to use partial theories (Ritzer, 1990; Wallis, 2012a).

Ad-Hoc

Creativity and innovation are hallmarks of the ad-hoc process. In brief, the ad-hoc process involves the combination of concepts from multiple theories. However, because of the creative effect, additional concepts may be added that are not necessarily part of the original set of theories under investigation. Starting with the two theories presented above, an ad-hoc method might be narrated something like this:

From the CAS on organizational change, particularly proposition three, it is clear that there is very little opportunity for predicting the future of the organization. It can also be recognized that the lack of predictability also applies to natural systems. For example, where "complex systems can exhibit alternative stable organizations." Therefore, it appears that the important similarity between natural and service systems is a duality between predictability and chaos. Moving into other sources, an individual who is managing an organization (or, presumably, a natural system) should "expect to be wrong (Richardson, 2009, p. 49). An idea that makes perfect sense if we have partial theories and chaotic situations. From this, a manager might conclude that there is no reason to study complexity, systems, or anything else for that matter – because one will always be in chaos and always be wrong.

To some extent, this is a straw man argument – it is easy to argue against it and break it down. That is exactly the point. Indeed, all of our theories have a certain amount of ad-hoc logic within them. Thus, none stand for long. Each is replaced rapidly with some combination of other theories, concepts, and notions from a variety of sources until a "Frankentheory" is created. That theory rampages across the pages of our publications until it is dismembered and recombined to create some new golem.

In this ad-hoc process, it may be seen that concepts were chosen through a reasonable process. Thus, there appears to be some validity. However, it should also be understood that the same level of reasoning might just as easily have been used to choose different concepts. Thus, the ad-hoc process cannot be relied upon to integrate multiple theories with any useful level of rigor or repeatability.

It should also be noted here that the ad-hoc process does not require the scholar to engage the entire theory – or any theory. In short, like cherry picking, ad-hoc integration allows the scholar to look at theory in a non-systemic fashion.

Intuitive Integration

The intuitive process is, almost by definition, a process that cannot be governed by a rigorous process and explicit set of rules or guides. By way of brief explication, however, I will note that I have just read the theories closely… then put them aside and let my intuition emerge as I type…

Service and natural systems are different because natural systems become more brittle with decreasing complexity. Service systems in chaos, on the other hand exhibit similarity across levels of scale. It seems to me (intuitively) that such similarity would be quite the opposite of the complexity needed to maintain the natural systems. Thus, it seems that the two cannot be completely integrated. Another part of this (which may or may not have been mentioned in one or the theories is that the social system is geared toward purposefully creating value for the other participants. Members of a natural system, on the other hand, seem geared toward the creation of value for themselves. Similarly, however, service systems create value for themselves by harvesting natural resources. Often without concern for the long-term sustainability of those resources. However, as the service systems evolve, they may learn to manage service systems for long-term success.

Returning now to look at the theories, and reflecting on my limited intuitive effort, I note how I neglected to include a number of concepts. I may have misrepresented some concepts and created some conceptual linkages out of thin air (or limited intuition, as the case may be).

It seems therefore, that intuition, like cherry picking and ad-hoc, is a soft approach to theory integration. While I know of no studies that have formally measured this, my personal experience in investigating theories and their sources suggest that this is the most common approach. This is problematic for the field because intuition is not reliable (Meehl, 1992, p. 370). The validity of this claim may be seen in the actions of any gambler who uses intuition to make wagers – only to go home empty handed.

An important key to the scientific validity of any study is the ability to replicate that study. If another scholar cannot replicate the study and arrive at similar conclusions, the validity of the study is thrown into doubt. The same criteria should apply to metatheoretical studies (Wallis, 2010b). If, for example, we ask ten graduate students to analyze the same ten theories using the same rigorous methodology they should arrive at similar conclusions. If not, the metatheoretical methodology must be called into question. That way, we can advance the science of metatheory and the study of systems of thought.

Because replication is a mainstay of science, it must be concluded that these kinds of soft approaches cannot be considered useful from a science of metatheory perspective. In short, soft approaches are limited in that they do not seem to be replicable.

To summarize this sub section on soft methods of theory integration, it seems unavoidable that a scholar using these approaches must rely on intuition and reduction. While it may be easy to use, intuition is clearly not to be trusted. And, similarly, reductionism leads us to address partial models that can only lead to fragmented understanding. The lack of scientific replication of these processes drives the final nail. These methods that have been used for so many decades have resulted in low performing theories – clearly we need something better. In the next section, I will present and discuss more rigorous methods.

Rigorous Methods

In this section, I will briefly present three rigorous methods for integrating multiple theories. Formal grounded Theory (FGT), Reflexive Dimensional Analysis (RDA), and Integrative Propositional Analysis (IPA). These methods are more rigorous, follow a prescribed path, and are thought to provide a more repeatable approach to the scientific analysis and integration of theories.

A number of methods have been suggested in past literature. For example, Dubin (1978) suggests a measure of "efficiency" (pp. 109-111). These relate to: 1) the presence (or absence of some unit of measure within a theory. 2) The casual directionality between two units of measure. 3) The covariation of those units of measure. 4) The rate of change between them.

These are certainly good and useful things to have within any theory. And, I hope, we all strive to include them. One limitation of this approach is that there is no concrete method to measure what a theory has within (or between) those levels. Dubin only provides a general guide (although, it is a very good one!). Ritzer (2001, p. 53-55) suggests "architectonics" as an approach to compare and integrate theories of sociology. However, that approach is geared toward identifying fundamental similarities in human actions, rather than engaging in a highly rigorous study of the theory, itself.

More recently, Shoemaker, Tankard Jr., & Lasora (2004, pp. 170-178) suggest key steps to building a theory including: Problem recognition, Identification of key concepts, Observation and creativity to imagine as many causes and effects of those key concepts, Specify theoretical and operational definitions for all concepts, Link some concepts to form hypotheses, Specify rationale for hypotheses, Attempt to think in terms of multiple hypotheses, and Attempt to place the hypotheses in an organized system. Theories can then be tested as to their testability, falsifiability, parsimony, explanatory power, predictive power, scope, and cumulative nature of the field, degree of formal development, heuristic value, and aesthetics. While their suggestions provide a good starting point, the steps for building and evaluating theories are open to ad-hoc reasoning, cherry picking, intuition, and poorly defined measures.

In short, these kinds of methods offer some improvement over soft methods. However, the level of rigor does not seem sufficient to develop more effective theories because they still employ or allow for the application of soft methods. Therefore, for this section, I will focus on the more rigorous approaches that follow a specific methodology.

Formal Grounded Theory

Grounded Theory was developed by Glaser & Straus (1967) as a transparent process to create theory that is grounded in real word contexts (Glaser, 2002). In brief, experiences and insights are coded, categorized and related in a specific methodology to create a theory with a specific focus. Since then, others have used a Formal Grounded Theory (FGT) approach that uses extant theory as the data to create a new theory. For example, Apprey (2006) who suggests, FGT can be used to combine multiple theories and so gain more meaning and insight in an area

of study. The process includes: Gathering data; Coding the data and categorizing theoretical concepts;
Constant comparison between concepts; Memo writing; and the creation of a theoretical construct (Charmaz, 2006).

Gathering data

This part is easily accomplished by choosing (as examples) the two theories presented above.

Coding the data

Initial Codes are:

1. Vulnerability
2. Bifurcation process
3. Sources of novelty
4. Scale
5. Forecasting possibility
6. Functional diversity
7. Actions lead to the same (or different) result
8. Time
9. Complex systems have more states can exhibit more alternate stable organizations
10. Emergence of organized regional resource systems
11. Functional overlap within scales
12. Functional reinforcement across scales
13. Interactions of few variables
14. Organization is attracted to identifiable configurations
15. Resilience
16. Similarity across levels of scale
17. Organization is in chaos
18. One dynamic state of organizations
19. Organizations are potentially chaotic
20. Second dynamic state of organization
21. Cross functional replication
22. Complex systems can exhibit more alternate stable organizations

Categorizing theoretical concepts

Misc.: Time, Forecasting possibility

Emergence: Bifurcation process, Sources of novelty, Emergence of organized regional resource systems

Conditions of the system: Vulnerability, Organization is in chaos, Resilience

More Abstract Conditions of the systems: Complex systems have more states can exhibit more alternate stable organizations, Functional diversity, One dynamic state of organizations, Organizations are potentially chaotic, Second dynamic state of organization

Scale: Scale, Functional overlap within scales, Functional reinforcement across scales, Similarity across levels of scale

Actions & Attractions: Interactions of few variables, Organization is attracted to identifiable configurations, Cross functional replication

Constant comparison between concepts

I accomplished this pat of the process by keeping the (fortunately small) theories on a single page and referring back to them frequently.

Memo writing

Some memos include:

- Time is an interesting concept – many concepts include time implicitly, although only one mentions it explicitly.
- Some concepts do not seem to be well connected with others.
- Bifurcation may be understood as a process of creation and/or emergence
- I don't like ending up with a "miscellaneous" category – but I'm not sure where to place these two.
- Are resilience and vulnerability two sides of the same coin?
- One dynamic state and a second dynamic state are clearly in the same category – what might the opportunities be for defining what those states are?
- There seem to be few actions involved here.
- Scales seems to be a category – but there could be another one or two ways of looking at them. Within scales and between scales.
- Given the highly abstract category of conditions of the system, it seems that the more concrete concepts may not be needed as a part of the model. Chaos is not well defined (within the model) and vulnerability/resilience are represented more abstractly in "functional diversity"
- It is a common concept to consider the context or environment of the systems in question. Here, we are integrating natural systems and service systems. Where then is the context? Is it self-contextualizing? Is one the context of the other – if so, which one? Or, is the notion of context not relevant here… in this context?
- Where is "edge of chaos?"

Create theoretical construct

For FGT, the theoretical construct is based on a central question or focus. This introduces another point of ambiguity to the process. After all, if two scholars approach the conceptual data with different questions, they will likely create different constructs. Here, in addition to the subjectivity of creating themes, is another source of subjectivity for the FGT process. The combined theoretical construct I developed came out as:

> Within and across levels of scale, there are overlaps and reinforcements. Organizations in chaos tend toward recognizable configurations and cross functional replication. The larger and more complex system emerges from interactions of smaller systems. And, conversely, the larger system exhibits more stable systems and alternative stable states.

Conclusion

I conclude this section with a few observations about FGT. First, in this process, some complex concepts were fragmented into multiple simpler concepts before being combined into categories. Also, the categories are not rigorous – another scholar might legitimately undertake the same analysis and develop different categories. Thus, the process is not necessarily repeatable. Because this process is focused on concepts, rather than their relationships, it is too easy to conclude with a theory that is a collection of ideas, rather than a set of interrelated propositions. Thus, one may end up with a construct that is hardly a theory at all. The usefulness of the resulting construct seems questionable.

Multiple concepts were categorized into fewer – suggesting that reductionism may be taking place. This might be countered in future versions by creating a new method of FGT that requires that each category represent an abstraction of the concepts. This opens some interesting possibilities. For a rather abstract example, if a theory contained concepts of "square" and "rectangle" the abstract categories that are suggested might include "width" and height." So, here, the idea is not to force many ideas into fewer ideas. Rather, the goal is to seek highly abstract categories that can fully represent the concepts within the theories. As such, it is entirely possible that identifying all the abstractions might result in a theory that is much larger and more complex than the subject theory upon which it is based.

Reflexive Dimensional Analysis

Reflexive Dimensional Analysis (RDA) his derived from FGT and has been used to integrate theories of CAS (Wallis, 2006) and CT (Wallis, 2009). RDA differs from FGT because RDA specifically calls for the scholar to identify causal relationships at the sub-category level – and apply them to the category level. This provides an additional level of rigor above the FGT approach. RDA has six steps (Wallis, 2006, p. 7) :

1. Define a body of theory.
2. Investigate the literature to identify the concepts that define it.
3. Code the concepts to identify relevant components.
4. Clump the components into mutually exclusive categories.
5. Define each category as a dimension.
6. Investigate those dimensions through the literature, looking for robust relationships.

Define a body of theory.

The scope of the theories includes service systems and natural systems.

Investigate the literature to identify the concepts that define it.

This step has been done by choosing the two theories presented above

Code the concepts to identify relevant components.

This step has already been accomplished in the FGT process above.

Clump the components into mutually exclusive categories.

This approach to categorization is a bit more rigorous than other approaches to categorization. By calling for categories that are "mutually exclusive" there is a bit more work to be done – and we end up with more categories. For ease of comparison, I will simply break out the category of "miscellaneous" into new categories of "time" and "forecasting possibility." I will also re-focus the category of "conditions of the system" to focus on vulnerability and resilience as that seems to be a state of the system that is of particular importance. Next, I will break out "scales" into overlap and reinforcement.

This gives us the following categories:

1. Time
2. Forecasting possibility
3. Emergence
4. Vulnerability
5. Conditions of the system
6. Overlap within scales
7. Reinforcement across scales
8. Similarity across scale
9. Actions/Attractions

Define each category as a dimension.

Here, we simply define each category as a scalar dimension – giving it the ability to represent a wider variety of states. For example, "time" may be seen as "more time" (or, conversely, less time).

1. More Time
2. More Forecasting possibility
3. More Emergence
4. More Vulnerability
5. More (differing) Conditions of the system
6. More Overlap within scales
7. More Reinforcement across scales
8. More Similarity across scale
9. More Actions/Attractions

Investigate those dimensions through the literature, looking for robust relationships.

Here is an interesting difference between FGT and RDA. FGT simply asks the scholar to identify relationships between the categories. Thus, the scholar may intuitively assign relationships. This kind of approach is not so rigorous as it might be. RDA, in contrast, calls for those relationships to be defined by the data itself. Therefore, at this stage, we must go back to the propositions within each category to see if they contain linkages to other categories.

From the service systems model, More Time causes Less Forecasting ability – thus casually linking those two categories. Also from the service systems model, the states as one Condition of the system will lead to bifurcation found in the Emergence, which leads back to create more states of the organization in Conditions of the systems. Therefore, there are some linkages between those categories. I continued the process in this way – for each category, investigating the causal propositions of the concepts within that category. Those concept-level connections were then used to justify category-level connections. The result is a RDA model integrating the two theories that looks like this:

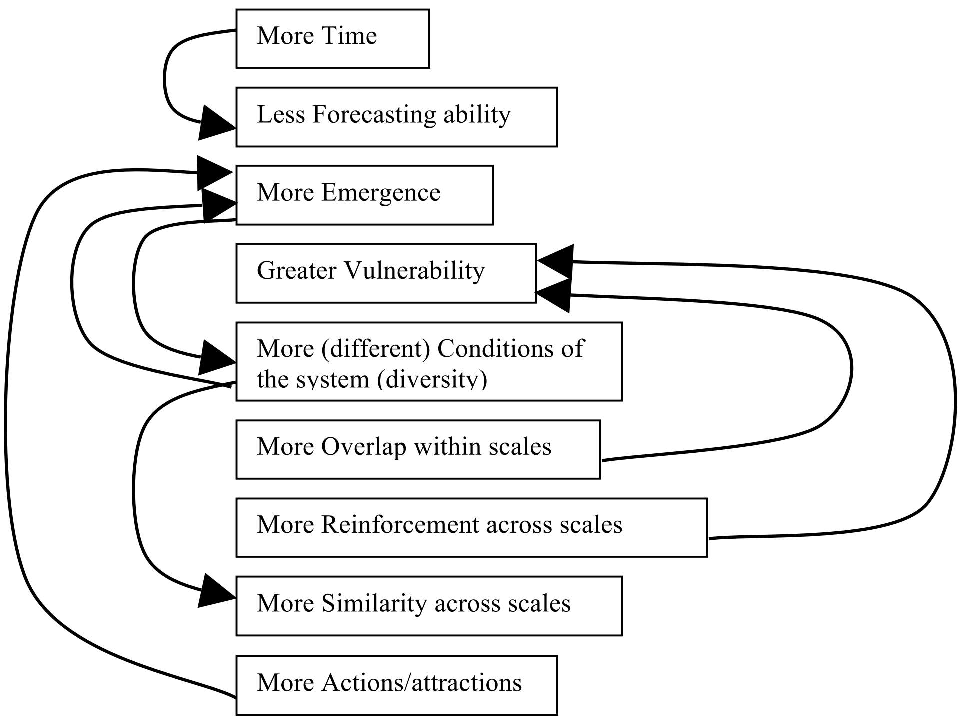


Figure 1 - RDA integrated model of Service Systems and Natural Systems

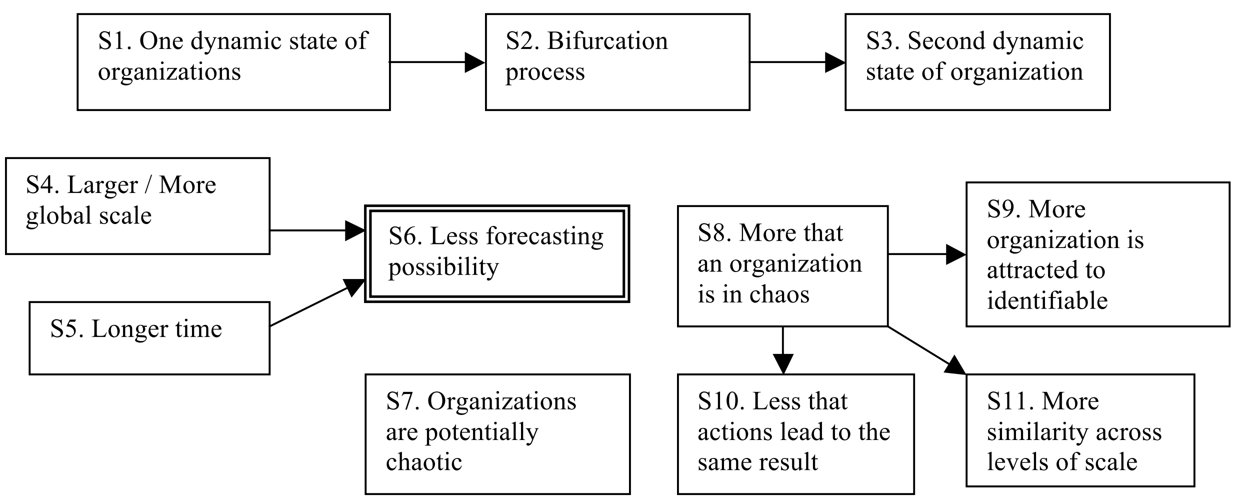
To conclude this section, RDA is a more rigorous way to integrate theories from the service systems and natural systems. However, there is still room for interpretation and intuition. This may be a “good” thing if one values creativity (which, I hope, we all do). However, that openness and flexibility becomes problematic when we are trying to make a more rigorous science. To apply one test – a thought experiment – we might consider giving these two theories to ten scholars and ask that they all use the RDA method to create an integrated theory. My hunch is that they would end up with ten different integrated theories. In short, where advances have been made in the area of rigor, there are accompanying difficulties in the convolutions that may work to reduce the effectiveness of the results. A more straightforward approach may be found in Propositional Analysis.

Propositional Analysis

Propositional analysis (PA) is used to determine the complexity and interrelatedness of a theory or body of theory. This is a structural approach which extends and deepens the work of well-known authors who suggest a correlation between the structure of a theory and the effectiveness of that theory (Dubin, 1978; Kaplan, 1964; Stinchcombe, 1987) by providing reliable quantification. This process includes the following six steps (Wallis, 2008):

1. Identify propositions within the theory.
2. Compare with one another to identify overlaps, and drop redundant aspects.
3. Investigate propositions for conceptual relatedness.
4. Link causal aspects with resultant aspects.
5. Identify "Concatenated" aspects (those aspects that are explained by, or resultant from, two or more other concepts).
6. Divide the number of Concatenated aspects by the total number of aspects in the theory (to provide a number between zero and one).

In short, PA starts by creating a diagram of the causal relationships found in the propositions of a theory or body of theory. Below, I have diagramed each of the subject theories for clarity. Each concept is placed within a box (and numbered); each causal relationship is represented by



an arrow.

Figure 2 - Sample Service Systems Theory

By counting the aspects within the theory it is clear that the complexity of the theory is C = 11. There is only one aspect that is the resultant of two or more causal concepts (see box #6). Therefore, the Robustness or interrelatedness of the system of theory is R = 0.09 (the result of one divided by eleven). Performing the same analysis on the Natural systems theory, we have:

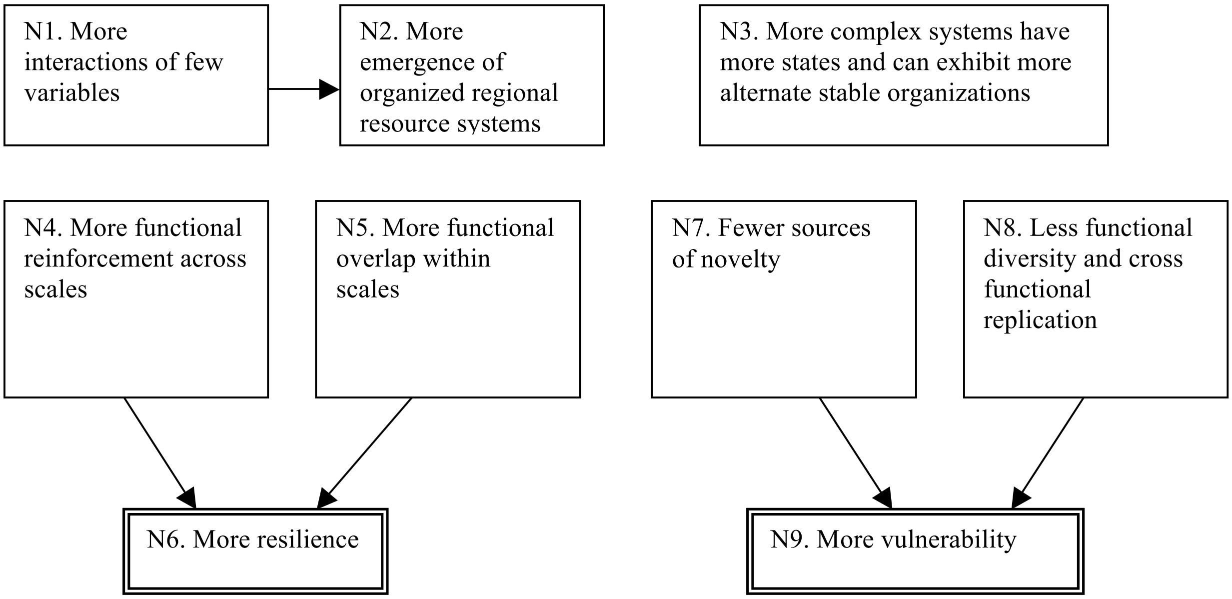


Figure 3 - Sample Natural Systems Theory Diagramed

Here it can be seen that there are nine different aspects, so the complexity of the theory is C = 9. There are two aspects that are concatenated (#6 & #9) because they are the resultant of two or more other aspects. Therefore, the Robustness of this theory is R = 0.22 (the result of two divided by nine). There is some small possibility for alternative interpretations. For example, it may be that resilience is the inverse of vulnerability. However, here we will stay with a direct representation of the author's text in order to maintain rigor.

Reflecting briefly on the two studies, it seems that the Robustness for both theories is rather low. This is not unusual for theories of the social sciences. That low level essentially reflects how the aspects of each theory are interconnected. The theories, themselves, are not highly systemic. Thus, neither is likely to be highly useful in practical application. Each theory may be improved through research that identifies causal linkages between the aspects within the theory.

Seeking to integrate the two theories, a strict application of PR requires that we identify aspects within each theory that are identical. Where identical aspects are identified, overlaps exist and the theories may be connected. While there are a number of similar aspects between the two theories, there do not seem to be any exact matches.

Allowing for some interpretive license, there are some tantalizing possibilities for linking the two theories. First, we might interpret the theories to suggest that some of the aspects are really the same thing – only with different names. This kind of renaming is not uncommon in the social sciences! Another approach would be to seek a higher level of abstraction – and so link the two theories under a more abstract concept that adequately accounts for the more concrete phenomena. Third, we might infer casual linkages between aspects of the two models (although, in the name of rigor, this should not be done without empirical analysis).

In these kinds of integration is much too easy to fall into the trap of intuition or ad-hoc thinking. For example, N4 and N5 include the concept of scales, as does S11. So, one may be tempted to integrate all of those aspects. However, N4 and N5 discuss Reinforcement and Overlap, while S11 is about Similarity. Therefore, it is not clear from the propositions that Similarity would be causal to Overlap and/or Reinforcement.

We are on more solid ground by addressing simpler aspects. For example, the linear logic represented in S1-S2-S3 might be abstracted to a derived proposition, SD1 "More bifurcation process creates More states" Similarly, N3 (which is represented as a single aspect because of the wording provided by the author) might be deconstructed to a derived proposition, ND1 "More states cause more complex systems that cause more alternatives to be exhibited. The derived propositions would be diagramed as below.

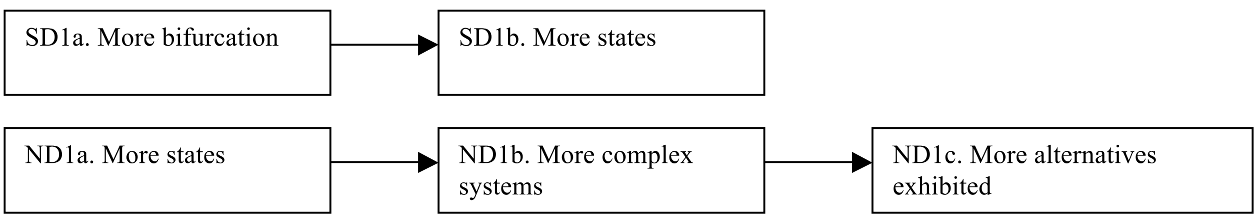
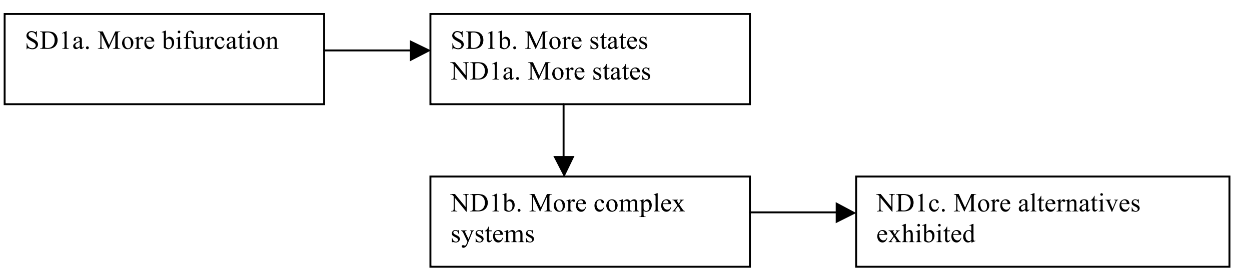


Figure 4 - derived propositions

This opens the door for a match between SD1b and ND1a to create an integrated model



as below:

Figure 5 - Integrated derived propositions

With their derived aspects legitimately integrated, the other aspects of the theories may be added to the structure as below:

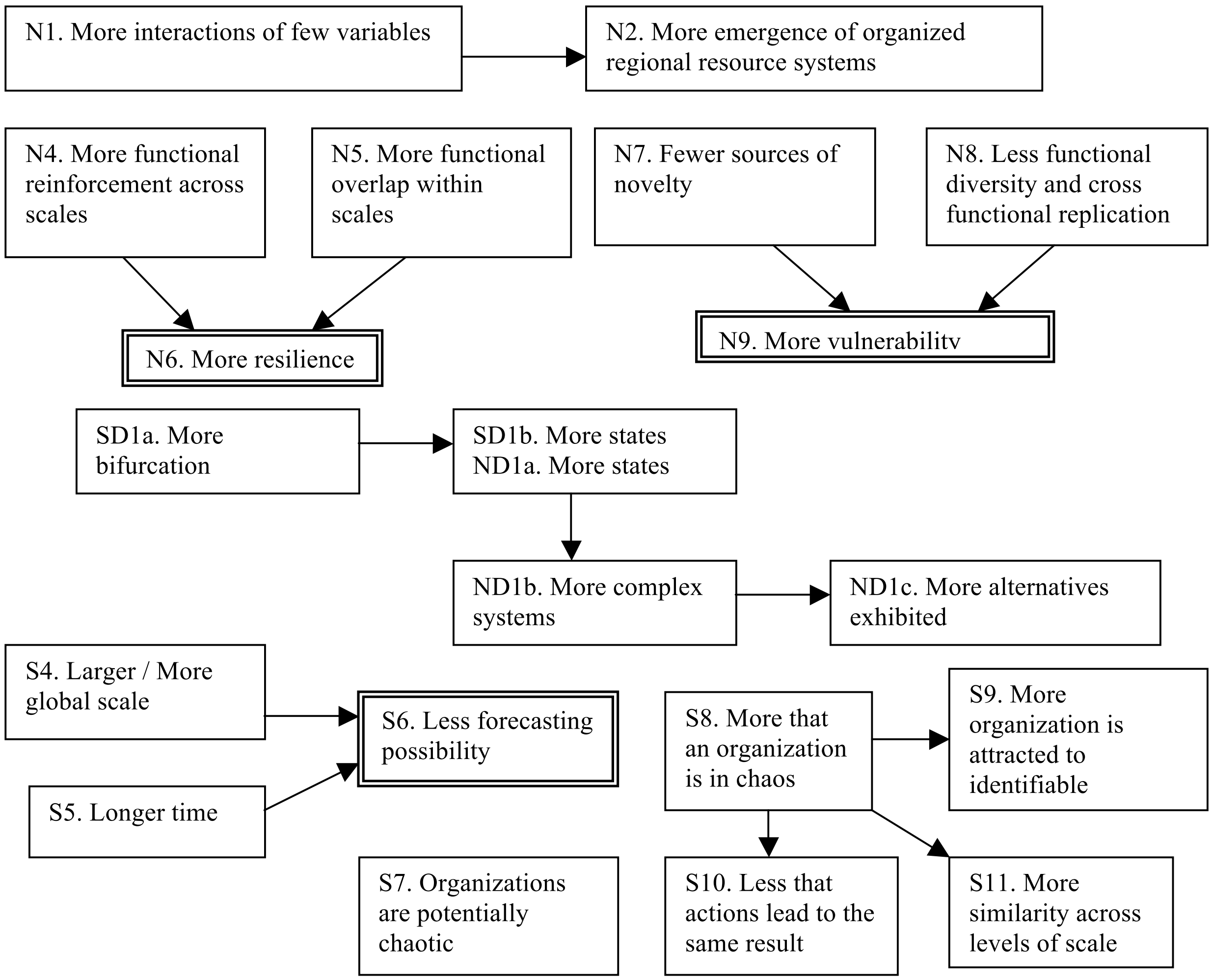


Figure 6 - Integrated theories

Integrated Propositional Analysis (IPA) is a useful approach to integrating theories from within and between disciplines. The approach has more methodological rigor than other approaches and requires the use of whole theories and a systemic perspective. The integrated theory in Figure 6 has 20 aspects, therefore it has a Complexity of C = 20. Three of those aspects are concatenated so the Robustness is R = 0.15 (the result of three divided by 20).

The complexity of the integrated theory is much higher than either of the source theories. This may be seen as a step forward in the evolution of the theory. However, level of interrelatedness between the aspects of the theories has not increased. Therefore, while the integrated theory may be more effective than either of the source theories individually, it is not expected to be highly effective in practical application. To increase the effectiveness of the derived theory, more research is needed to identify causal and co-causal relationships between the various aspects.

One potential weakness of this approach is the creation of highly complex theories. Some scholars (as well as editors and potential clients) may look on complex theories with some suspicion because they are too large to print or too complex to understand. For editors considering the inclusion of complex theories into their journals, I would suggest that links be created between print and other online sources. This is one way that the key ideas may be communicated in print without the conceptual loss of the entire system of theory.

For those interested in using highly complex theories to inform interventions in service and/or natural systems, I suggest that scholar/practitioners adopt a team-based approach. For example, each scholar/practitioner might adopt one smaller "chunk" of the larger theory. The more that the chunks of theory are coherent and carefully integrated, the more that they may effectively work together for the benefit of the client.

Another important benefit of the IPA approach is that the integrated theory combines multiple theories. Thus, instead of fragmenting the field (as occurs with the soft methods) this integrative approach serves to unify the field. It should also be noted that the integration process creates new insights and new challenges for testing the theory. For example if we integrate "more A causes more B," with "more A causes more C", we might ask if B & C are the same thing because they have the same causal relationship with A? Or, is there an abstraction that is relevant? Or, is there some dimension of similarity we might find between them? These are challenges that would not arise if we looked at one theory or the other.

Similarly, juxtaposing the theories creates a challenge and opportunity for research that will clearly advance the coherence of the theory. Using the above set of integrated theories, it is clear that the theory does not have a high level of systemic integration. Each set of disconnected boxes represents an opportunity for research to define the two as a causal relationship. And, defining those relationships will increase the theoretical coherence and usefulness of the theory.

CONVERSATIONS AND ADDITIONAL CONCEPTS

In brief, the use of soft methods (cherry picking, ad-hoc, intuitive) for integrating theory give the appearance of making sense, but do not seem particularly useful in the creation of more effective theories. First, they have been used through history, without great result. Second, they are reductionist and non-systemic. Third, they support the fragmentation of the field.

Other approaches (FGT and RDA) follow a more rigorous methodology. And, they are more systemic because they seek to identify and connect causal relationships between concepts within theories. However, both of those methods allow the scholar to address partial theories. FGT, for example, would allow the theorist to cherry pick portions of the subject theories that seem most relevant to the analysis. In contrast, IPA requires the rigorous integration of whole theories – each as a "closed system" (Dubin, 1978, p. 116) unto itself.

Emerging Methods for Integrating Theories

Investigating theories as systems unto themselves appears to be a useful and effective path to improving theories of natural systems and theories of service systems. Research suggests that theories should evolve towards greater complexity first, then toward greater systemic interrelationship second (Wallis, 2010a). Therefore, the IPA method presented above seems to be a good first step toward creating more complex theories – and pointing the way for additional research that will support the development of more systemic theories.

However, this approach seems to be counter the prevailing current of the social sciences. In preliminary studies of theories of psychology and sociology, it seems that theories of the social sciences have been declining in complexity (Wallis, 2012b). This may be due to scholars following the false call of parsimony that has been decried in theory.

In this section, I will discuss some additional insights and approaches that may be useful in developing theories that are more effective in practical application.

The Case Against Ease of Use

The case in favor of parsimonious theories is simple. "The simplest theory is the best" (Shoemaker et al., 2004, p. 172). There is, however, no a priori reason or proof that a theory "should" or "must" be easy to use. Indeed, given the astonishing complexity of our lived world, it is reasonable to assume that our theories should be highly complex. Certainly, it seems that policies which are more complex tend to be generally more successful in practical application (Wallis, 2011).

Indeed, it seems reasonable to assume that we will be more effective in our use of theories if we use more complex theories. Given the limitations of the human mind, however, such an approach calls for greater collaboration between scholars. For example, in an organizational intervention, we might require three consultants instead of one – with each consultant focusing on a different area of a shared theory. Until we prove that our theories are effective, however, we must still engage in some splicing and pruning. To that end, the following discussions on logical structures and scale of abstraction are presented. It is anticipated that these approaches may provide useful insights for creating theories that are more effective (whatever size they may be).

Structures of Logic

In order to better understand a house, it is important to look at the bricks because you can't make a good house out of bad bricks. Just as one cannot make a useful theory without valid data, it is impossible to make good theory with weak logics. Because a theory is built of causal propositions, the building blocks of theory may be described as structures of logic. In this section are insights into atomistic, linear, circular, branching, and concatenated logics. Some of these are useful for building useful theories and some are not. By developing a better understanding of how those bricks fit together and interact as a system, we can gain a better understanding of our theories and how they may be made more useful.

Individually, none of these structures them rises to the level of theory. When combined (in the construction zone of the scholar's mind, and placed on paper for rigorous review, a theory may be evaluated based on its underlying logical structures. In this section are five forms of logic. Each of them is fundamental in its structural simplicity. Although, if they are combined, they may become a highly complex system. For each form, there will be examples of how these logics have been used (and misused). This conversation is significant in two ways. First, it shows how some logics are more useful than others for creating theories. Second, by understanding these forms of logic, we can learn to objectively measure them. That ability to measure, in turn, gives us a new way to evaluate theory. The forms of logic are presented, in abstract form, in Figure 7.

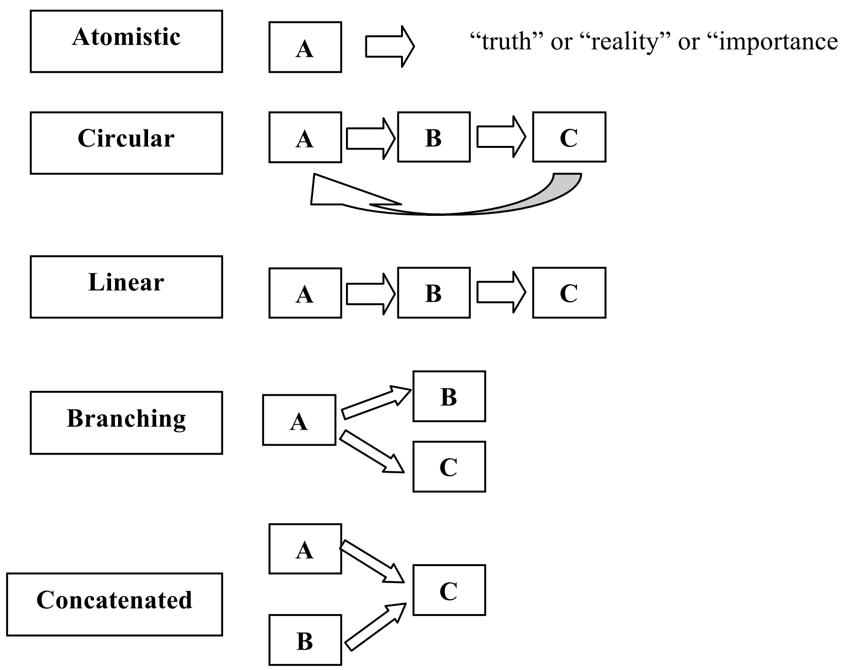


Figure 7 - Five Forms of Logic

An Atomistic logic structure is like an unsupported truth claim. By itself, it does not have much value. It is much like saying "A is true" or "A is important" or "A is real." By themselves, Atomistic claims are not good for explaining or proving anything. To make an Atomistic logic more useful, it is often supported with other claims. This leads us to Linear logics. That structure of logic (abstractly) is very similar to claims of "proof" that says, "A is true because of B and B is true because of C" and so on. Such linear representations of the world are, as systems thinkers are aware, of limited use.

Circular logic is where a change in any aspect will lead back to itself. This tautology is also of little worth. For example, Figure 7 shows how, more A will cause more B, which will cause more C, and that will lead to more A. Or, in short, one could say that more A leads to more A. The use (and miss-use) of Circular logic is generally frowned upon.

The Branching structure of logic is more complex. Here, "more A causes more B *and* more C. A Branching logic (like Atomistic, Linear, and Circular logics) gives the appearance of making sense. However, those specific forms of logic are not so useful when they are applied to creating useful theories.

The fifth structure of logic is much more useful. That is the Concatenated form of logic. That is where changes in A and changes in B cause changes in C. The usefulness of Concatenated logic can be seen in the brilliant work of George Bateson (1979). Bateson referred to this approach as "dual description." The idea here is that any two descriptions were better than one. Whenever two perspectives are combined, a new (and better) understanding emerges. For a biological example, one eye cannot discern depth. Two eyes, in contrast, provide two perspectives, which the brain integrates to create a third perspective, one with the added dimension of depth.

From a philosophical perspective, the Concatenated logic can be seen in the classic Hegelian dialectic (e.g. Appelbaum, 1988). There, thesis and antithesis lead to synthesis. More related to CT, the idea of a Concatenated aspect is similar to the idea of emergence in that something new may be seen or understood.

With this understanding of the structure of logics, we gain the ability to deconstruct a theory into its constituent logics. By identifying what logical "building blocks" have been used to create the theory, we gain a new perspective on how well the theory is built. By counting those logics, we can quantify the potential usefulness of a theory. By counting the logics in two theories, we can compare them and decide which one is empirically more logical. This approach also shows which theory is more co-casual and non-linear in structure. And, based on previous research, will show which one is more likely to be effective in practical application (Wallis, 2010a, 2011).

These structures suggest the benefit of rigorous methods for integration. Because, if we understand the structure of our building blocks, we can better understand how they may be assembled more effectively. The way we would build a wall with rectangular bricks would be very different from the way we would build a wall with bricks that were spherical or triangular.

It is entirely possible that there are additional structures of logic that may provide additional insights into the evaluation and integration of theories. What they are, or may be remains to be seen.

Scale of Abstraction

In this section, I will discuss a few insights on the nature of abstraction. Starting with a few foundational concepts, I explore those concepts to suggest how we may use these ideas to create more effective theories. Starting with the basics, Quine (1980) draws on Russell's theory of types to discuss abstraction in terms of "individuals" on one level, "classes of individuals" on another level and "classes of classes" on a still higher level of abstraction from concrete to abstract. Leading him to ask, "How much of our science is merely contributed by language and how much is a genuine reflection of reality?" (Quine, 1980, p. 78). Fodor (1998) argues that each concept is atomistic – without structure. Although, of course, each concept is an abstraction of a whole or part of an object in the real world.

Yet, form a more systemic perspective, "the coherent, and mutually dependent presence of the clustering beliefs in the mind of that believer is thus essential to the justification of members of the cluster" (BonJour & Sosa, 2003, p. 209). Thus, when we understand the abstractions and the rules for relating those abstractions (as in understanding words and the rules for grammar) we understand the interrelationships more effectively (Quine, 1969). This makes it possible to create more effective theory.

It is generally accepted that the process of description and abstraction is one way to build a theory Morgeson, F. P. and D. A. Hofmann (1999). "The structure and function of collective constructs: Implications for multilevel research and theory development." – and Ostroff, C. and D. E. Bowen (2000). Moving HR to a higher level: HR practices and organizational effectiveness. Indeed, we may say a theory is a form of abstraction. And, of course, many scholars accept that there are unit-level theories that are more concrete, and grand theories that are highly abstract. Further, the more abstract the theory, the broader area is may be used. For example, Newton's F=ma (force equals mass times acceleration) is a highly abstract theory and is broadly applicable.

It is also interesting to note that theories may be developed through the use of data that is derived from differing levels of abstraction. For example, Newton used observation to gain empirical data to build his theories of motion. Einstein, on the other hand, used existing theories to create a more effective theory (Dubin). The empirical observations led to an abstract theory while the integration of abstract theories led to theory that was more effective. This suggests the opportunity to use existing abstract theories and rigorously integrate them to create theories that are more effective than we ever imagined possible. In short, this conversation suggests that we should follow in the footsteps of Einstein rather than Newton.

In the social sciences there is also the understanding that such highly abstract theories may be difficult to test or use in practical application. The focus of this section, however, is something different. I am not looking at the abstraction of the theory in relation to the world around it. Nor am I looking directly at the differences between concrete objects in the natural world and their relationships with abstract concepts within the human mind. Instead, this section explores the relationship between those levels of abstraction, how those differences relate to building theory.

In short, in this section, I surface an important issue of metatheory and sensemaking. Here, I integrate new and existing insights to suggest a more useful model for understanding how we understand the world, how theories are made, and how they may be made more useful.

I begin with the assertion that nothing exists in isolation. This is analogous to the idea that "no person is an island" and the idea that "everything in the world is interrelated/interconnected/connected." I would suggest that this rule applies to objects in the natural universe as well as to concepts within our minds. Second, I would assert that nothing can be properly understood except in relation to other things. And, therefore, that things are better understood when they are seen in relation to more similar things. This is the key – that greater similarity opens the opportunity for greater understanding. While, in contrast, things that are less similar do not lend themselves quite so well to a process of improved understanding.

The physical world

Of course, we may look at an object and identify what it is and the features and the characteristics of that object. Yet, in that process, no human is a tabula rasa. The structures and images in our memories allow us to make such distinctions. For example, in the physical world, if we compare apples and oranges, we are talking about a broad class of apples and a broad class of oranges.

Apples may be understood when they are placed in relation to oranges. By comparing the two, we can more easily identify differences in flavor, color, texture, etc. Indeed, such comparisons may well rise in the readers mind at this moment. However, such a broad difference indicates that we can judge/compare/understand apples only broadly. When I write “apple and orange” I suspect that most people will imagine one apple and one orange – a representative sample, if you will. Few minds will immediately conjure all of the many varieties of both fruits!

There may be many variations in flavors among all those different apples. To gain a better understanding of apples, they must be related to one another. There, we start to see differences in color, flavor, and texture. For example, we might compare a golden delicious (more yellow in color) with a pippin (more green in color).

Moving to a still more nuanced comparison, we would compare two apples of the same kind. For example, two pippin apples. To an individual with a high level of discernment, it would be possible to detect slight differences between two pippin apples (variations in color, flavor, etc). Those subtle differences are not so evident when comparing pippin apples (or apples generally) with oranges.

Zooming back our to compare objects of still greater difference, apples are less well understood in relation to (for example) automobiles. A car might have an “apple red” color. Which provides one point of comparison. However, there is not a good way to consider the difference in structure and function between apples and cars. There are few points of comparison. What are car seeds? No such thing. How about comparing apples with stellar nebula? The greater the difference, the fewer opportunities exist for comparison. Moving further away, it would be more difficult still to compare an apple with a concept such as freedom. Freedom, does not have color, or flavor.

Here, I am not saying one cannot find any comparison. Both apples and nebulae are made of matter. My point (if not already overstated) is that there are fewer relationships and so fewer opportunities to identify nuances.

Sure, we might span the gulf by the creation of metaphorical relations and poetic endeavors. While those too may be interesting, they are not useful for working with either. Indeed, they are likely to lead to misleading speculative endeavors. For example, one might "reach out and pluck an apple" but reaching out and plucking a nebula is not likely to be successful or result in a tasty snack.

Indeed, the greatest differentiation between levels of scale might be in the comparison of things that are and things that are not. That kind of comparison opens the door for questions that may seem challenging and interesting, but are of little usefulness (e.g. how many fairies can dance on the head of a pin).

Apples are made of matter, as are nebulae. Ergo, nebulae may be made into delicious pies. No, such an approach does not work well. This is not to say that no useful insights are possible. Only that they are fewer as the difference is greater and we are less certain as to their applicability. For example, we might say that exploring a nebula is like eating an apple – both are done one bite at a time. Such an aphorism may help an astrophysicist learn patience. However, we might also say that exploring a nebula is like eating an elephant – the same rule applies as apples. From this conjunction of insights the line between elephants and apples is blurred and our knowledge is not increased.

The conceptual world

Similar to the way that physical objects are connected within the physical world, in world of one's mind, concepts are all interconnected. This idea is generally accepted in observing that a theory is made of interrelated concepts. The coherence of "real world" maps is not usually in question because those maps duplicate the internal coherence of the real world. The benefit of internal coherence appears to be valid across multiple levels form the concrete to the highly abstract – from the physical to the conceptual. This suggests that we may measure the coherence of a conceptual structure to determine its potential usefulness as a map.

When comparing concepts, the same approach applies as discussed above for comparing objects. That is, we are able to gain a more nuanced understanding of a concept when we compare concepts that are more similar. Indeed, because our minds provide us with a conceptual reflection of the world, our act of comparing objects in the physical world is truly the act of comparing concepts within our minds. And, when comparing concepts, we gain more knowledge, more nuanced understanding, when comparing concepts that are closer together.

For example, if a child is learning basic math functions, the idea of multiplication is easier to learn if the child has already learned addition because the two concepts are similar (four times three is the same as four plus four plus four – or four plus four three times). Learning the concept of multiplication would be much more difficult if the student were to begin with the concept of glassblowing because the concept of glassblowing is not as will connected to multiplication as the concept of addition.

For a negative example, one might compare the concept of "movement" with the concept of "size." There is not much overlap there – they seem quite distinct. However, if we compare the concept of "upward movement" with the concept of "lateral movement" clear similarities and differences begin to emerge.

Emerging Methods for Integrating Theories

In academic circles, in creating theories for the social sciences, we have attempted through the centuries to define and clarify the apparent connections between things (objects in the physical world) and concepts (objects within our mental world). This empirical or perhaps positivist approach has not met with great success. There is no evidence that the theory-based practices of the social sciences are more effective now than they were 50 years ago. Indeed, practitioners call for more useful theories (when they bother to look our way at all) and studies across a range of fields show that our theories are of very limited value.

In contrast, recent studies have shown that theories with more internal connections are more effective in practical application that theories with fewer internal connections.

To summarize, more knowledge may be gained by comparing things that are more similar. Therefore, the act of linking a concept with a physical object is not expected to be as useful as linking concepts with other concepts. Yet, the social sciences continue to engage in a process of "renaming." It makes little difference if we create a theory that calls an object a rose, or if we call it a complex adaptive system or a Holon. Such munching is unlikely to increase our understanding because the concept and the object are very dissimilar.

Similarly, and from a more positive perspective, if we want to make effective theories, they should be constructed of concepts that exist at the same level on some scale of abstraction. That approach optimizes the opportunity for insights to emerge that will add to our knowledge and the usefulness of the theories.

For example, consider a highly theory from physics known as "Ohm's Law." There, the relationship is between the rather abstract concepts of Volts, Amps, and Ohms. One does not find a highly useful theory that links abstract Ohms, with more concrete concepts radios or communities of practice.

Indeed, the whole idea of abstraction takes on a new meaning if we check-in with a more foundational meaning of the word "This usage was originally determined by mere etymology. In Latin '*concretus*' means simply 'mixed', 'fused', 'composite', compound; while the Latin word '*abstractus*' means 'withdrawn', 'taken out of', 'extracted' (or 'isolated'), or & estranged'.
http://www.marxists.org/archive/ilyenkov/works/abstract/abstra1b.htm

Thus, as abstract concepts become MORE interlinked, they become MORE concrete and so MORE useful in the natural world. Similarly, as one's understanding of a physical object become more abstract, more disconnected, that understanding becomes more useful in the conceptual realm. Therefore, instead of creating theories that seek to link concepts (very abstract) with objects or events (very concrete), we should instead seek to create theories whose component concepts are all at a similar level of abstraction. Of course, this is a new and evolving idea. Therefore, it may be useful (as an alternative approach when creating and presenting a theory) to identify within that theory, exactly where and why there are differences in the level of abstraction.

Moving between levels of scale

It may be seen that the human sense making ability drives (and/or is driven by) the movement between levels on the scale of abstraction. For example, if I have a note from my wife saying that I should buy milk at the store, my mind makes sense of that note – in part by shifting from a highly abstract level (pencil marks on a piece of paper) to a more concrete level (actual carton of milk at the store).

There is a certain level of usefulness that is related to sensemaking. Although, not all sensemaking is equally useful. Form the preceding discussions it seems that there are two related insights into relatedness. First, that concepts are more useful when they are interrelated. Second, moving between levels of scale increases usefulness. Third, that physical objects are interrelated.

Even if we take a Wittgensteinian / Shotterian approach where one may say, "Look what you've brought on your dirty feet, wipe them next time" (Shotter, 2004). The dirtiness of the shoes can only be understood in relation to the other things (authority figure, mud and shoes situated in house, looking, etc). That kind of approach implicitly recognizes the relatedness of the things involved. And, the human sense-making ability starts with the concrete experience and creates a more abstract understanding (theory, if you will), which may be applied more generally with other houses, other shoes, and other mud.

To open the door for future explorations, it seems that there is something in these conversations that is tantalizingly close to the micro-macro problem. That problem prosaically presented in the age-old question, "How many grains of rice are in a heap of rice?" While there are many ways to parse the answer from a component perspective, I'm increasingly starting to think that it is a dimensional problem. Or, to say it in another way, grains and heaps are measured according to different dimensions – and different abstractions. They are of different universes and so cannot be measured with the same yardstick. One might just as well as, "How many two dimensional squares can you fit into a three dimensional box?"

Summary and conclusion of additional concepts and conversations

To summarize and conclude, it seems useful to adopt a new metatheoretical understanding and practice in fields such as business, psychology, sociology, economics, and policy. First, that a well-constructed theory should contain concepts that are of the same level of abstraction. For example, a theory should not contain one concept as concrete as "pippin apple," and another concept as abstract as "fruit." The internal validity of the theory will be enhanced to the extent that all the concepts are at the same level of abstraction. I know of no studies that have examined this relationship. So, the gates are open for a new stream of research.

It seems possible and potentially useful to create a method to analyze and measure the levels of abstraction with some degree of objectivity. And, thereby, suggest a new method for scholars and editors to evaluate the internal validity of a theory under submission to a journal. Further, such an internal measurement of the conceptual coherence within the theory (the percent of all concepts within the theory that are at the same level of scale) might be correlated with the scale of abstraction of the theory as a whole – as it relates to the world at large (unit level to grand level). This relationship would indicate the extent to which a theory remains true to its stated role. This kind of measurement might also be useful in creating a "periodic table" of theories that includes scale of abstraction along with Complexity and Robustness (from Propositional Analysis).

Second, it is the role of the human (individually and/or organizationally) to shift between levels of scale. This includes developing an understanding of theories as to where they may be applied and how to apply them in a concrete situation. For example, if there is a theory of motivation (including interrelated abstract concepts), a person or team might decide to apply that particular theory to their particular situation.

This approach provides two interrelated ways of knowing. First, the same scale relationships within a theory, second, the relationships between the theory and the practice. Research, similarly, may be understood as the human-theory interaction where understanding is shifted across levels of abstraction from concrete experience/observation, to conceptual understanding.

By differentiating these inseparable relationships if becomes more possible to understand and measure them – thus leading to more effective study of theory and practice. Methods such as RDA, IPA, and a metatheoretical application of FGT suggest more rigorous approaches to support us in our endeavors to go beyond the empirical/positivist approach of Newton and leap forward to the poly-conceptual approach of Einstein.

Insights such as this suggest the opportunity to create more effective theory that is highly abstract. That, in turn, suggests that we might be able to make more effective theories for bridging disciplines (e.g. between service systems and natural systems). Future explorations might find interesting insights in comparing the insights developed here with insights developed by Marx, Hegel, and others in the study of dialectics. It may be asked, for example, what happens if the thesis and antithesis are of the same level of abstraction? Or, what occurs if one is more abstract and the other more concrete?

We may say, therefore, that things are better understood when compared with things that are more similar. This suggests that a scale of abstraction is an important part of the sense making process. Or, more sense (or more nuanced sense, or more details) may be inferred or derived when the objects under consideration are at the same (or more similar) level of abstraction.

Glaser (2002) does make some good points on scale of abstraction which he calls "conceptual levels." There, concrete data exist at conceptual level 1, while categories (into which the data are grouped in the creation of grounded theory) are at conceptual level 2. Finally, the "core category" is at conceptual level 3. This raises some difficult questions in the use of GT based on the conversations above. For example, if a Grounded Theory claims that more people, more hammers, and more time will result in more productivity, such a theory would be of limited value because productivity is more abstract than people or hammers.

If we look at the claim from another direction it may be seen that the more concrete level of "hammer-based productivity" could only be measured in terms of work that might be done by hammering. On a higher level of abstraction, by way of comparison, if we used "tools" instead of hammers, "tool-based productivity" might be measured by all the things that all the tools might produce – (e.g. screwdrivers and bulldozers – in addition to hammers).

CONCLUSION

To briefly summarize and conclude, it seems that soft methods of theory integration (intuitive, ad-hoc, and cherry picking) have been applied through the history of the social sciences without great benefit. Our present theories for understanding and engaging natural and service systems tend to be simple and have very low levels of internal coherence. Indeed, this is part of the reason why we have the problems we do – because we do not have effective theories to understand and improve the situation.

Soft methods may be responsible for the fragmentation of the social sciences, as they tend to lead toward the creation of theories that are atomistic and spurious. Those theories, suffering from a lack of recognizable logical structure, are bad houses made of bad bricks. Further, the social sciences seems to be following the false promise of parsimony – and creating theories that are simpler instead of better. This has led to the creation of frankentheories – wild patchworks of limited use. Perhaps a better phrase, however, might be "pygmailiantheory" because each scholar places so much effort into the research and admires his or her own insights so much that for each individual researcher, the theory becomes alive.

What we have here is a kind of three-body problem. There is the world (irreducibly complex), the scholar (with abductive moments of inspiration), and the theory (no reliable way to evaluate them). None of these is a "fixed point." Instead, each orbits the other in ways that have not been well defined. And, indeed, may be indefinable. It should come as no surprise that there is no easy way to understand the situation.

A systemic view of theories suggests a number of alternative approaches to reverse the trend and create theories that we may use to more effectively address our social-ecological issues. First, using more rigorous methods (FGT, RDA, and particularly IPA) will serve to re-integrate the many fragmented theories. Second, the use of whole theories should be preferred to the use of partial theories.

There is a new opportunity for analyzing and categorizing theories based on the scale of abstraction "within" each theory. Using such an approach, it may be possible to create a "periodic table" of theories based on their internal structures. Another dimension of that table might be the level of abstraction "of" the theories from the vast reaches of grand theory to the small details of unit-level theory. I expect that this paper will provide new tools that scholars and practitioners might use to more effectively decide which theories will be more useful for research and practice. It will also provide a better understanding of how to more rigorously create more effective theories. The integrative effort and resulting conversation of this paper is expected to engender new challenges and new insights into bridging the theory-gap between natural and service systems through a deeper understanding of theory-systems.

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