Chapter 2
A Narrative of [Complex] Situations and Situations Theory

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Abstract When faced with intractable problems that are surrounded by high degrees of uncertainty and transience, it is imperative that the nature of the problem be understood. Too frequently, solutions are proposed in the same disciplinary construct in which the problem was framed, and the intractability encountered. Situations Theory is the meta-theoretical study of the conditions that surround a problem. It is not a specific discipline aimed at developing understanding higher levels of understanding of specific phenomena from a well-formulated perspective. Rather it is focused at understanding how such perspectives contribute to dealing with problems encountered in complex situations. The practicality of Situations Theory lies in being able to better judge the effectiveness that an approach will have given a specific set of conditions that might surround a problems, or as a basis on which robust methods and tools can be developed that are congruent with the nature of the problem that is to be addressed.

Keywords Complexity • Complex situations • Wicked problems • Situations theory • Complex adaptive situations methodology • Pragmatic idealism • Paradigm • Worldview

2.1 Introduction

2.1.1 In Breve

In complex situations understanding of the *nature of the problem* is required to ensure that consistent methods and approaches are being used given the conditions encountered, even though an understanding of the problem itself may be limited.

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For this narrative, situation refers to the condition(s) that are encountered by the participant-observer. Situations theory refers to the set of theories, models, tools, and know-how that have evolved from research of wicked problems that provide an alternative perspective of such problems. Situations Theory is the study of the *nature of problems*, from a meta-theoretical point of view. As such, it is not a discipline aimed at solving a problem or set of problems, but rather a meta-discipline studying the efficacy of the understanding generated by other disciplines. That is not to say that there is limited practical value since this understanding of the *nature of problems* serves to inform a rich methodology; namely, the Complex Adaptive Situations Methodology (CASM). It has also enabled the conceptual and prototypical development of tools, methods and approaches for a variety of problems including organizational structuring, decision-making, risk management, operational integration, situational awareness, and other fields.

There is a highly practical and pragmatic focus to Situations Theory that generally transcends purely disciplinary studies. The interest lies in maximizing the possible comprehension and understanding that we have of a problem, irrespective of the discipline, sense-making, worldview or otherwise labeled process that served to form the representation of the problem. Interest in disciplinary improvement becomes subservient to this practical imperative, however, for a simple problem to exist, it can be assumed that an adequate representation has been formed to be able to solve the problem.

2.1.2 Background of the Problem

It is not uncommon to start research on a problem, and while working towards a goal, end up heading in a completely different direction. Ironically, the very non-ergodic nature of research not only underlies the indeterminacy that results in these changes in direction, but also turns out to be one of the many attributes of the problem that was being studied.

The work that lead to the research of complex situations and the formulation of situations theory, started out quite innocuously as an advanced study of interoperability of systems, or system of systems engineering (SOSE). The intent of system of system engineering was to develop design based approaches that would enable the engineered acquisition of capabilities through the integration of existing and new technologies, both in the form of hardware and software, and organizations. Acquisition of capabilities in this manner has and remains problematic due to the intricacies that are generated when integrating disparate components. Difficulties arise from a variety of factors, for example:

- The integration of technologies of different generations. Older technologies may overly restrict newer technologies. Reverse compatibility may not be possible.
- There may be differences in the synchronicity of problems forcing changes to underlying processes.

- Conceptual difference in data may make sharing of information extremely difficult if not impossible. Different frames of reference may defy mapping to each other.
- Integration of independent social organizations may encounter a variety of socio-psychological barriers ranging from an unwillingness to share by stakeholders of the different entities, to politics and policies that restrict integration or even interaction through normatively or regularity means.

Keating et al. (2003) established a baseline for system of systems engineering, identifying the different problems, and perspectives for the field. Unfortunately little consensus could be generated between researcher, research sponsors, and even practitioners that were seeking means to propagate any capabilities. Different schools of thinking about the problem rapidly emerged and have not seen significant convergence in methods (Sousa-Poza, Kovacic, Keating 2008). To confound matters further, a singular concrete definition of what constitutes a system of systems has failed to emerge.

Two important reports that strove to define SOSE were generated. The United States Air Force Science Advisory Board (AF SAB) published a report on SOSE in 2005. To ensure consistency in the methodology, it was required that problems be "predictable", and be approached in a "predictable manner". This approach eliminated many systems of systems based capabilities acquisitions that face extensive emergence and/or self-organization. A second report published by the Trans-Atlantic Research and Education Agenda in Systems of Systems (T-AREA-SoS) (2012) titled "State of the Art on System of Systems Management and Engineering" takes a much more inclusive perspective on integrating diverse entities, identifying many problems and areas that require further research.

Case studies and implementation efforts resulted in the conclusion that *engineered* integration of technologies and organizations might only be possible for a subset of system of systems type problems. Most problems that were being addressed for defense and security type problems repeatedly encounter serious problems, for example:

- The Integrated Deepwater System for the US Coast Guard,
- The SBInet for US Department of Homeland Security, and
- The UK FiReControl project.

2.1.3 The Problem

It was becoming apparent that the development of SOSE was facing attributes that it might not overcome (Sousa-Poza et al. 2004a, b; Sousa-Poza and Keating 2004; Keating and Sousa-Poza 2005; Kovacic, Sousa-Poza, Keating 2007a). Whether it is due to technological, semantic, social or psychological factors, the attempt to engineer complex and numerous entities into an integrated capability delivering organization was turning into a Helleresque catch-22. To integrate and ensure the interoperability of increasingly diverse, heterogeneous components, increasingly intricate and involved designs would be required to the extent that the "complexification" would ultimately become a liability.

This liability is exemplified in Mr. Ray Ozzie's discussion on the future of Microsoft Operating Systems (http://ozzie.net/docs/dawn-of-a-new-day/), and consequences of the intricacy being incorporated. To ensure that all the different OS components and application function together, and that they are reverse compatible requires a great deal of "complexification". He indicates that these designs are resulting in extremely *fragile* solutions instead of realizing ever-greater agility, flexibility and robustness. In other words, there appears to be a limit of our comprehension of integration and interoperability type problems and solutions.

Our research arrived at the conclusion that a different line of questioning was going to be required, namely, "what are the attributes of the problem that (1) impose limitations on the methods being used, and (2) given a set of attributes can new methods be developed that circumvent the limitations?"

Efforts to understand the nature of the problem better, and to identify solution approaches led to the recognition of facets of engineering and management other than interoperability facing similar complexity and uncertainty. For example, Conklin (2006) found that in wicked problems, as Rittel and Weber would have prognositcated, work did not flow in a nice linear manner according to the waterfall model. In fact, it was found that problem solvers nearly concurrently maintain facets of analysis, problem formulation, solution development and implementation. This finding is very much in line with the description of the attributes of wicked problems that Rittel and Weber provided. For example:

1. In an environment where a there is *no definitive problem definition*, due to whatever reason, the formulation of the problem becomes an ongoing elaboration of the awareness and understanding and it would be expected that the problem solvers constantly switch back to, or even maintain a problem identification phase.
2. The problem definintion and the solution become synnonymous and the *choice of an explanation determines the nature of the problem's resolution*.
3. The *lack of a stopping rule* means that there is no means to define the transition between states, particularly since no clear outcome state might be definable.

Attempts to fomulate more effective approaches to deal with wicked problems was first directed at improving existing based on the rudimentary understanding that had been developed of wicked problems. For example, to overcome the problem of having many complementary perspectives, a Unifying Framework approach was developed. The rationale behind the Unifying Framework followed the lead of extensive seminal work in diverse fields, such as General Systems Thoery (Skyttner 1999; Von Bertanlanffy 1976; Checkland 2006). This attempt resulted in the theoretical ability to combine two or more perspectives. The investigation, however, led to the conclusion that the integration of perspectives is extremely inefficient. In extreme cases, the loss of fidelity imposed on the individual perspectives might be enough to make them useless for the function that they are to support, while not guaranteeing that a sufficiently strong contribution would be made to the common perspective to justify any loss (Kovacic, Sousa-Poza, Keating 2006, 2007a, 2007b). The lesson learnt from these efforts was that an attribute of a complex situation is intrinsic, and it is

not possible to overcome the attribute by an increased effort using the method that led to the recognition of the attribute in the first place.

It also became apparent, that as new approaches were formulated to deal with one facet of a problem, many others would be affected. For example, to maintain integrity in organizational structuring and reduce the amount of conflict, it is often suggested that self-organization be embraced using policies and norms to regulated behavior within the organization. For this to be possible, changes are also required to planning, resource allocations, human resouces, and decision making.

The problem, in brief, stems from the limits to the understanding that any perspective is able to generate, which limits what can be done to address a problem encountered within the situation. The problem is generated when we fail to recognize the limitation, or if we fail to adjust our paradigms and behaviors in spite of having identified them.

2.1.4 Need for a New Approach

All lines of reasoning resulted in having to rethink "everything". For example:

- Imposing a new paradigm on how to structure and organize to better deal with complexities encountered in interoperability allowing for greater self determination and self-organization,
- New methods would be required for decision making to allow for the inherent uncertainty that would be generated by the innumerable alternatives that would be generated,
- And, new planning and goal attainment methods would be needed to deal with the lack of a clearly posited end-state or the lack of an identifiable transition.

The dominant principle became that new methods would be required that were consistent with the problem, and in turn with each other.

The importance of the evolution of a paradigm that has a comprehensive impact is also underscored by the recognition that in a practical setting, it is not possible to isolate functions. The decision making approach cannot be altered without taking into consideration the impact on planning, control, etc.

2.1.5 Overview of the Paper

The purpose of this paper is to provide an overview of complex situations and situations theory. The focus is on:

1. Describing
   (a) Situations
   (b) Situations Theory

2. Purpose of situations theory
3. Highlighting some of the salient features of situations theory
4. Methodological considerations in evolving situations theory
5. Research agenda of situations theory
   (a) Micro-Situations Theory
   (b) Macro-Situations Theory
6. Consequence of ST: Call to Heretics

2.2 What Are [Complex] Situations?

A situation is more readily described than defined. When dealing with topics that scratch the edge of what may be comprehensible, it is inevitable that the justification of any definition, like an Ouroboros, will ultimately turn on itself and become part of its own justification.

To ovoid this 'complication', it often becomes necessary to bound and constrain a problem or context to ensure the consistency of the definition, whilst hopefully not forgetting that such a bounding will cause an obvious incompleteness, a separation of the definition derived from the bounded space from that which we initially intended to define. The definition will ultimately only be as good as the bounding that we impose. In those cases where any bound will detract from that which we originally set out to define, the definition will suffer and fail to fully convey that which we intended to state.

Abstractly, a situation is defined as a set of conditions that we expand on with the requirement that an individual 'is' or 'becomes' cognizant of the set of conditions. It is consequently an experiential construct that requires the participant to simultaneously establish an awareness of that which is being experienced and in so doing a self-awareness that bring the experience into being. It requires simultaneously having a perception be formed through the observation of that which the individual is experiencing as well as the [cognitive] imposition of the individual on that experience.

On a metaphysical or microcosmic scope, situations are a transient and near persistent state that are manifested when an individual becomes aware of a set of conditions, or when that individual imposes themselves to form a set of conditions. They are the combination of an unbounded participation of a person in life (noumenon) as well as the cognitive and bounded observation of that life (phenomenon).

The situation, as best we can, quite simply establishes "*that which is*". We refer to this as the *Reality Is* principle. Due to its largely unbounded nature, we recognize that "*that which is*" is in general, and in most cases, invariably much greater than that which we will be able to form an understanding of (Sousa-Poza and Correa 2005; Brewer 2010). In very select, special, and constrained cases do the conditions manifest themselves in such a manner that the understanding of "*that which is*", is able to

form a perspective that is representative of "*that which is*". This would be referred to as a *Simple Situation*. This also implies that the complex situation becomes the general case, making the word complex somewhat redundant and unnecessary. The distinction between a simple and [complex] is thus defined by the degree to which comprehensibility and understanding of the situation can be established.

2.2.1 On Situations and Wicked Problems

Complex situations, such as those that Rittel and Weber describe in their work on wicked problems, refer to problems of a highly practical nature. Not that they are not of interest to researchers, academics and other scholars, but rather that there are situations in which the bounding of a problems requires the imposition of assumptions and simplifications that may very well reduce its practical value; even if in so doing make them more acceptable from an academic perspective. To meet the criteria of knowledge researchers are compelled to carefully govern the context in which the research is conducted to ensure the consistency and reliability of their conclusions.

Wicked problems, as have been described in literature, have an intransient and a perplexingly incomplete and intractable nature to them that make their study extremely difficult. It is possible to extract elements of these problems and isolate them from everything else that is happening to possibly study some facet of what might be transpiring. This separation is at once necessary, but also dangerous in the sense that the conclusions that are derived within the bounded space may be barely relevant to the original problem being studied.

Studying situations fundamentally becomes similar to the development of our understanding of wicked problems (Kovacic, Sousa-Poza, Keating 2008). The concrete, intransient statements that we can make reflect the nature of the problem. These focus on:

1. The *wickedness* of wicked problems
2. What makes wicked problems, '*wicked*', and ultimately,
3. How a person should proceed given the *wickedness* of a problem

Wicked Problems are at once a form of situation, just as situations come into existence through the awareness of the existence of a wicked problem.

2.2.2 On Situations and Systems

The terms "situation" and "system" are semantically quite distinct. A system can be referred to as a set of inter-related components that together generate a behavior. From this a variety of different perspectives or interpretations are possible.

Commonly a strong empiricist bent is present where the system and that which it is supposed to represent become synonymous. Another interpretation would be much more rational in nature, where the word system is merely a representation. From an analytic point of view the system is representational of an observed set of components and their ensuing behavior. Alternatively, however, the system may precede any observable entity, as would be the case in a design.

In all cases, a system is ultimately a bounded representation for which there is the "system" and the "environment". The frequent inclusion of the environment in systems models actually forces the inclusion of the environment into the system or a layered view that would include the system, the environment, "and everything else that could not be considered". Systems, as a discipline, is a means by which we attempt to make sense of something. The simplifications and assumptions made in the bounding process and the ensuing focus on the bounded system ultimately lead to the risk of turning this into an academic exercise, studying (often in great detail) a system that no longer has any bearing on actual events.

Conversly, a situation differs from a system in that it is less about the workings within a perspective (or this case system), and much more about the manner that the bounded perspective interacts with the set of conditions, in other words the situation, from which it is derived. Assuming that a system representation is intrinsically as good as it can be, the question that arises is how much comprehension of a situation is possible. Accepting that there may be limitations or flaws in the representation itself, we also recognize that the degree of understanding may not fully reflect what might be comprehended (Brewer 2010).

2.2.3 Research of Situations: A Segue to Situations Theory

The consequence of this has been that in general, research on complex situations has studied the meta-constructs of complex situations; in other words, *the nature of situations*.

Both the focus on studying the meta-construct and the sheer intractability of many of the topics being addressed helped evolve a unique perspective on how research is undertaken. Methodologically a reliance on rational coherence is necessary to ensure that the inferences being drawn are consistent (Sousa-Poza and Kovacic 2008).

The difficulty of maintaining a continuous tie to actual or practical conditions also presented challenges. Research within a laboratory or other bounded domains is possible. Maintaining the imperative of practicality and where necessary the participatory construct as a necessary part of a situation does present challenges within social settings. Elaboration of quasi-experimental techniques, as well as specialized laboratory environment became imperative to ensure that even when a virtual environment is necessary, that a moderating assessment of the impact of bounding the problem space can be effectively provided, through for example, the use of individuals familiar with a problem (Sousa-Poza and Kovacic 2008).

2.3 An Overview of Situations Theory

2.3.1 Purpose of Situations Theory

The purpose of Situations Theory is to provide a set of theories and models to facilitate the understanding of the nature of a situation with the practical intent of improving practice in [complex] situations. The guiding principle of Situations Theory is to maintain within the developed constructs the natural tie to reality that (1) is necessary to understand a dynamic, transient, context specific, situation, and (2) an individual, as a participant, will continuously experience. Situations Theory is intended to inform with respect to a reality in which the individual participates, not solely a construct of the observer.

The importance of this principle is driven by:

1. The incorporation of the participant and maintenance of the observer in the problems (Kovacic, Sousa-Poza, Keating 2007, 2008)
2. The practical nature of the problems
3. The paradigm captured in Pragmatic Idealism, that led to the present state of understanding of Situations Theory and Situations Theory, helped to influence (Sousa-Poza and Correa 2005).

Under certain circumstances, where the participatory influence cannot be externalized (Nonaka et al. 2001), the situation and its nature will only be understood when maintained in situ to retain continuity of the context.

Situations Theory provides principles, models and means to interpret the nature of the situation (see for example Brewer and Gheorghe 2011).

2.3.2 Representations of Reality – RDP Model

Important in the evolution of situations theory were the ideas presented in Sousa-Poza and Correa (2005). The basic ontological construct stipulates that at the point that awareness and self-awareness occur, a domain, D, is established that encompasses the comprehensibility, C, that a perspective *potentially* could provide of the situation (Fig. 2.1).

The extent that the domain captures comprehensibility of a problem is contingent on the nature of the bounding. The assumptions, simplifications and other strategies that come into play when the domain is formed will influence the approximation distance, A′(d), between the domain and reality. A′(d) can be interpreted as a proximity measure affecting the resultant comprehension.

The degree to which the perspective can capture the comprehensibility offered by the domain will influence what is ultimately understood, U, of the problem. If the approximation distance, A″(d) between the domain and perspective is large the understanding of the problem will ultimately also be significant.

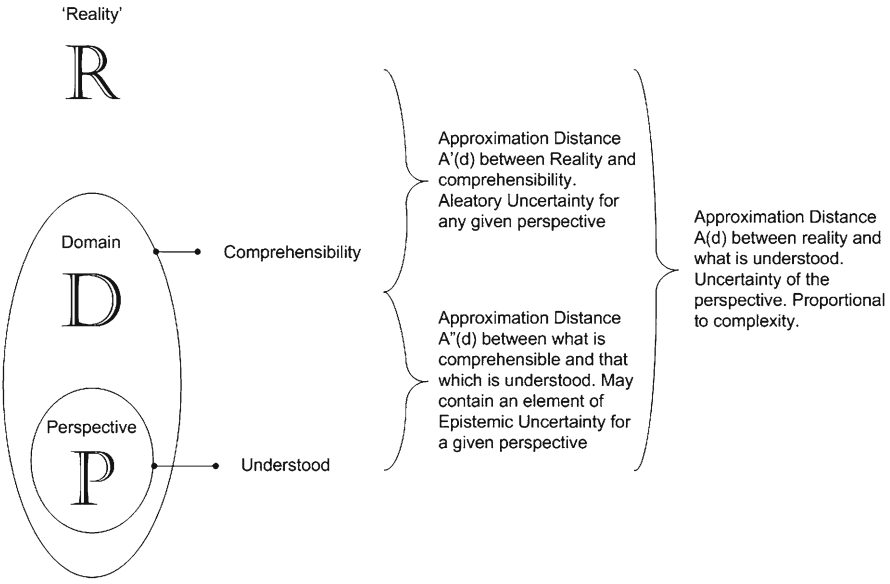

Fig. 2.1 RDP model

In situations theory the total Approximation Distance, A(d), that is formed by the confluence of A′(d) and A″(d) is of interest. Minimizing A(d) is one of the primary objective of situations theory. Understanding the interwoven relationship between the two approximation distances, A′(d) and A″(d) is crucial to understanding how A(d) may be minimized. Since the generative process that forms the domain and perspective applied to both, D and P cannot be treated as independent constructs. Consequently focusing on only A′(d) or A″(d) may have a detrimental effect on the overall understanding of the problem.

For example, a highly structured, tight bounding might be sought for D to ensure that it can be well understood. This would minimizing A″(d). This domain formulation may however require extensive assumptions and simplifications to be made that result in a large A′(d) and consequently the domain might be well understood but not the problem.

Similarly, a much more encompassing domain might be established to better capture the problem, minimizing A′(d). The inclusion of great variability, heterogeneity, etc. in the domain might however result in very little of it being understood. In this case there is a high *potential* comprehensibility but low understanding.

Ultimately it is imperative that the individual recognize the forces at play and come to understand what strategies minimize A(d) for diverse conditions and problems.

2.3.3 Sense-Making

The formation of a perspective and understanding of a problem takes place through a generative process. It incorporates the philosophical, sociological, psychological, physiological and other factors and predispositions that form the individual's cognitive foundation. Brewer (2010) refers to the perspective as the Cognitive Representation of Reality, and defines cognitive in an extremely expansive manner reminiscent of ancient Greek philosophers' definition of psychology.

Once a domain and sense making, generative process is established, the best outcome for the objective of minimizing A(d) will be A′(d) (assuming that increasing understanding by reconsidering P will not affect the comprehensibility captured by the domain). If it is established that the residual [aleatory] uncertainty is too high, a change in the domain is required. This requires a change in the generative process that will ultimately alter D and the situation. Whether or not the original problem is still perceived will be contingent on the outcome of the shift in paradigm and resultant perspective. In other words, a greater understanding might be obtained at the cost of "loosing" the problem. Obviously further refinement of the generative process and ensuing Domain-Perspective dyad would be required.

2.3.4 The Participant-Observer Dyad

This process of bounding or making sense of Reality also results in the individual adopting two roles: that of an observer, and that of a participant (Fig. 2.2). This relationship between participant and observer is central to situations theory. It can be defined and described as a syncretic construct. The individual is defined by both roles, each role making up a side of a coin. The individual and their perspective cannot fully be understood by just one of the facets. Recognizing both is however not a guarantee depending on the degree to which the perspectives formed by the roles are complementary. The necessity of maintaining both roles is predicated by the extent that the two roles are reconcilable, or whether the role of the participant can be externalized into a more explicit element of the observer's perspective.

The generative process is a means by which sense can be made of all of the inputs and influences acting on the individual both in their role as an observer and as a participant. It is not solely a formal, explicit process; relying also on experience, intuition, expertise as well as formal reasoning to organize reality into a perspective.

In problems that are highly context sensitive, it becomes imperative that the individual undertaking the problem is also a participant. This is particularly true if an observer alone cannot codify the context of participation.

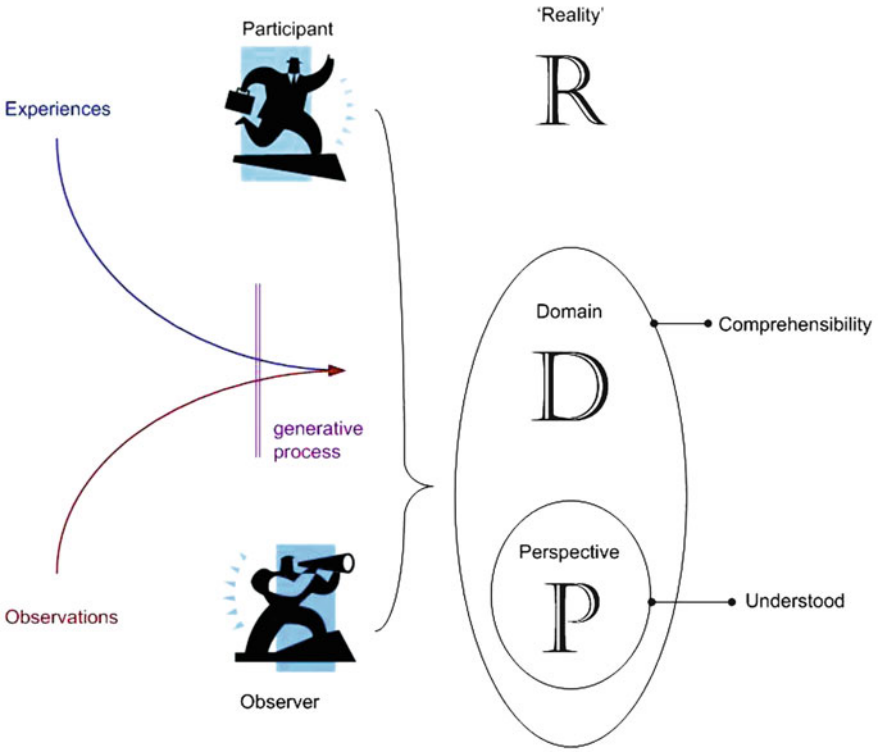

Fig. 2.2 The participant-observer

2.3.5 The Syncretic Imperative: Paradoxical Coexistence

Paradox can exist in two forms:

1. The first is when understanding of a problem and expected behaviors are found to be incongruent with resulting "Real" or observed behavior (Fig. 2.3). Typically an error in the perspective would be assumed. However, since the expected behaviors are predicated by the understanding derived of the same generative process that defined that which is comprehensible within a domain, the question of right and wrong has a secondary layer. An expected behavior can be found to right based on the domain and comprehension from which it is derived. In other words is it consistent within the construct of the domain. This still allows for a disparity with observed behaviors given the approximation distance between the Domain and Reality. The expected behavior is both incorrect and correct.
2. The inclusion of several syncretic structures results in the potential for conflict between perspectives that might also be paradoxical. The condition is possible where two perspectives result in two irreconcilable descriptions of an entity, or

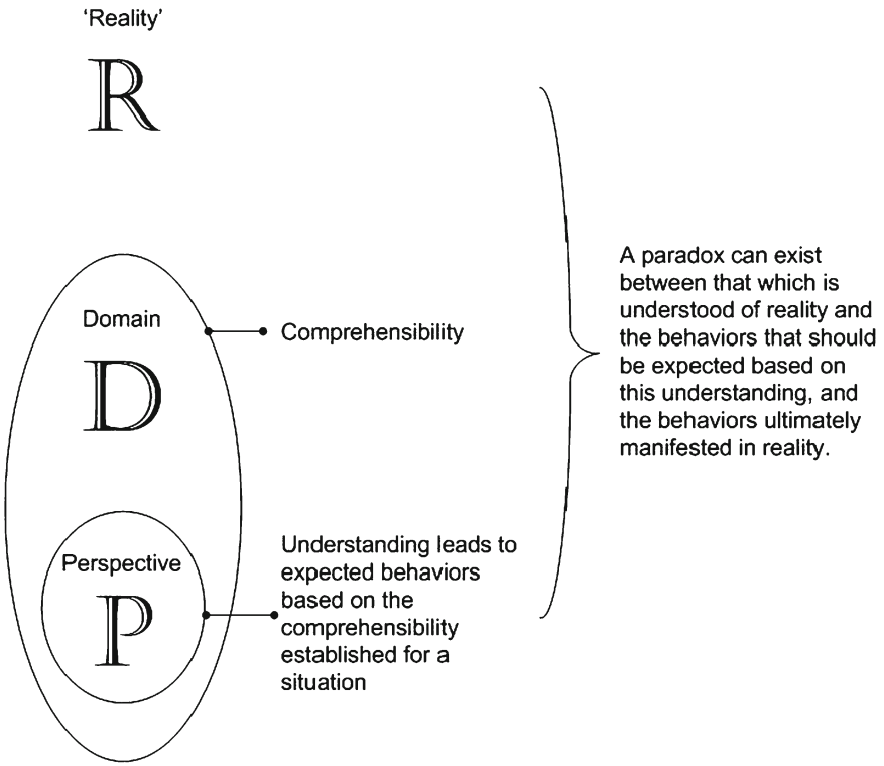

Fig. 2.3 Paradox of counterintuitive conclusions

two expected behaviors that cannot coexist (Fig. 2.4). The expected behaviors may be fully consistent within their domains, making them both correct. This dilemma is at the heart of many complementarities and dualities (Bohr 1949) in which two behaviors should not be attributable to the same entity. For example, an entity should not be able to behave as a wave AND as a particle, since particles do not exhibit wave like behavior, and waves do not exhibit particulate behavior. Within their respective domains, the wave and particle behaviors may however be completely consistent with expected behaviors and thus judged to be correct.

These dilemmas highlight an interesting facet of complex situations that also remains consistent with the RDP and other models, namely that problems can be correct, yet wrong, or even luckily, incorrect and right!

- The terms correct and incorrect are applied when judging whether a description or expected behavior is consistent with the conditions and comprehension established within the domain.
- The terms right and wrong are applied when judging whether an expected behavior or description is consistent with observed behaviors or conditions.

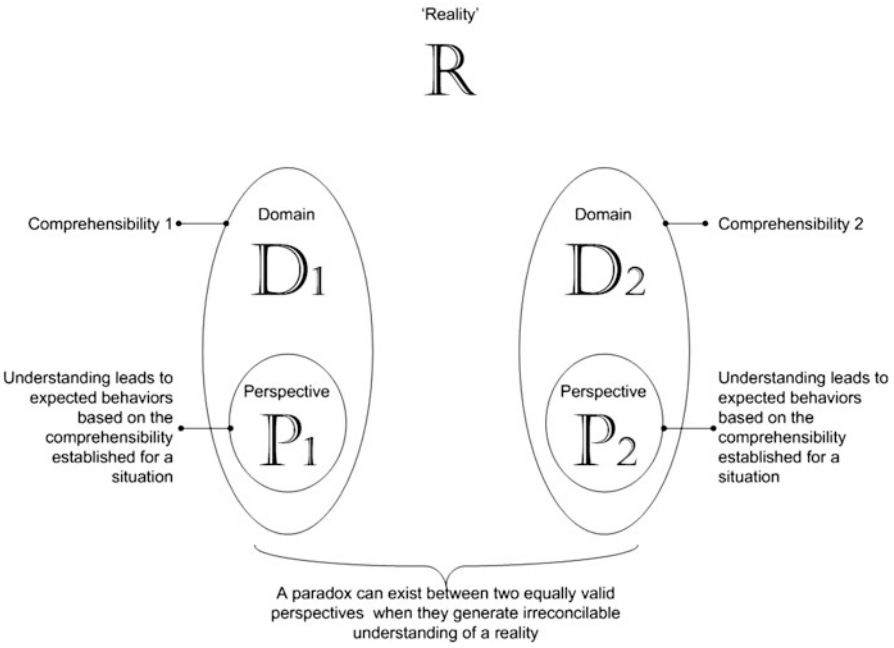

Fig. 2.4 Paradox of irreconcilable perspectives

A further distinction can be made which refers to the approach or methods applied, where the judgment is on the congruency of the approach to the conditions that surround a situation. A method that is not capable of dealing with the conditions of a situation is referred to as incongruent or misaligned.

2.3.6 Situations Theory View of Knowledge, Understanding and Situations

Situations Theory uses understanding as the core, practical output that is derived from the activities of observing, studying, researching, participating, and acting by an individual in a situation (Sousa-Poza and Correa 2005).

Participation and Observation take place within the Noumenon (from Kant as per Oizerman 1981) and Phenomenon elements of the situation respectively.

Observation is a conscious, explicit activity. Observation might include any effort to gather explicit information and data. Participation is an activity that takes place at a subconscious level and is inherently implicit. Participation includes the experience derived from working and living within a situation.

At the simplest level, the individual acquires and is part of the inputs that must be made sense of. Although the diagram (Fig. 2.5) infers that there is a sequential

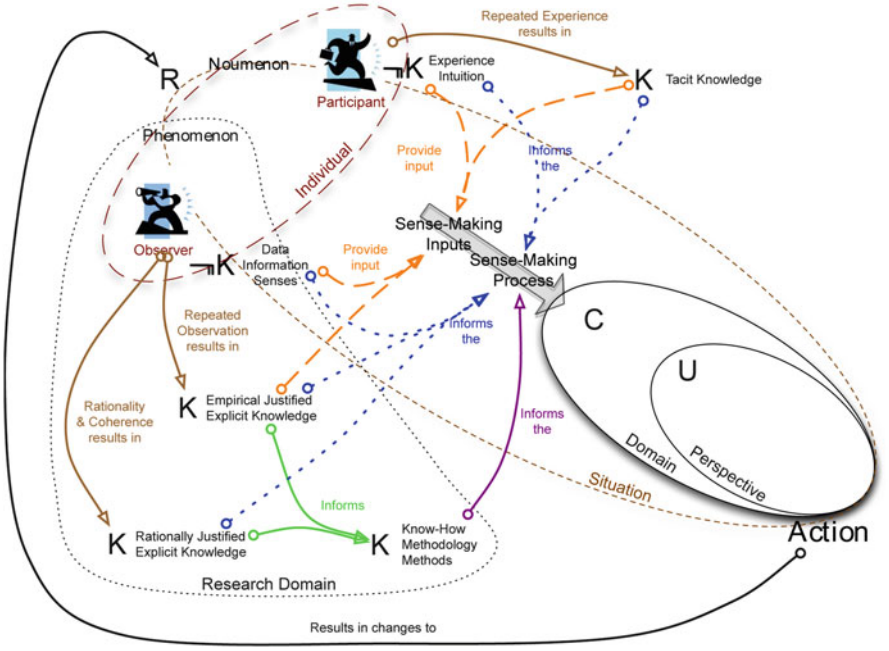

Fig. 2.5 Dual nature of understanding

step in identifying the situation, followed by the formulation of the sense making approaches and generative process, the generative process is part of the mutually generative elements that come to be at the inception of the situation.

Through the generative process/sense making activities an understanding is formulated of the situation. It is this understanding that forms the basis for practical action (Sousa-Poza and Correa 2005; Padilla 2010, Padilla, Diallo, Sousa-Poza 2011). The understanding incorporates, participatory and observed elements. The sources of input may include items that are knowledge (K) and items that are categorically not-knowledge ($\neg K$). Knowledge in this model is defined as an item that can be considered to be a Justified True Belief (Brewer and Sousa-Poza 2009). Where knowledge is available, assuming that sufficient evidence exists that the knowledge is appropriate for the situation in question, one could assume that a high utility should be derived from the knowledge (Brewer and Sousa-Poza 2009).

The contextual sensitivity of situations, where the individual's predispositions play a significant role, makes the use of all but highly generalized knowledge difficult. Transferability of knowledge may be difficult where sufficient recognition of important contextual factors are missing (Brewer and Sousa-Poza 2009).

Since individuals maintain a participatory role it can be expected that the continued experiences that an individual has will have just as significant effect on the situation as that which is learnt is assimilated in the perspective and the sense making

processes. It can be expected that situations, other than in some very specific, highly static cases, will be highly transient. This high level of transience will make the utilization of knowledge difficult if not impossible (Brewer and Sousa-Poza 2009).

Consequently, from a practical point of view, the use of a greater variety of inputs will be required. The burden will ultimately fall on the generative or sense making processes.

Knowledge acquisition in such environment is possible although it will be affected and possibly limited by the nature of the context and transience. In a participatory role the dominant form of knowledge will be highly tacit derived from the indoctrination and internalization of effective behaviors.

The observer in their interaction with the phenomenological element becomes the dominant source of knowledge. Although the transience and contextual sensitivity may impose the requirement that knowledge be established of large number of observations and will likely be extremely abstract in nature. Empirically based knowledge is derived from the repeated observation of behaviors and results and is justified through correspondence (Millikan 1986; Padilla, Diallo, Sousa-Poza 2011). Rationally based knowledge is informed through the interaction of an individual with complex situations (in general), and other sources. Rationally based knowledge depends on coherence to provide justification (Dauer 1974; Sousa-Poza et al. 2008a, b). A further form of knowledge is formed that is methodological or pragmatic in nature. This knowledge focuses on "how" and will dominantly influence the sense-making processes rather than inform the perspective itself.

Important is the differentiation of knowledge and understanding in complex situations. The two have distinct semantic meaning with understanding (if it exists) providing the causal inference required to be able to make decisions and take other actions (Padilla 2010; Padilla, Diallo, Sousa-Poza 2011). Knowledge on the other hand plays a role in supporting understanding, although its utility will vary based on the situation. Even though knowledge may be acquired from any situation, there is no guarantee that it will provide practical utility at a later point in time, or for other problems.

Confusing not-Knowledge with Knowledge, or failing to determine whether an item is knowledge or not-knowledge, from either a participatory or observer role may compound ineffective or incorrect conclusions and behaviors since the treatment of knowledge and not-knowledge is and should be different. Ultimately, a higher degree of trust should be possible with knowledge than not-knowledge based on the justification required in its establishment. This trust must affect the manner in which knowledge can be used in decisions and other actions. The scarcity of knowledge in highly transient, context specific situations should, however, also be noted. Consequently, it is important to recognize the criticality of being able to formulate understanding from not-knowledge. Given that not-knowledge lacks the justification that would make it knowledge means that it should be treated differently, possibly with less trust, but it must be dealt with none-the-less.

Table 2.1 AALA model

Reality is: \ Asserts problem is	Not understood	Understood
Comprehensible	High complexity Epistemic uncertainty Justifiable action is to learn	Low complexity Low uncertainty Justifiable action is to proceed within what is correct in the domain
Incomprehensible	High complexity Aleatory and epistemic uncertainty Justifiable action is to adapt the perspective through the adoption of a new paradigm/ generative process	High complexity Aleatory Uncertainty that may not be recognized by the perspective Justifiable action is to assess the perspective and domain

The level of comprehensibility and understanding will justify a variety of actions (Brewer 2010) (see Table 2.1: AALA Model).

In extreme cases it may be difficult to make an accurate determination of the degree of comprehensibility of a situation, or the degree to which an individual believes that they understand a problem (Brewer 2010).

Taking action of some sort will often be the only way to answer this question and provide for a way forward. There are obvious risks involved in taking marginally informed decisions to be able to study their consequence with the intent of resolving uncertainty. Again the reliance on a "live" context, of learning and making decisions in situ make studying the problem in "safe" environment difficult, although advanced in decision environments that account for some of the contextual sensitivity and transience are conceptually possible.

2.3.7 The Situational Construct Model

There are two major ontological elements that contribute to our understanding of situations. The first is the RDP model discussed earlier in this paper, and the second is the situational construct model (Fig. 2.6) that elaborates on the interaction of the observer and the participant with a teleological element (the solution form) (Sousa-Poza 2007). The elements are often difficult to reconcile and quite possibly complementary.

The situational construct relies on an assessment of alignment (Padilla et al. 2007) between the three elements to form an a priori determination of the degree of complexity of a problem by assessing the potential sources of tension as misalignments between three components: the entity (in which the individual participates),

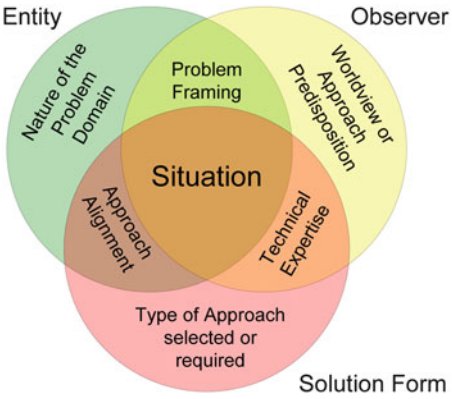

Fig. 2.6 Situational construct

the observer (representing the role of the individual separate from the entity), and the solution form (providing an impetus for the formation of the situation).

The situational construct also highlights that the source of complexity in situations theory is derived from studying the confluence of at least two interacting elements. It is in the alignment of factors, for example, expectations with what is possible, where complexity is generated (Padilla 2007).

As such, an entity, be it an artifact such as a pencil, a machine such as an aircraft, a sociotechnical platform such as an aircraft carrier, an organization such as a country, cannot be deemed to be simple or complex until it is made clear what the expectation is for a solution form and how an individual as a participant and observer combine with this as a situation. The pencil may turn out to be more complex than an aircraft based on what is required.

The three elements of the situational construct include:

- The Entity: which is defined by a set of meta-attributes of the "participatory" element of the problem.
- The Observer: is characterized by the individuals worldview, predispositions, capabilities
- The Solution Form: which as an element includes a teleological components for the situation, establishing the purpose of the situations existence.

The three elements are mutually generative and as such, influence each other significantly in many cases, but also leave the potential for significant misalignment when, for example, one of the elements is subject to external definition.

The first order interaction between the elements provides for a basic assessment of alignment.

- The problem framing is the result of comparing the attributes of the entity with those of the observer. A variety of comparisons are possible ranging from capability (observer is a mechanic, and the entity entails a socio-psychological problem) to worldviews (observer is an extremely detailed, analytic thinker, and the entity is irreducible).

- Technical expertise relates the requirements imposed by the solution form both as a teleological element and based on the attributes of the mean that will be required to reach an expected solution. This may include comparisons of skills, worldviews, predispositions and other factors.
- The Approach Alignment compares the attributes with the attributes of the means selected for the solution form. The comparison may for example be between the requirements of the mean/method to clearly define an end state, which fails to align with the entity that might be non-ergodic.

Ultimately, the complexity and degree to which a problem is understood requires an assessment of all of the elements and their alignment in either a second order analysis, or a qualitative comparison of the combination of all three elements.

2.3.8 The Environment

We understand that, in general, a situation is a highly transient, contextually sensitive construct that is tightly enmeshed with an individual who acts both as an observer and a participant. Individuals that do not participate in the same problem or "reality" space will be limited in their comprehension and understanding to what can be extracted from extrinsic, observable items, and what is lost through the lack of participatory experience. Furthermore, even individuals that do not share the same experiences or are predisposed to think differently will not perceive the situation in the same manner.

Even in the case where there is only one individual, because of learning, changes in the reality, and changes in predisposition, we cannot assume that the perspective at one point in time can be shared with that at a different point in time. Similarly, different generative processes may be required to make sense of the past and present (possibly and empirically driven worldview), and the future (possibly a rationally driven worldview). The different perspectives that are formed may be extremely heterogeneous.

There are two important directions that this concept of the shared understanding leads to. The first is one in which an environment is established to deal with many component perspectives that exist over a period of time; past, and infinitesimally short present and a future. The second relates to a spatial construct that combine many different perspectives at some point in time, where different individuals might hold those perspective.

2.3.9 Fundamental Constructs of the Environment

The relationship between the Environment, which forms a Domain-Perspective (DP) dyad and Reality (R) is of a Syncretic nature establishing R-DP. This formulation

implies that R-DP has a singular existence where R exists in DP inasmuch as DP exists in R. It also highlights that R and DP are not [generally] the same and at any point, R may be manifested independently of DP (as a form of participative transcendentalism), as DP may manifest itself independent of R (as a form of observational separatism). From first principles, however, it is co-existence of R-DP that is dictated by Pragmatic Idealism (Sousa-Poza and Correa 2005) (1. non-extremism principle; 2. Awareness principle), rejecting the extremist position that either of the elements may fundamentally be attained separated from the other. In the specific or simple condition we recognize that the differences or differentiability between R and DP may [tend to] disappear, at which point, an orthodox stance is acceptable; but is arguably only so given that R can be [quasi-] fully subsumed into DP, or vice versa, and consequently even the orthodox condition is arguably a syncretic condition although it need not be recognized as such.

The first implication of this is that there is a difference between "that which we say" and "that which we do" (and vice versa) for which a balance must be maintained. This difference establishes a saddle point between "free will" and "fate or the preponderance of inevitability", normative behavior and naturalist behavior, action and consequence, intelligent design and evolution, and so on. For the syncretic construct to maintain its existence, it is therefore necessary that we accept that environments can be established, but must accept the influence of being enacted (participation exists within observation), or that environments can evolve, but must accept the influence of being recognized (observation exists within participation).

The second implication of this is that an environment, as a fully evolved construct, requires R and cannot fully manifest itself in cross-sectional conditions (point in time; discrete; observation), but requires its enactment longitudinally (over time; continuity; participation). In the specific simple condition where the observational separatist construct is a sufficient manifestation of Reality we can still fully argue the existence of R as a [quasi-] fully subsumed construct of the DP. This is the condition on which typical analysis based methods rely in which the DP is relied upon to project future discrete DP. Similarly in the specific simple condition where the participative transcendental construct is a sufficient manifestation of DP we can argue the near complete incorporation of the DP construct into R. This is a condition in which we trust our actions to unintentional, subconscious behavior, for example walking, running, swimming, or as is often the case for situations in which rapid response is required such a life and death situations encountered by soldiers. For such situations, highly conditioned responses are relied upon that can be developed through extensive exercise and repetition until a behavior becomes 'second-nature'.

In the Environment several potential boundaries exist. From an empiricist point of view by the set of all perspectives relevant to the situation, and from a rational perspective by the bounding that encompasses all relevant [manifesting] perspectives. For these two to coexist, a further boundary must be present within which both perspectives are present. This boundary is established by conceptual bounding and at this point we assert that is based on the/a value premise (). At minimum, an environment will contain a perspective, a complement to the perspective, a synthetic perspective formed from the complement pair, and a synoptic perspective that encompasses the complement pair.

[Note: Each perspective is in its own right an environment, since a perspective can form or be defined by its own synthesis or synopsis. The de facto evolution of such an environment would, however, indicate an extraordinary simple condition in which no distinct complementary perspective evolves. The establishment of such an environment would either have to assume a similarly simple condition in which any complementary aspect to the perspective is subsumed in the perspective, or a condition of imposed orthodoxy, where complementary views are fundamentally ignored.]

2.3.10 The Environment – Temporal Integrity

The relationship between R and DP, and the relationship that we have formed between the rationally and empirically derived manifestations provide a means to describe (1) the progression of perspectives and activity over time, and (2) a teleological differentiation based on the dominance in the formation of perspectives (see Stacey et al. 2000 for an extensive discussion on Teleology).

Within an environment (DP) we have formed distinct yet interdependent elements based on local, synthetic and synoptic perspectives. The differences in worldview that drive the formation of the synoptic and local perspectives will result in irreconcilable, yet related views. The synoptic perspective captures the set of possibilities and is representative of the Realmoglichkeiten (Hartman 1949) (Real Possibilities), whereas the set of local perspectives is representative of the Realwirklichkeiten (Hartman 1949) (Real Actuality). In the general case of a [complex] situation, there is interplay between possibilities and outcomes that can be framed by this differentiation.

The perspectives, although distinct will be influenced by each other through the manner in which the environment is formulated. A differentiation can be established based on whether the environment (DP) is formed as an [evolution of] the description of a situation (R) or whether it is a projective imposition of the environment (DP) on a situation (R). A simplification of this distinction would relate to an inductive formation of an environment, in which the local environments, and consequently, their underlying worldview dominates perspectives, vs. a deductive formation in which the synoptic environment precedes, and consequently dominates the formation of local perspectives.

To resolve this duality, we require an algedonic enactment of R-DP or the maintenance of a participatory role. The determination of how action, if framed, will be defined by the underlying worldview. Irrespective of the worldview we can however state that any action is the execution of a select alternative of possible actions, and that any action is the enactment of a perspective, chosen or derived from a set of possible perspectives. This creates a sequential (not necessarily causal) construct between possibilities and actualities in which the future is merely the manifestation of one of the possible actualities, or vice versa, between actualities and possibilities in which the future is merely the manifestation of an actual possibility.

As an example: in the Schrödinger's Cat thought experiment (Schrödinger 1935), the two states in which the cat exists before the box is opened form the Realmoglichkeiten. This construct is generally arrived at through rational means, although empiricist approaches which are driven by listing of alternatives, such as brain-storming, threat analysis, scenario analysis or use cases will also generate a similar condition (although, unlike the rational construct these approaches are often unbounded or divergent). To determine an actual outcome, an action is necessary. The box must be opened, at which point we will see whether the cat is dead or alive establishing a Realwirklichkeit. The actuality may ultimately be influenced by the nature of the initial framing. The empiricist view will reflect an observed reality. This will be the more common of paradigms governing actualities. A rationalist view will state the reality as a function or manifestation of the rationalist framing and would take the form of a state or condition of the originally defined construct. This is typical in OR, theoretical work, chaos theory and other methods, where the actuality is merely a manifestation of the generalized construct from which it is derived; e.g. a subject to statement, or an outcome of a fractal.

Finding the cat dead or alive does imply that we could have known more before the box was opened, because until the very moment at which we looked in, the cat could have been either, or both. Given that we should be switching between underlying paradigms; from rationalist to empiricist, or vice versa, also implies that the Realmoglichkeit and Realwirklichkeit cannot simply be reconciled.

In general cases, where we have not one, but a quasi-continuous set of switches between the two spaces; the possible and the actual, a new baseline must be established after each collapse of the possibility function into an actuality; and consequently a new set of possibilities considered. This rapidly grows the set of extended possibilities (i.e. possibilities that are built over a series of iterations). The growth is exponential and similar to the logistic curve found in Chaos Theory. Metaphorically, it can also be represented by Heisenberg's Wave. The more dynamic and uncertain that a situation is, the more rapidly the wave diverges. In the construct that we are using this is analogous to the separation between DP and R. In such situations, the time interval between iterations must be reduced and new baselines established to manage the divergence in the dissipation of possibilities.

2.3.11 The Environment – Spatial Integrity

It would seem that under these conditions everyone functions in their own situation with little to share (even if willing) with others. Luckily, even though each individual is unique we share sufficient commonality for shared awareness to form. There are two mechanisms by which this is postulated to happen.

1. For cases where there is a high degree of uniformity a synthetic shared understanding is possible where through abstraction and aggregation a common perspective can be built.

2. For cases where there are significant differences a synoptic shared understanding is possible. The synoptic perspective is formed through a rational formulation of universal(s) within which component perspectives can exist, recognizing that other perspectives also form part of this synoptic construct, even though there is no specific overlap between individual components.

The formation of a shared perspective or understanding is fundamentally emergent. The complexity of the emergent process may however vary greatly.

In the simplest cases, the emergent shared perspective will be the same, or not significantly different, as the perspective of any of the components resembling what Bar Yam (1993) would refer to as local emergence. The degree of homogeneity between the salient features of the component perspectives would have to be significant with few or no relevant difference.

In cases where the component perspectives can still be deemed to be homogeneous, albeit with difference where the condition on the difference is that they be regularly distributed, a synthetic perspective will be possible. This synthetic perspective is in essence a form of sense-making reducing the existing variances in a manner that is congruent with the distribution. Depending on the stochastic nature of the variability, a local emergence may still be assumed.

It is when significant variance or heterogeneity between component perspectives is introduced that a form of global emergence (Bar-Yam 1993) will underlie the formation of a shared perspective or understanding. In these cases, the nature of the shared perspective cannot be known from a single or sample part of the components. To fully understanding the extent of the shared understanding, all of the components may have to be considered concurrently. Alternatively, the synoptically based shared perspective would allow for a preconceived shared perspective to exist that would govern the component understanding.

Understanding the manner in which shared (global) environments form, whether they be synthetic in nature or syncretic is an area of continued study. The emergence of shared perspectives is presently hypothesized to take place in a manner best described by percolation theory. According to percolation theory, a critical point is reached in which a phase transition occurs that would be representative of the formation of a shared transition. Present work is studying the effect of predisposition, proximity and intent and their effect on the critical point at which a phase transition occurs. The critical point is referred to as the K-Threshold; the point at which emergence becomes likely. This too is a meta-theoretical study, focusing on attributes of the situation, and the potential for emergence, without necessarily being able to say specifically what will emerge.

2.4 Research Methodological Considerations in Evolving ST

There are several thrusts defining the research in Situations Theory (Fig. 2.7, Table 2.2). These can broadly be categorized as (1) Ontological studies focusing on the nature of situations, (2) Methodological studies that draw from the understanding that ST

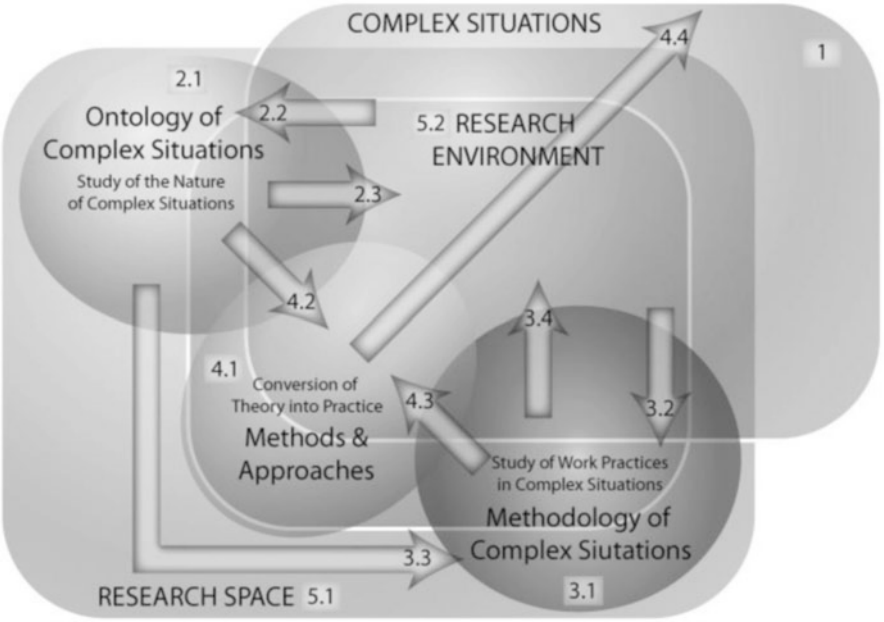

Fig. 2.7 The research methodology elements

Table 2.2 Description of the research methodology elements

1. Relevant wicked problems and other situations of interest
2. Complex situations (Ontology)
   1. Study of the nature of complex situations: this element proposes to study complex situations identifying their dominant characteristics and attributes, their behaviors and other ontological aspects
   2. The study of complex situations is moderated by the context encountered in the situation. The intent is to identify specific complex constructs that are faced in the situation [type] being studied
   3. *Influence on the practitioner: understanding the nature of the domain in which the individual must participate*
3. Work in complex situations
   1. Study of the work methods and best practices that are applied in complex situations. The general focus of this study encompasses any complex environment and includes documented findings of best practices
   2. Focus is on studying practices presently undertaken which may be compared to the general definition of best practices
   3. Best practices are compared and related to the specific nature of complex situations to better understand which methods, approaches and practices work under what conditions
   4. *Influence on the Individual: an improved understanding of the effectiveness of present practices, comparison of present practices to general best practices, and a decision making capability of identifying what practices to use under specific conditions*

(continued)

Table 2.2 (continued)

4. Methods and approaches
   1. Fundamentally it is expected that new methods and approaches will be required to satisfy situations for which existing methods and approaches fail to provide effective solutions. The new methods and approaches will be informed by:
   2. The generalized constructs of complex situations, and
   3. Existing knowledge of best practices
   4. *Influence on the Individual: through new practices extensive leveraging of the knowledge of complex situations and other capabilities is expected*
5. Research methodology
   1. Research methods. Research of Situations and Situations Theory is multidisciplinary encompassing a variety of approaches including: Empirical techniques, experimentation, survey and correlational studies, grounded theory and inductive research, case studies and rational techniques (OR, M&S)
   2. A Research Environment that captures empirical and experimentally generated data may support the research. The environment is intended act as both a test base for knowledge acquisition and as a learning space for knowledge dissemination. The environment provides and efficient interface in which learning can be undertaken to actively transfer knowledge to DHS. The environment will be capable of Live, Virtual and Constructed (L-V-C) training modes

provides and attributes and requirements that a situation might impose, and (3) development and evaluation of methods, tools and approaches as part of a pragmatic effort. These are meta-theoretical studies that elaborate on attributes of complex situations that are suggested to have an influence on practice and understanding.

From Sousa-Poza and Kovacic 2008

2.5 The Research Environment

The architecture for the environment is extendable allowing for a near seamless transition from

- A constructive environment in which a purely simulated laboratory configuration is used, to
- A virtual in which the simulated 'reality' is augmented by human players (HITL), to
- A live environment in which an empirically, rich human exercise is supported by both simulated and other technical components, to
- Integration and testing in a live operation.

The laboratory is designed on traditional experimental concepts expanded with fundamental theory (Fig. 2.8). The expansion of the traditional experimental designs with the RDP model (Sousa-Poza 2005) provides: (1) an advanced protocol for guidance on the design of the testing and decision environment to optimize the testing process, and (2) a metrification of confidence of the test or experiment that is run based on the conditions of the problem that is to be addressed.

The decision and testing environment is highly reconfigurable, and largely extendable, allowing for near seamless transition from one configuration to another,

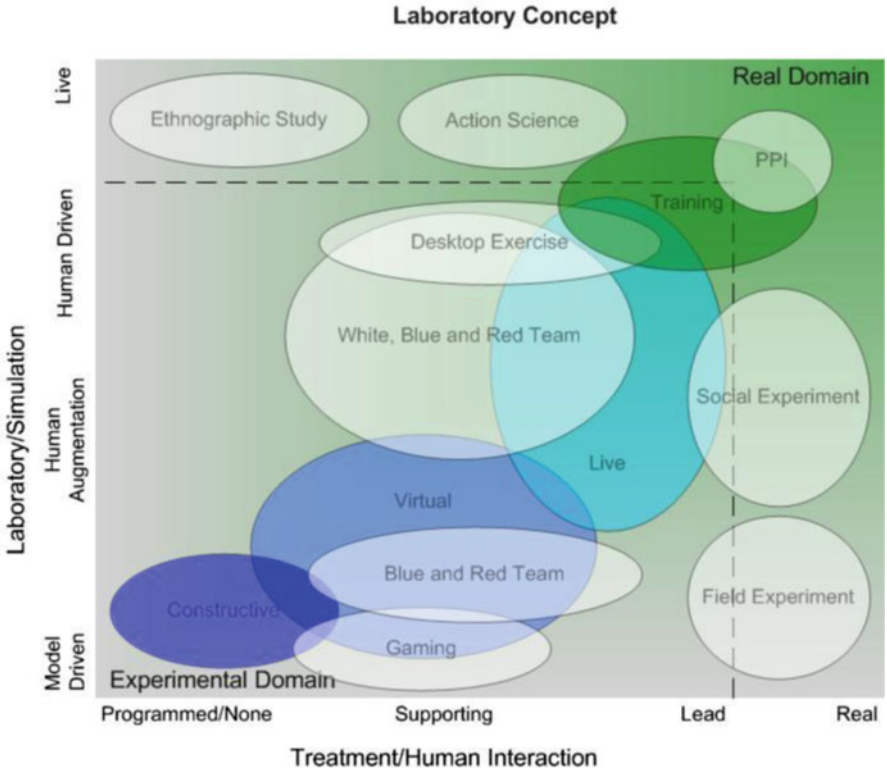

Fig. 2.8 The research "Laboratory"

as well as offering a high degree of compilation of runs executed in different configurations. The underlying support of the Research Platform provides a high degree of persistence to any sequence of tests or experiments, as well as an evaluative capability to assess the actual test construct.

Within the simulated environment, treatment may be applied following traditional experimental design approaches. In this layout a high degree of control is provided internal to the experimental environment, from which, in general, highly concrete, causal statements can be made of relationships within the laboratory. The trade-off, particularly for complex social environments, comes at the cost of assumptions and approximations that must be made in the development of the simulation. Conversely, a 'live' layout results in lower abstraction in the establishment of the laboratory with reality external to the laboratory. This, however, generally results in lower control within the environment reducing the concreteness of statements that can be made.

The ability to transition between layouts allows for a higher degree of confidence to be established in conclusions. The layout is ultimately expandable beyond the

bound of the laboratory into live or 'real' tests in the field; with continued support of the research platform to ensure continued learning and adaptation.

2.6 Research Agenda

2.6.1 Micro Situations

Micro-Situations Theory focuses on the development of elementary understanding; understanding that is generated from perspectives.

Perspectives are cognitive constructs and ultimately the purview of an individual. Every individual's perspective of a situation is fundamentally unique; which is not to say that there are no aspects of perspectives that are not shared by two or more perspectives. Micro-Situations constructs focus on the development and evolution of perspectives as well as the different constructs that explain the manner that shared constructs or perspectives are both formed and communicated. Both mechanisms, the formation and the sharing of perspectives, have multiple models that explain how these occur and are to be understood. Not all of the constructs provide for the same conclusions.

Different models of the formation of perspectives can be found in literature, including the lens model, explanations involving worldviews, and others. Fundamentally, most of them rely on an element of 'what is real', a conversion of that reality by an observer, and the ensuing perspectives. Focus lies heavily on the conversion process and the nature of the perspective. The conversion constructs vary in nature depending on the school of use. In positivist thinking, for example, the conversion constitutes a 'bias' and has pejorative connotations; in constructivist terms on the other hand, the conversion is fundamental, inescapable, and necessary for the interpretative process that underlies the formation of perspectives.

Sharing has less to support it, although concepts such as 'common operating picture', shared or common awareness, collective learning and organizational knowledge are widespread in use. The idea of sharing is generally an imposed and often relatively positivistic concept, assuming that that which we see is that which is. What a shared perspective is (whether it is a global construct or elements of perspective that are common across individuals) is never clearly delineated. Furthermore, there is little investigation on synthetic perspectives (perspectives that provide aggregate general insight of all perspectives) or synoptic perspectives (perspectives that incorporate all perspectives but provide little insight on any specific perspective), even though their use is not uncommon or undocumented.

Micro-Situations Theory provides a set of concepts, models, processes, and 'ideas' on these important constructs.

Micro-Situations Theory rests on a particularistic assumption that ultimately stipulates that the situation is: (1) an enactment of the collective existence of perspectives, and (2) that the efficacy of a situation is contingent on the effectiveness in the formation of perspectives, the breadth in the types of perspectives, and the degree to which these are able to 'co-exist'.

2.6.2 Macro Situations

Our understanding of macro-situations theory is less evolved than the micro-situations constructs. In part this is due to the manner in which the research began, which was focused initially on elementary constructs surrounding knowledge and understanding. A lot of effort has consequently gone into this line of work. Micro constructs are also the basis on which self-reflection takes place, an exercise that we have all gone through extensively in trying to both separate ourselves from existing dogma, and trying to break from personal orthodox views. It is, however, also due to the limited opportunity to study collective constructs, although some [limited] opportunity has been available through reflection of our own progress as a group.

Macro-Situations Theory deals with the behavior of whole, studying the collectives as universal constructs. Fundamentally Macro-Situations Theory still rests on the tenet that it is understanding that leads to action; and that the qualitative nature of understanding impacts the quality of action. It also rests on the concept that the Representation (as a Domain-Perspective or DP construct) is in essence a separation from Reality (R). The similarities with Micro-Situations Theory, however, end at this point.

Macro-Situations Theory is focused at identifying practical global processes and activities that maximize the overall understanding within a situation. In extremely simple situations where the component perspectives are extremely homogeneous, there is one (or very few) component perspectives; the overall understanding is fundamentally equal to the understanding of a single component. In the general condition, however, the overall understanding cannot be stated as a function of the individual components (although it is effectively composed of these elements). To complicate matters, there are multiple theories that can be applied to derive a statement of understanding.

Macro-situations constructs are fundamentally universalistic in nature, where the concept of the environment precedes the formulation of individual perspectives. Efficacy within this construct indicates that effectiveness is governed by the ability of the environment to create a shared or common domain and provide for means to allow for individual perspective to co-exist within this structure.

2.7 Imperative of Situations Theory: The Call to Heretics

Situations Theory is not about solving problems but rather about understanding the paradigms that are applied to study and solve problems. The intent is to study what works and what does not, and to understand why this is the case. Through this understanding, it has become possible to gain a unique insight into [complex] situations such as those that Rittel and Weber (1973) describe.

That is not to say that “solutions” have been found, but rather ways to think about the complexities have been elaborated. The utility of understanding the

nature of a situation better lies with the improvements that have been, and might be made, in dealing with the a specific situation. At very least, it should reduce senseless activity in which it is clear that there is no feasible manner to achieve a desired outcome.

Insanity: doing the same thing over and over again and expecting different results

Albert Einstein

It is interesting, however, how strong the pushback is when a challenge is made to the worldviews and paradigms being applied. For many it would appear preferable to continue down a fruitless inquiry than to question the reason and methods being applied. Ultimately, this may be due to the manner in which a paradigm is engrained, not only in how we think, but also possibly in defining who we are.

"There is nothing louder than the sound of a breaking paradigm"

Charles Keating

Given the complexity of a situation is contingent on the observer and the manner that situation was generated, there is a very strong likelihood that the paradigm underlying the generative process is partially responsible for the complexity and difficulties encountered in understanding the problem. Dealing with the systemic intricacies that might be present in an engineering or organizational problem is often necessarily accomplished through the implementation of highly evolved technologies, processes, procedures and structures. There comes a point however, as Ray Ozzie pointed out, that this "complexification" of the solution becomes its own worst enemy. At this point it becomes imperative to change the dialogue, the very manner in which the problem is being addressed.

Any intelligent fool can make things bigger and more complex… It takes a touch of genius - and a lot of courage to move in the opposite direction

Albert Einstein

This is not always easy, particularly if individuals have a strong vested interest in the work being done.

Over the millennia there have been many of Gladwell's (2000) 'tipping points' that have been encountered, at which a change in thinking became necessary. Art Kleiner (1996) refers to these instances where change was undertaken as the age of heretics, making reference to Pelagius who challenged 5th century church doctrine with his ideas of free will and individual morality. Pelagius was confronted by Augustine (who was canonized to sainthood, should there be any doubt who held sway in this debate). There seems to be a degree of truth that change is seldom embraced!

"History warns us, […], that it is the customary fate of new truths to begin as heresies and to end as superstitions"

Thomas Henry Huxley

Huxley also warns that any truth, once accepted, will become the new dominant discourse that will no longer be questioned. This cycle is not new.

We often fail to see that which is apparent, only to then fail to see it once it become commonplace.

This is not a matter of creating new technologies, artifacts, or solutions. It is a matter of questioning what is perceived; the situations that are encountered. It is quite likely that what is being sought is already available; the next great breakthrough has possibly already been made yet remains to be "seen". After all, Heron of Alexandria invented the steam turbine in 100 AD, 1,500 years before it was rediscovered in the industrial age.

Change in management styles has also required its revolutions. Frederick Winslow Taylor (1947), father of scientific management, was called to testify on his methods before a Special House Committee. Given the gains that organizations and employees were making it seems inconceivable that this should have taken place. In retrospect, we may have succumbed to complacency in questioning. Irrespective of the gains that scientific management has provided, some of the criticisms that Taylor faced on the problems of overspecialization, and "mechanizing" employees may now be surfacing as detrimental in a knowledge-based economy. This does not make scientific management wrong, but rather it must be recognized that it may not be appropriate for all problems.

Of course, only history will tell whether we are at a 'tipping point' of management theory, and what the outcome will be.

References

Bar-Yam Y (1993) Dynamics of complex systems. Westview Press, Boulder

Bertanlanffy V (1976) Ludwig, general system theory: foundations, development, applications. George Braziller, New York

Bohr N (1949) Discussions with Einstein on epistemological problems in atomic physics. In: Albert Einstein: Philosopher-Scientist. Cambridge University, Cambridge

Brewer Van A (2010) Decision-making construct for complex situations. ODU Dissertation, May 2010

Brewer V, Gheorghe A (2011) Forensic complexity. Int J Syst Syst Eng 2(4):347–355

Brewer V, Sousa-Poza A (2009) Generalized research canons for JTB(+) knowledge, international symposium on peer reviewing (ISPR 2009). In: Proceedings of the 13th world multi-conference on systemics, Cybernetics and informatics (WMSCI 2009), Orlando, July 10–13, 2009

Checkland P (2006) Systems thinking, systems practice, 2nd edn. Wiley, New York

Conklin J (2006) Wicked problems and social complexity. In: Dialogue mapping: building shared understanding of wicked problems. Wiley, Chichester

Dauer F (1974) In defense of the coherence theory of truth. J Philos 71(21):791–811

Gladwell M (2000) The tipping point, how little things can make a big difference. Little Brown Publishing, Boston

Hartman N (1949) New ways of Ontology. (trans: Reinhard CK). -Henry Regnery Company, Chicago, 1953, pp 13–14

Keating C, Rogers R, Unal R, Dryer D, Sousa-Poza A, Safford R, Peterson W, Rabadi G (2003) System of systems engineering. Eng Manag J, Rolla, MO, 15(3):36–45

Keating C, Sousa-Poza (2005) A system of systems engineering analysis of integrated port security for the Virginia port authority. NCSOSE-TR-002-05. Agency: Virginia Port

Authority, Number of Figures: 15, Number of Tables: 5, Number of References: 29, Pages: 125, June 2005
Kleiner A (1996) The age of heretics. Doubleday, New York
Kovacic S, Sousa-Poza A, Keating C (2006) Complex situations: an alternate approach for viewing a system of system. IEEE/SMC Proceedings
Kovacic S, Sousa-Poza A, Keating C (2007a) The national centers for system of systems engineering: a case study on shifting the paradigm for system of systems. Syst Res Forum 2(01): 52–59. World Scientific Publishing Company, Singapore
Kovacic S, Sousa-Poza A, Keating C (2007b) Type III: the theory of the observer. SoSE'07. In: IEEE international conference on system of systems engineering. IEEE, New York
Kovacic S, Sousa-Poza A, Charles Keating (2008) Complex situations: an alternative approach for viewing as system of systems. In: Proceedings of the third international conference on system of systems engineering, Monterey, CA, June 2–4 2008
Millikan RG (1986) The price of correspondence truth. Noûs 20(4):453–468
Nonaka I, Konno N, Toyama R (2001) Emergence of "Ba": a conceptual framework for the continuous and self- transcending process of knowledge creation. In: Nonaka I, Nishiguchi T (eds) Knowledge emergence. Oxford University Press, New York, pp 13–29
Oizerman TI (1981) Kant's doctrine of the "Things in Themselves" and Noumena. Philos Phenomenol Res 41(3):333–350
Padilla J (2007) Non-monotonic synopsis: an approach for assessing complex situations. In: MECS forum conference proceedings, Norfolk, pp 182–191
Padilla JA (2010) A theory of understanding within problem situations. ODU Dissertation
Padilla J, Sousa-Poza A, Tejada A, Kovacic S (2007) Towards a Diagnostic Framework for Understanding Complex Situations. In: NECSI conference, Quincy, MA, 28 Oct–2Nov 2007
Padilla JJ, Diallo SY, Sousa-Poza AA (2011) Establishing a theoretical baseline: using agent-based modeling to create knowledge. In: Tolk A, Lakhmi J (eds) Intelligence-based systems engineering, vol 10. Springer, Heidelberg, pp 259–284
Rittel H, Webber M (1973) Dilemmas in a general theory of planning, policy sciences, vol 4. Elsevier Scientific Publishing Company, Amsterdam, pp 155–169
Schrödinger E (1935) Die gegenwärtige Situation in der Quantenmechanik. Naturwissenschaften 23(49):823–828
Skyttner L (1999) Introduction to general systems theory. Plenum, New York
Sousa-Poza A (2007) Plenary presentation. MECS Conference, Norfolk, VA
Sousa-Poza A, Correa Y (2005) Pragmatic idealism as the basis for understanding complex domains: the trinity and SOSE. In: Proceedings of the IEEE SMC 2005 conference, Hawaii, 10–12 Oct 2005
Sousa-Poza A, Keating C (2004) An investigation into the use of recursion in system of systems engineering. NCSOSE-TR-002-04. Agency: concurrent technologies corporation, Number of Figures: 2, Number of Tables: 1, Number of References: 21, Pages: 32, December 2004
Sousa-Poza A, Kovacic S (2008) A research agenda for complex situations. Eng Manag J 20(4): 32–39
Sousa-Poza A, Keating C, Kovacic SF (2004) System of systems analysis of the maritime security system for the port of Hampton roads. NCSOSE-TR-001-04. Agency: US Coast Guard and Concurrent Technologies Corporation, Number of Figures: 13, Number of Tables: 21, Number of References: 29, Pages: 123, April 2004
Sousa-Poza A, Keating C, Mun JH (2004) System of systems methodology. NCSOSE-TR-001-05. Agency: Department of Homeland Security, Number of Figures: 8, Number of Tables: 3, Number of References: 16, Pages: 53, April 2004
Sousa-Poza A, Kovacic S, Keating C (2008a) System of systems engineering: an emerging multidiscipline. Int J Syst Syst Eng 1(1/2):171–188
Sousa-Poza A, Padilla J, Bozkurt I (2008) Implications of a rationalist inductive approach in system of systems engineering research. In: Proceedings of the third international conference on system of systems engineering, Monterey, CA, 2–4th June 2008

Stacey RD, Griffin D, Shaw P (2000) Complexity and management: fad or radical challenge to systems thinking?. Routledge/Taylor & Francis Group, London

Taylor FW (1947) Scientific management (comprising shop management, the principles of scientific management, and testimony before the special house committee). Harper and Row, New York

Trans-Atlantic Research and Education Agenda in Systems of Systems (T-AREA-SoS) (2012) "TAREA-PU-WP2-R-LU-9, SOA Report", © Loughborough University

Unites States Air Force Science Advisory Board (2005) Systems of systems engineering for Air Force capability development", SAB-TR-05-04, July 2005

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