

# Agile Theory based on a Special Complex Adaptive Systems Theory

## Synopsis Chapter 0

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## Abstract

An Agile Theory is proposed based on Special Systems theory and Emergent Meta-systems Theory. This paper provides a synopsis of a longer monograph that compares in detail Special Systems Theory to Agile Practices with special attention to extraordinary claims of Agile (such as hyper-effectivity) and Lean (such as hyper-efficiency) as well as the claim of sustainable cadence but also paying attention to the structure of Scrum as the implementation of Agile values and principles.

## Introduction

Agile has principles as expressed in the manifesto, and it has principles as well as practices. But what it seems to lack is a specific refutable Agile Theory. For theories to be sound according to Popper they need to be refutable. And thus one needs not only to have a theory but provide the operationalization that would render it refutable. Agile Theory is based on Special Systems theory which is a sub-species of Complex Adaptive Special Systems Theory of the sort that has been defined by Holland who was the inventor of the Genetic Algorithm. Koza went on to define genetic programming in which he showed that he could rediscover antenna designs that were already patented as well as new antenna designs that were not yet patented that human inventors had missed. So it has been shown that Genetic Algorithms as implemented in Genetic Programming can be produce creative solutions to problems on the order of the kinds of creative solutions that humans are able to produce. Special Systems refines the idea of Genetic Algorithms and generalizes it into a structure called the Emergent Meta-system, and that structure is composed of a normal system along with three special systems that together transform into the inverse dual of the system called a meta-system which is an organized environment of a system that provides a niche for the system. Special

Systems have many interesting properties including hyper-effectiveness and hyper-efficiency. And these special properties can be seen as the theoretical grounding of Agile (hyper-effective) and Lean (hyper-efficient). Agile Theory is grounded in various mathematical anomalies including those that appear in four dimensional space as seen from the view of Synergetics as inaugurated by B. Fuller. But Agile theory also is grounded in physical anomalies that have the same qualities as the mathematical analogies. Thus Agile Theory claims to be a fully scientific and robust (in the sense of S. Wallis) meta-theory composed of lower level theories taken from Prigogine, Maturana and Varella as well as Robert Rosen, and O'Malley and Sandywell. This paper is a synopsis of a book recently written that grounds the extraordinary claims of Agile and Lean in the theory of Special Systems. Extraordinary claims of hyper-effectivity or hyper-efficiency, or sustainable cadence need extraordinary justification, and Agile theory provides a scientific basis for those claims rooted in Advanced Systems Science theories.

## **The Need for an Agile Theory**

Having Values, and Principles and Practices but no Agile Theory is not enough. A very specific Agile Theory is needed if nothing else to distinguish between what is Agile and what is not Agile when everyone is claiming that what ever they have thought up is Agile. Agile and Lean practices are based on ad hoc experimentation with software development teams over the past ten years or so. And this experimentation has yielded a fairly wide consensus as to what is Agile and Lean and that these experimental practices that are in line with the value statements and principles are actually effective and efficient. But without a theory it is hard to say why these practices work, or to relate them other phenomena or discern their inner coherence or essence. Theories give great leverage, but the closest we come to having a theory is the citation of Complex Adaptive Systems (CAS) theory as an inspiration, but CAS is a very wide theoretical expanse into which almost anything can fit. What is needed is a very specific CAS theory that is precise enough in its signature to attempt to refute it, but which also explains the properties of agile and lean systems, especially what might be thought of as the extraordinary properties, such as hyper-effectivity, hyper-efficiency and sustained cadence, as well as specific structures that show up in Scrum project management organizational implementation of Agile. Special Systems Theory provides such a framework. It is a very specific theory that there are exactly three special systems called Dissipative Ordering Structures, Autopoietic Symbiotic Special Systems, and Reflexive Social Special Systems. Basically the Dissipative Structures that are negatively entopic described by Prigogine are composed by conjunction into these higher emergent special systems that are theoretically defined by Maturana and Varella as well as Robert Rosen, and by reflexive sociologists like J. O'Malley and B. Sandywell as well as others. What the monograph Agile Theory does is explain specific agile characteristics and structures of Scrum based on the Special Systems Theory structures that derive from anomalies in Mathematics and Physics. Because the various mathematical anomalies fit together to form a broader theory when translated out of mathematics into Systems Theory with an interesting and

somewhat unique signature it is possible to be very precise about the nature of special systems and their structural characteristics. These same natures and structural characteristics are analogous to ones seen also in Agile and Lean developmental systems derived by trial and error and experimentation by the Agile community over the last decade or so. This isomorphism between the practices that have been agreed on by consensus and the Special Systems theory known as Agile Theory has a very deep explanatory basis that allows one to discriminate the basic features of agile and lean solutions and to distinguish them from non-agile and non-lean solutions. It tells us directly about the coherences of the practices and how they devolve from the values and principles as an underlying set of assumptions and approaches. Having an Agile Theory if not refuted would allow us to derive other Agile and Lean practices by a detailed exploration of what is and is not covered by the theory in current practices.

Many companies are considering not just implementing agile teams but also making Agile at Scale transformations of their cultures, for instance using the Leffingwell big picture. Having a theory that explains why Agile and Lean practices make sense from a scientific perspective is key to convincing large companies to make this investment and reduces the need for hand waving considerably. Right now we have mostly word of mouth testimonials as to the effectiveness of agile and lean, but if we have a deep theory that explains the characteristics of agile and lean approaches that are embodied in practices then it is easier to consider doing studies that attempt to establish the efficacy of those approaches. In all other disciplines having a theory is tantamount to being able to claim to have knowledge. So without any precise theory we cannot even begin the process of building up an agile body of knowledge. At most we can have a body of ad hoc practices with claims of their being worthwhile and we can have consensus about those that seem to work within the community, but we cannot defend these ideas against skeptics. In fact, the danger of not having a theory is that agile and lean becomes merely an ideology, i.e. the next baseless fad being adopted by corporate America as a silver bullet. When everything is Agile or Lean, and everyone is claiming that their practices are Agile or Lean then it is almost impossible to tell snake oil from genuine remedies. As an aside it turns out that original snake oil used by Chinese railroad workers to ease their pain was an authentic remedy, but when it was adopted by Westerners they adulterated the ingredients and it became a plethora of suspicious cures for everything that ails you what would probably just make you sicker if not kill you. It was in the face of this nihilistic market of suspicious cures for everything that one company began putting on its bottles the list of ingredients in order to show that theirs actually did contain the oil of snakes, and so the ingredients that we have on pharmaceuticals today are based in this competition between various forms of universal cure which were mostly bogus. In Agile today as it gains momentum and is moving toward universal adoption as an approach to software we are in the same sort of situation as in the days when *snake oil* was a seriously marked cure all. The first experiments in Agile were interesting and extraordinary, and the testimonials are coming thick and fast, but what we lack is an idea of what should be the ingredients of this cure all, and beyond that what is the real chemistry that allows

those ingredients to effect a cure in our bodies. This is where Agile Theory comes in. It is a theory of why teaming should be an ingredient that motivates us to adopt a process like Scrum. It explains why the special features of agile methods exist as against the traditional waterfall or spiral methods of the control culture of corporations. It explains why Lean methods work when optimizing across projects that are composed of multiple work teams or why Agile at Scale approaches are structured the way they are. In other words it is the isomorphism between the consensus version of Scrum as an Agile method and the Special Systems theory signature which is very specific in terms of its rootedness in mathematical and physical anomalies that provides a platform for a rational explanation of Agile and Lean practices in relation to the values and principles that they are suppose to embody. Agile theory is a necessary bridge between the values and principles and the practices that embody them. Without such a bridge anyone can claim anything and adheres to the values and principles and who is to deny it, on what basis because values and principles are just too broad to provide a criteria for judgment. We do not allow theoryless ad hoc answers in other domains to stand as knowledge why should we allow it where Agile and Lean practices are concerned? It is important to develop a theory of Agile and Lean practices that are in line with our values and principles but narrow down and explain the efficacy of accepted practices from a theoretical point of view not just for the skeptics but also for the practitioners who would like to reason about those practices rather than just trying things at random and seeing whether they can be called agile or lean. If the theory can tell us about the inner coherence of agreed upon agile and lean practices and especially their special features, then perhaps it will allow us to predict what other practices might have similar properties. And it might even allow us to do studies that contrast practices to each other that have the same theoretical underpinning. But most of all having such a theory is the first step on the road to having an agile or lean science because we can seek to refute the theory, and thus improve our agile or lean theories, and thus gain real knowledge rather than merely basing our practices on hearsay. This theory even if wrong, which as the first agile theory it probably is, is an example of the kinds of characteristics an agile or lean theory should have. First of all it was developed independently of Agile and Lean practices and values and principles. It was developed as an advanced Systems Science theory of the CAS species. It was developed to explain the relation between thermodynamics in far from equilibrium systems that display negative entropy, and autopoietic living phenomena, and social phenomena as separate emergent levels. It was modeled on the first social systems theory which was that of Plato as developed in his description of imaginary cities. But with the discovery of multiple mathematical anomalies that interlock to specify the characteristics of special systems it become a general theory directly based on mathematics. Then with the discovery that there were physical phenomena that had the same anomalous structure it laid claims to being a fully scientific theory. In the intervening years many precursors and examples have been found of similar structures in different fields of study. But in 2012 the theory was applied to Agile and Lean practices and especially Scrum to see if it could explain the characteristics of the agreed upon practices that have been developed in software over the last decade or so. This validated that my own

software process theory given in “Advanced Process Architectures” tutorial and “The Future of Software Process” article of the same time period (1995) was in fact a precursor to Agile as contra-CMMI process theory was an experimental direct application of the Special Systems Theory to the definition of Software Process in a way different from that of Watts Humphrey of the SEI that was based on Demming and physical production lines. It was not until years later when I began working for a firm undergoing an Agile at Scale transformation that I realized the efficacy of Agile and Lean practices which were much hyped but which I had not witnessed for myself. It was during my research into Agile at Scale problems that I began wondering if my original theory which I had been refining over the years would apply to Agile and Lean practices as they stand today for instance as discussed by Kenneth Rubin in Essential Agile or in the original Scrum article by Ken Schwaber which has many interesting features from a system theory point of view. The only real attempt to relate Scrum back to Systems Theory which is credible I have found is SDLC 3.0 by Mark Kennaley. So I decided to write an exploratory work that would do a close comparison between Agile and Lean as considered the common received practices and the Special Systems theory and I called the work Agile Theory, even though it also covered Lean and Scrum practices as well. That work intends to show how the theory explains and underlies the practices that have come to be known as standard Scrum practices that implement agile approaches and extend that to lean systems as well as a basis for further development of Agile at Scale theories.

Any Theory of Agile should be based on mathematics and have physical correlates, that is should be scientific in the richest sense possible as well as being a robust theory under the definition of S. Wallis. Social Sciences are very short on robust theories and physical theories are almost always robust. The fact that Special Systems Theory is practically robust means that it has many of the properties of physical theories that are normally lacking in social science theories. However, a second monograph called The Foundations of Agile Teaming explores specifically the social basis of Scrum and Teaming in general and the claims that High Performance Teaming is possible. Since Agile draws many of its resources from Teaming so this is an essential extension of the theory that uses Sociological, Psychological and Anthropological theories as a basis for extending knowledge of the Reflexive Social Special System and its role in the efficacy of Agile. Thus this theory besides being fully scientific and robust also draws on recent social science theories in order to give it's a grounding to our understanding of high performance teaming. An Agile theory should do more than merely contrast with a strawman waterfall method that was abandoned by Software Engineering long ago. Agile theory should explain how this paradigm change in the way that work is done contrasts with the control centered organizational theory that has dominated America industry since the end of the Second World War and how this new paradigm will change the essential relation of workers to the companies that adopt agile and lean practices. Companies are caught in a bind in which in order to compete they must adopt agile practices, but these same practices have deep implications for their control paradigm, and basically will cause them intrinsic difficulties unless they engage in an organization wide agile transformation. The

actual frontier of Agile developments are in Agile at Scale patterning for larger projects and organizations such as that introduced by Leffingwell. But in order to understand the agile at scale problems in organizations it is first necessary to understand agile itself theoretically so that its paradigm changes can be isolated and the paradigmatic and epistemic transformations can be understood fully. Agile at Scale theory is dependent on there being first an interesting and explanatorily rich theory of Agile itself, and that does not yet exist in the literature that I can find. Once we understand Agile itself theoretically then it may be possible to understand the grander problem of Agile at Scale transformation, i.e. the implications for the whole organization and how it can provide an agile friendly meta-system for agile teams which can keep up with the cadence of those teams.

The first step in producing a theoretically rich edifice to explain Agile and Lean was to map it to Special Systems Theory. The Second Step which is done in another manuscript is to start with the Reflexive Social Special System and explain the resources of teaming and the possibility of high performance teaming practices. These two steps have been accomplished. The next step is to produce a workbook, which uses Systems Science isomorphies, and linkage propositions such as those articulated by Len Troncale as extended by the author based on General Schemas Theory to explain the actual form of Scrum as an agile approach. And finally the fourth step is to use this grounding to begin to explore the possibilities of Agile at Scale transformations of Organizations in terms of Meta-systems for Scrum teams rather than as Systems. At this point Meta-systems theory, which is the inverse of Systems theory becomes the key to understanding how great the transformation of Agile at Scale really is because it forces us to understand organizations as meta-systems, organized environments for scrum teams, rather than as systems. This is like saying that Agile at Scale transformations will turn organizations considered as systems inside out and will fundamentally disrupt the command and control structures of those organizations producing what might be called post-modern organizations.

Two steps of this research program have been completed with existing monographs concerning Agile Theory and The Foundations of Agile Teaming and the second two steps need to be completed. But once a single theoretical edifice has been constructed based on what is known from other sciences that support Agile and Lean Systems as pragmatic realizations of a new paradigm for work and coordination in organizations then it will be possible to explain in a deep way what this new way of working is really about from the perspective of a grounded theory. This theory is probably wrong, but we need at least one theory of Agile to begin the work of science to develop newer and better theories to support agile practices and to act as criteria for what does and does not fulfill the agile values and principles. A theory can tell us the inner coherence of the practices and how those express the values and principles directly. Without a theory we are left guessing. We are now in the position of Aristotelian Science, there is a dogma that has become an ideology, but because there is no theory that can be tested against nature, in this case human nature, then we are really just guessing as to the way the world works, and we are

trying things in an ad hoc manner that were discovered in uncontrolled experiments, and we are applying those things that seem to work and discarding those things that do not seem to work, but we have no basis for knowing what works and what does not work. Only theory can give us that criteria, and it gives us the ability to predict what may be parts of Agile and Lean that are yet to be discovered based on the extrapolation from the theory. Worse without an Agile Theory which is sophisticated and attempts to be specific enough to be testable, there is no basis on which Corporations can gauge the risk of adopting agile or promoting themselves as Agile at Scale. Without Agile Theory we have only beliefs no reasons based on evidence collected based on theoretical testing. If we want a Lean Systems Science, or an Agile Systems Science then we will need eventually to have a theory of what Agile is or Lean is or better what both are, and it would be nice if that theory were independent of the phenomena that it is theorizing, not just made up to suit the picture we want to paint of agility and leanness. This theory is fully independent of the phenomena yet points to how specific characteristics of the phenomena that are extraordinary might be explained.