Agile is Not the End-Game of Project Management Methodologies

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Abstract

As businesses continue to feel the chilling winds of the global economy, nowhere more than in project management is the pressure felt to demonstrate resilience.

Today the term "Agile" has become for many a business mantra to address mounting these economic woes.

Agile methods are portrayed as the means of moving from traditional technical processes to a more proactive and inclusive approach. Agile is perceived as the inevitable result of the evolution of project management methodologies. But this is far from the truth, for there is very little 'new' or inevitable about Agile methods

The paper explores the role of Agile methods by turning the clock back a century and more, and illustrates how today's Agile practice of project management has come to incorporate methods and tools which can be found throughout activities that underpinned the rapid economic growth of the twentieth century.

By uncovering Agile's evolutionary history we see patterns of change and adaptation in methods of production that suggests the inevitability in how project management methods will adapt in response to ever-increasing and complex technological and economic pressures. Agile is therefore reframed not as an end-game, but part of the evolutionary journey of project management.

Keywords: *Socioeconomic Complexity, Agile method, Project Management Methodology, Post-postmodernism*

Introduction

This paper builds upon the work of McKenna and Whitty [1] which structured an examination of the evolution of project management from a socio-economic standpoint, and contributed a "phylomemetic tree of project management" to the project management literature, as a mechanism with which to focus a discourse.

"*Phylomemetics*" has previously been used in socio-scientific research [2-5] and is to the exploration of the origin and propagation of ideas, or 'memes' [6], as "*phylogenetics*" is to the study of evolutionary relationships among groups of organisms.

This paper takes a more detailed phylomemetic view of agile methods to reveal that they are not new or radical. It begins by setting out the issue at hand which is that agile methods are seen as breaks from the past practices, as new alternatives, and as somewhat revolutionary ideas. Following a review of the literature we set out to put the 'Agile methods are new' hypothesis to the test by examining 'Agile' in its historical, socio-cultural and socio-economic contexts, and identifying specifically those social and cultural events that have influenced and shaped what are popularly conceived to be 'agile' project management methods.

Our approach to the subsequent analysis and discussion of these events is both chronological and recursive: that is, we take the opportunity as appropriate to reflect upon past events, to see how and why 'agile' is what it is now, and what it may well be in the future.

Finally we offer a view on what the impact of future socio-economic and socio-cultural trends may have upon agile approaches and upon project management itself.

The issue at hand

In 2001 a gathering of leading software practitioners, self-styled "organizational anarchists" [7], met in Utah. Striving for "an *alternative* to documentation driven, heavyweight software development processes" (emphasis added), the result of their endeavours was an "Agile Manifesto", incorporating a set of 'principles' which purported to be *a break from past practices* of "make-work and arcane policies".

The effort has been viewed as revolutionary [8] and has further been argued to be a Kuhnian "paradigm shift" [9, 10]. This theme of revolution or radial change continued as awareness and application of agile approaches to project management spread [11]. Implicit in all these statements is that, somehow, agile management represented something *new*: an evolutionary state in which the features of project management have just emerged and have replaced, or at least augmented, clearly delineating, what was there before, through original methods for organising and managing work.

For this study the exploration of the evolutionary, rather than revolutionary, nature of agile is important in realising that the features of agile are not inevitable; rather the ideas are a compromise of various social, cultural, and technological selection pressures in response to environmental changes in which they are used. Furthermore we can examine emerging socio-economic trends as a basis for conjecture as to what lies ahead for the project management discipline and its practices.

A Review of the Literature

Of interest is research that has already surfaced the notion that agile methods are not new, but the accumulation of past ideas.

A search of the literature can explain not only *if* agile methods are not new, but *how* this re-presentation can occur. That is, how and why agile methods are perceived and paraded as one thing, revolutionary, if in fact they are merely evolutionary.

The agile lexicon contains terms which clearly illustrate a *homage* to previous methods, such as the influence of the Toyota Production System and lean manufacturing and new product development [12-14]. And whilst the influence of such existing ideas and concepts (or memes as we shall define them shortly), is acknowledged, the rationale and mechanisms for their selection and application to new fields of endeavour remains unresolved at this level of inquiry. However, the role of memes (ideas and concepts that compete for our attention and spread [15]) has already entered the discussion on agile methods and how they have evolved.

More broadly, Whitty [16] has previously explored project management from a memetic paradigm, and asserts that "conceptualising of PM [project management] as a memeplex presents scholars and practitioners with new ways of seeing and thinking about projects and their management…"

In the context of 'agile' project management, Kruchten [17], builds upon Whitty [16] to note that its memetic nature has resulted in an accumulation of practices but that "there is no real common, shared understanding, only an illusion of shared understanding, which is itself creating some issues inside and outside the agile world." Appelo [18] further emphasises the memetic nature of 'agile' methods in noting that there has been a "copying frenzy" of existing practices as agile memeplexes (groups of memes that spread well together [15])have taken hold.

Means of transmission and replication of agile ideas and concepts have been identified: agile teams (in replicating, evolving, and spreading agility memes [17]; and agile methods, such as Scrum, acting as memeplexes serve a similar purpose in *reinforcing and aiding memes* to be copied around in the minds of practitioners [18].

Thus far, the literature offers a view of *what* memes occupy agile methods, from *whence* they came, and *how* they are carried forward.

Our search for a more general rationale for meme propagation leads us to consider *why* project management, and indeed other forms of organising methods for work, adopt specific memes and memeplexes.

The story of project management has unfolded against a backdrop of particular environmental conditions and pressures [1]. For example, classical project management retains the influence of its historical, Puritan influences [19], and we see project managers, both manipulated by particular memes and in turn manipulating their environment through these [20]. Further, the fidelity of project managers to the expectations of their environment has been debated in observations on "performativity" by project managers in exhibiting behaviours which may superficially support the professionalisation of project management (through the 'second nature' observation of project management and methodology), but which can subliminally subvert the very professionalism which the Bodies of Knowledge seek to foster [21].

Agile practices have been labelled a "brand" [18], a "a named collections of good practices …a crucial step in the evolution of software development". But their selection should be a matter of context [22], those of the organisational environment (such as business domain and culture) and the project characteristics (such as criticality of project results, and team distribution).

Thus, the literature already offers insights into the evolutionary nature of agile methods. What is less explored with any sense of focus or conclusion is how quite disparate memes have coalesced to become what are heralded as the present and future of project management, namely Agile.

Research Methodology

Our hypothesis emerges from the issue at hand as we have stated it. It is the common preconception that: Agile Project Management, also known as Agile Methods, is new. We suggest that the validity of this notion will be tested by subjecting it to a phylomemetic analysis.

We acknowledge that the debate surrounding the use of memetics as an explanation of socio-cultural evolution is not fully resolved. Yet, whilst reservations have been expressed regarding this approach [23-25], there are sufficient precedents to justify this research approach [26-28].

Research Design

If phylomemetic analysis is to have validity we need to understand the cogency of the underlying analogies between biology and socio-cultural evolution, and the relevance of phylogenetics to such analyses.

For the purposes of this paper reassurance can be achieved by briefly navigating the relationship between exploration of socio-economic evolution and that of project management (Figure 1).
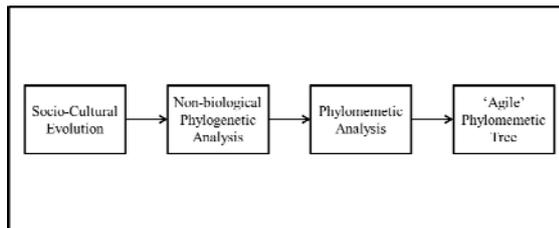

Figure 1 - Research Approach

On balance, research [29] points to a strong analogous relationship between biological and socio-cultural evolution, as phylogenetics has been used as an analytical tool in understanding the evolution of culture [30, 31].

An important distinction that McCarthy [27] makes is that, whereas once a biological species is extinct, it stays that way, social, economic and technological entities, if recorded or stored, can be recreated "…if there is wish to and the environment allows".

Our study invokes a genealogical standpoint to look at 'relatedness" of ideas. A similar use of phylogeny and genealogy has been undertaken previously [32] and used to "explore relationships among …[and] describe the pattern of evolutionary events causing certain distribution and diversity in living things" [5].

On Phylomemetics: of memes and memeplexes

In accommodating the biological and cultural evolution analogy, Stuart-Fox [33] examines application of evolution theory to culture and recognises the 'meme' as the unit of replication. A workable definition for the current discussion is as follows:

"The least unit of sociocultural information relative to a selection process that has favourable or unfavourable selection bias that exceeds its endogenous tendency to change" [34].

Weeks and Galunic [28] have looked at the role of memes in firms' cultural evolution, noting that this arises because of memes – firms themselves evolve over time "fundamentally because they are good ways for memes to replace themselves".

For our purposes, a 'meme' will likely equate to a specific project management method, tool or artefact which is sufficiently recognisable as representing a

discrete 'idea'; whereas a 'memeplex' can be seen as a means to facilitate conjoining or interacting of these memes to their greater good (i.e. survival and propagation). This reflects Whitty's [16] characterisation of 'project management' as a 'memeplex'.

However, given that we will explore the various features or methods of project management as distinct from "methodologies" we will offer the following distinctions:

- A 'method' is "…a step-by-step *technical* approach for performing one or more of the major activities of identified in an overall methodology" [35].

- A 'methodology' can be considered as "…a set of guidelines or principles that can be tailored an applied to a specific situation…" [36].

For example (illustrated in Figure 2), a project management tool such as Microsoft (MS) Project uses historically-discrete, but related, ideas, of 'PERT', 'Critical Path Method', a Bar Chart and a Work Breakdown Structure. Each of these might be considered a 'meme', whereas MS Project could be considered both as a memeplex - that is, the memes copy, or replicate. more effectively together [37] when hosted in MS Project as the utility of each is enhanced when used in combination - and as a meme, in that it is a 'vehicle', something in which "information can be stored" [26].
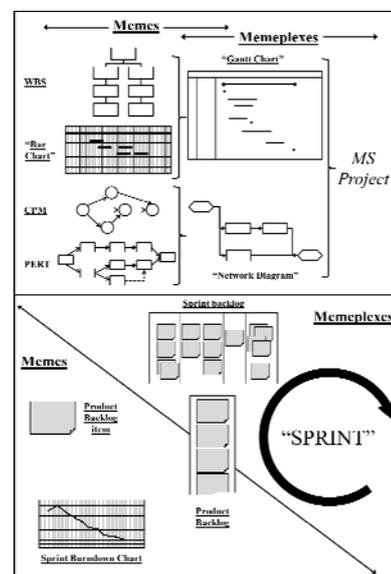

Figure 2 – Illustrative Project Management Memes and Memeplexes

Similarly, using Scrum as an archetypal 'Agile' methodology, its tools and artefacts (product backlog item; burndown chart), and its ceremonies (e.g. 'Daily Stand-up') and processes (such as a 'Sprint'), can be viewed respectively as memes and memeplexes.
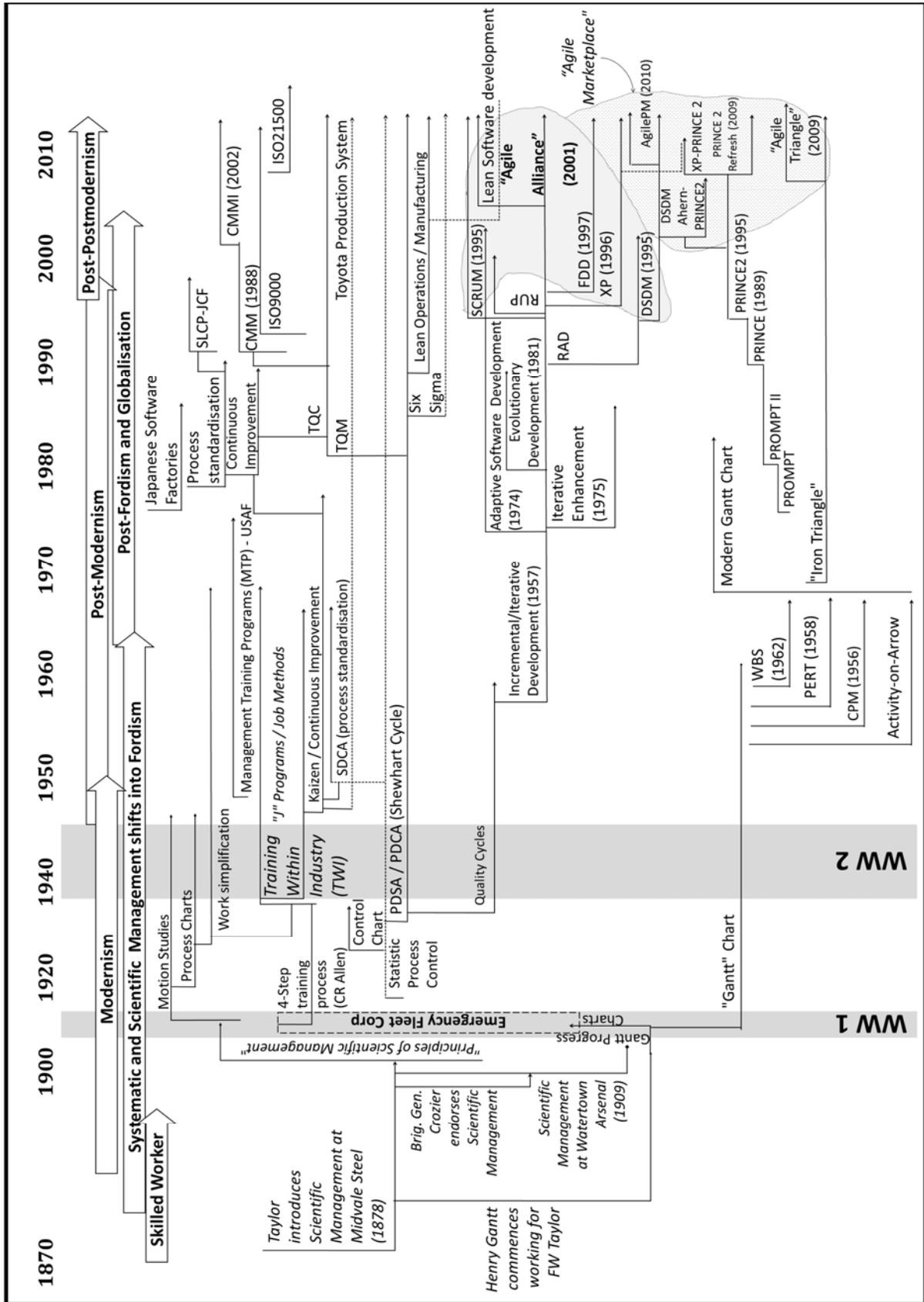
Figure 3 - The Project Management Phylomemetic Tree

Phylomemetic Analysis: establishing the lineages of Agile

The association of 'agile' as a shared descriptor for certain software development approaches emerged in the early 21st century [38, 39], although the notion of "agility" had emerged in management literature over the previous decade [40-42], and also in regards to software engineering practices [43-45].

However, as previously identified [1], distinct evolutionary paths of project management and other forms of organising for work have resulted in the 'agile' memeplexes:

1. Manufacturing techniques and approaches, particularly those which emerged in Japan after WWII.

2. Incremental and iterative development techniques, traced to the US military programs in the 1950's.

3. Contributions from 'traditional' project management.

The analysis is structured around these paths, noting that there is intertwining between them, and that we need to look further back over time to more fully understand 'agile' methods.

Whilst our analysis focuses upon the memes and memeplexes themselves which are highlighted in **Bold**, we also examine the broader narrative which portrays the environmental conditions which fostered their replication and adaption. Figure 3 plots the various memes and their connections, and through our narrative we make inferences in order to posit how and why ideas and concepts have evolved to their current state. From a research standpoint, inference is an established approach when applying phylogenetics to biology [46, 47] and to socio-cultural studies [30, 31]; and also in phylomemetics [2, 5]. Thus, it rests comfortably as a basis for moving from mere conjecture to something more rigorous.

1. Manufacturing

Taylorism and US Manufacturing

The influence of Frederick Taylor is well documented, not only in regards to general management [48], but also relating to project management [49, 50]. What is less clear is how and why the influence of 'Scientific Management' can still be seen in 'agile' methods. The evolutionary paths which we now examine provide a basis for that understanding.

Tracing the spread of Taylor's influences through a number of events in the late 19th and early 20th centuries offers an explanation in part as to how its modernist underpinnings have endured and permeated agile project management.

Our first path of investigation concerns what would become a series of pivotal events insofar as our discourse is concerned: that of Taylor's introduction to, and admiration by, key military personnel.

The US military had a history of standardisation which long preceded Taylor's work [51] and therefore would have provided an environment conducive to his ideas. In 1886 Taylor attended the conference of the American Society of Mechanical Engineers (ASME) in Chicago, at which he encountered Captain Henry Metcalf, an officer at Watervliet Arsenal, who presented views on work not unlike Taylors [52]. The significance of Taylor's military associations was raised considerably when Brigadier General William Crozier became U.S. Army Chief of Ordinance in 1901, a position occupied until 1918. Crozier had by then known Taylor for over a decade [52], and was an advocate of scientific methods [53]. This resulted, in 1909, in their implementation at Watertown Arsenal [52]. The Arsenal's then-commandant, Lieutenant Colonel (later General) C.B. Wheeler, [52], would introduce the **Gantt Chart** to the Ordnance Department during WW1 [54, 55].

The second path arises from Taylor's work at Midvale Steel, which commenced *circa* 1878, and its influence upon other key figures in Scientific Management. There, Henry Gantt was hired in 1887 to "assist in development" of Taylor's management methods [52]. Gantt maintained a long-term involvement with Taylor, though his works [54, 56] showed more sympathetic views of workers than Taylor. Frank Gilbreth, with a background in construction [57], and his wife Lillian, would become pioneers of the Scientific Management movement. Initially strong advocates of Taylor's methods [58], they gained prominence in their own right in the 1920's with their use of Time and **Motion studies** [59].

Stepping back a few years, another actor emerges, C.R. Allen, a Herbartian educator. Johan Friedrich Herbart (1776-184) was a German educator whose views gained popularity around 1890 in the U.S. [60], concurrent with a number of works published discussing his pedagogical and philosophical approaches [61, 62]. Allen adapted Herbart's process for instruction, incorporating behavioural modelling [63]. The result was a **4-step training process** [64]:

1. Preparation

2. Presentation

3. Application

4. Testing (or Inspection)

In 1917, the **Emergency Fleet Corpor**ation of U.S. Shipping Board set up an Education and Training Section [65], engaging Allen to head a program to train large numbers of non-experienced shipyard workers, in which he used this approach [66]. Consistent with prevailing philosophies, Allen emphasised the importance of 'standards' such that "…a man [should be] trained until he can meet these standards" [64]. Allen further proposed that work be subject to a "classified analysis", which "…gives us all that goes with the "job"" [67].

Though Allen's work seems to have dissipated in the early 1920's, Scientific Management memeplexes and memes continued relatively unabated. The Gilbreths gained further prominence through **Process Charts**, which purported to provide "first steps in finding the *one best way* to do work" [68] (emphasis added). Central to this was the need for standards to be applied to each process step. The focus on "eliminating waste" foreshadowed principles of lean manufacturing, and lead to the notion of **Work Simplification**.

Work Simplification was popularised by Allan Mogenson, an industrial engineer, who defined it as "common sense to finding better and easier ways of doing every job" [69]. Working closely with Lillian Gilbreth from the late 1930's [70], and using **Process Charts**, he travelled widely in the US promoting *elimination of waste* as a major motivation [71]. His approach found its way into major corporations such as Du Pont [72]. Du Pont would later to contribute to the development of **CPM** [73], the military–industrial socio-economic environment proving to be particularly suited for the various memes of Scientific Management.

The advent of WW2 provided another significant change in the environment. As in WW1, it was felt that "…TRAINED manpower [was] needed in unlimited numbers" [74] (emphasis in original). Thus was born **Training Within Industry** (**TWI**).

Recalling McCarthy's [27] assertion that extinct cultural ideas can be recreated, we see in **TWI** such a circumstance: the U.S. was at war, facing simular demands on its industries as in 1917, providing both the environment and the motivation for reinvigoration of Allen's work. Notably, three of **TWI**'s leaders were familiar with Allen's work at the Emergency Fleet Corporation [65, 74], from which circumstance it was revitalised.

TWI also drew upon Mogensen's **Work Simplification** [75], an important point in understanding the influence brought to bear upon Japanese industry.

Japanese Management and Practices

Taylor's Scientific Management found an early, receptive audience in Japan: *The Principles of Scientific Management* was translated into

Japanese in 1912 [76]; organisations such as Mitsubishi Electric Company embraced the philosophies [52] in the 1920's; and Kiichiro Toyoda visited the U.S. and England in the late 1920's to study production management techniques [77].

Largely under the influence of Ueno Yōichi, who had translated the works of Taylor, the Gilbreths and others, the Scientific Management movement formed a schism which took a view of 'efficiency' as applying to "all aspects of day-to-day life and social intercourse" [78], in keeping with the prevailing communal values [76].

The focus of Japanese industry turned to supporting its World War II campaigns, and the subsequent loss left its industrial base at less than one-tenth of pre-war capacity [79]. In re-building the economy, an influx of American management influences would permeate Japanese management in the years immediately following the War.

One might speculate then as to why, in contrast, **TWI** lost ground in the US as it was gaining traction in Japan. A plausible inference is that, just as with Allen's training techniques after WW1, recipients of the training would have turned to other forms of employment (or to domestic duties) once the munitions and weapons factories had no need of them, and the their replacement employers were unaware of or had no need of **TWI**. Viewed through our memetic paradigm, we can see how an idea (training) thrives in a particular socio-economic environment (wartime, military-industrial influence), its selection arising from the actions of its hosts (the TWI leaders).

TWI was introduced "lock, stock and barrel" as part of the US Occupation authorities' programs to rebuild Japanese industry, using a "4-Step" instruction approach based on Allen's training philosophies [66]. Over the next fifty years, ten million Japanese managers, supervisors and workers would graduate through **TWI** programs [79].

One of its programs, '**Job Methods** Training' provided supervisors with skills in "improving methods" [80]. and is credited with giving rise to the concept of *kaizen* [81, 82]. *Kaizen* was also influenced by a related "**Management Training Program**" (MTP) [82], introduced by the US Air Force to Japan *circa* 1950 [83].

The birth of lean

The auto industry, and Toyota in particular, would be at the forefront of adaptation of such methods introduced to Japan at this time.

In 1950, W.E. Deming, who had worked on Shewhart's **Statistical Process Co**ntrol (SPC) within U.S. war industries [84] introduced SPC and the Plan-Do-Check-Act (**PDCA**) **quality cycle** at

the behest of the Japanese Union of Scientists and Engineers [76]. Although debated [85], Deming's work is viewed as closely related philosophically to Taylor's Scientific Management [86, 87]. The **PDCA** quality cycle has been adapted to as the *Standardize*-Do-Check-Act (**SDCA**) cycle, emphasising the need for standardisation of work and processes as a first step in *kaizen* methods [82].

Taiichi Ohno, "father of the **Toyota Production System**" (TPS), was influenced by re-visiting the work of Taylor and the Gilbreths also in the early 1950's [88]. Key memes such as 'lean', 'kanban' and 'kaizen' were to become part of the TPS memeplex which had a major bearing on U.S. auto manufacturers during the 1980's, as the U.S. economy struggled and Japan became an economic powerhouse.

Japanese firms established operations in the U.S., with U.S. firms learning from Japanese counterparts [89]. Thus memes which had been replicated and nurtured over almost three decades in Japan were to find their way back to the U.S.

The TPS was crucial in influencing one of the early agile methodologies, **Lean Software Development** [14], and also broader agile project management philosophies [11]. Central to the appeal of lean manufacturing "philosophies" is the *elimination of waste* [90]. Both in intent and approach (of standardisation and simplification of process) this echoes work of the Gilbreths [68], Allen [64] and Mogensen [71] which shaped the TWI programs.

Other specific production techniques such as *kanban* [90], would be claimed as "agile" management methods [12, 13]: the *kanban* board has a strong memetic similarity to the Scrum "Sprint Backlog".

Although the recognised path of evolution of Japanese management methods upon the agile movement is via U.S., a similar evolution of software practices and project management occurred in Japan itself, ahead of the U.S.

The 1970's saw the emergence of **Japanese "software factories"** run typically by computer hardware firms whose manufacturing was influenced by the TPS and concepts such as lean [45]. Lean principles of work standardisation were reflected in software development through standardising workers' skills; **continuous improvement** addressed use of processes; and manufacturing flexibility was equated with using computer aided tools and integration.

First individually (in firms such as NEC and Fujitsu), and then at an industry level, there would be a growing emphasis upon **process standardisation**, with the establishment of a national standard, Software Life Cycle Processes-Japan Common Frame (**SLCP-JCF**) in 1994 [45].

As result of the emergence of the "borderless economy" which featured distributed and globalised teams, the software factories moved to adopt development and project management practices. This occurred to facilitate greater decentralisation of teams and parallelisation of work [44], and was deemed to be an "agile" approach,

Thus, we can recognise memes, such as work standardisation (of processes and roles of the individual) and simplification, with roots in late nineteenth century management, being carried and adapting to changing, disparate environmental conditions and at different levels of abstraction.

2. Evolution of incremental methodologies

Our second evolutionary path is that in which various **iterative and incremental development** (IID) approaches to software development – and thereby surrounding project management practices – emerged.

Larman and Basili [91] trace early manifestations of IDD to the US X-15 Hypersonic jet in the late 1950's. Personnel from this program seeded NASA's Project Mercury, which ran from 1958 to 1963 [92], foreshadowing later agile practices, such as very short, time-boxed iterations, and the use of techniques akin to those to be found in **XP**.

The subsequent decades reveal further practices which suggest the emergence of agile memes.

- *Iterative approaches to modelling* emerged in the late 1960's [93], aiming to overcome the problem that "system behavior and performance are not discovered until the system has been built …". Conceptually, this would anticipate iterative, architecture-focussed software development [94, 95].

- **Iterative enhancement** [96], using a *project control list*, which "acts as measure of the 'distance' between the current and final implementation" and for which "each iterative step consists of selecting and removing the next task from the list…until the project control list is empty". Whist there are differences in use, there is undoubtedly a relatedness between the project control list and a Scrum product backlog

- Gilb's **Evolutionary Development** [97] emphasising increment delivery achieving "*complete* delivery to a *real* user" (emphasis in original). This is similar in intent to a **Scrum** sprint focussing upon shipping a Minimal Viable Product. The resemblance of methods and principles of **Evolutionary Development's** later manifestation, "Evo" [98] to those of **XP** and **Scrum** have been noted [99].

What is apparent from these examples and others previously identified [1] is that we can reasonably infer memetic behaviour, as previous methods have been identified as worthy of selection. Agile methodologies however, demonstrate varying "situational appropriateness" [100] which would be expected to impact upon the extent and circumstances of their application.

3. Contributions from "traditional" project management

Although the "underlying theory" of project management has been declared "obsolete" [101], agile project management still evokes methods firmly rooted in traditional methodologies.

For example, iconic representations such as the "**iron triangle**" survive, if in a modified form [102]. Scrum sprints have two 'fixed' sides, being sprint duration and team size (which is a proxy for effort or cost), with the variable being scope (i.e. product backlog delivered).

Further, examination of such tomes as the PMBoK [103], reveal acknowledgement of "spiral" lifecycles which closely approximate those found in IID.

"Not the End-Game": the ongoing evolution of project management methodologies

Having uncovered an evolutionary history which demonstrates that 'agile' approaches are by no means 'new', but rather are a result of a selection process, we now consider our original position that 'agile' is indeed not the end-game of project management methodologies.

As we have identified, the current state is an *accumulation* of memes and memeplexes, chosen to suit environmental circumstances. So too its future can be expected to weave a course of adaptation to changing environmental conditions.

Broadly, these pressures can be summarised as:

- *Adaptation of 'Agile' methods, both into other fields and within the field of software development*. Memes replicate in other fields of endeavour, adapting to new environments.

- *Changes in the socio-cultural environment.* Driven by trends such as rapid technological advances and globalisation, the memes will undergo further tests of their fitness and adapt accordingly.

We examine each of these in turn and infer what shape project management will take in the future in its thrust for survival.

Adaptation of agile methods

Since the declaration of the "Agile Manifesto" there have acknowledged appropriations of agile concepts into other fields, including construction [104, 105], academia [106, 107], business functions [108], general management [109-111] and government policy development [112].

Whilst some adaptations may look outside of the software domain, such as from lean manufacturing to construction, methods such as those in Scrum prove attractive [113]. An example of New Product Development, that of the Wikispeed vehicle [114] in which Scrum techniques were utilised, illustrates a response to challenges of rapid technological change and globalisation.

Within the existing 'marketplace' competition also prevails. For example, DSDM Atern [115] is positioned as a "framework" within which others, such as Scrum, can operate [116], with an implicit hierarchy of fitness . Also, cross-over of memes occurs between various agile memeplexes, such as user stories (originating in **XP**) being integrated into **Scrum** [18], and with new memeplexes, such as Scrumban [117] (replication and adapting kanban and **Scrum** memes), evolving to claim their stake in the marketplace.

Impact of Socio-cultural changes

We have worked with an analogy between biology and memetics, but in exploring the impact of socio-cultural changes we need to be mindful of some important differences.

Such reservations should not preclude inferring how project management might evolve: virtually since their recognition as a subject of research, agile methods, particularly in the realm of software engineering, have been exposed to such speculations [100].

Current state summary

As a precursor to inferring future impacts upon project management, a pause to review the current evolutionary state of agile is taken.

Broad industry surveys on project management's current state and emerging trends [118, 119] point to widespread adoption of project management as part of business practices, but with an growing role for agile methods. Surveys of agile practices, albeit focussing upon their use in information technology [120, 121], reported that **Scrum** and **XP** remain the most widely used. Of interest to the current analysis is the use of such approaches for distributed teams by a quarter to a third of respondents, reflecting the impact of increased globalisation of project delivery.

Rationale for change

Our premise of agile memes surviving and propagating, by way of environmental 'fitness', requires consideration of characteristics which would emerge in a changing socio-cultural environment. The relative appeal of agile methods lies in their accommodating of "dynamism" (high rates of change) and in a culture which "thrives on chaos" [122].

Processes, such as project management and technical development, operate within an organisational environment, which both influences and is influenced by, such processes [123]. For agile approaches to thrive in an organisational environment, certain characteristics are more suitable, including support for collaboration [124] and championing by senior management [125] in accommodating approaches which contrast with conventional approaches. Although agile and traditional project management methods may indeed be ideologically incommensurable [126], organisations can accommodate both, through being "ambidextrous" [127], particularly– if traditional approaches are to be retained – through an organisational "sub-unit" in which agile practices are exercise in isolation.

Baskerville, Pries-Heje & Madsen [128] note this to be a matter of effectively "operating these two different ways of working consistently within separate boundaries", but suggest that being able to "seamless integrate" both approaches would result in a state of "post-agility". Our view is that this co-accommodating, either within the organisation or the process, would place project management practice into the era of post-postmodernism. This has otherwise been noted as a need for a balance of "agility and discipline" [122].

Socio-cultural trends

Despite what resistance may be offered, trends in the broader socio-economic environment point to such change being inevitable.

The "open source" movement has already radically impacted upon not only products such as Open Source Software (OSS), for example Linux [129], but also in the processes used in their production. OSS has seen significant growth both in terms of the number of projects and the scope of software products involved [130].

OSS development is distinguished by: potentially hundreds or even thousands of participants, many of whom are volunteers; work being chosen, not assigned; no explicit design; and no project plan, schedule or deliverables [131]. Agile methods such as Scrum have been used for OSS development, though with substitution of some methods, such as face-to-face sprint planning with on-line sharing of information [132].

What is significant for the future of project management is that the principles of OSS development have been applied to other products, such as drug development [133, 134] and broader biotechnology ventures [135]. Less than a decade ago, ventures such as the Wikispeed vehicle were considered "problematic" [136], but agile methods have contributed to realising this possibility [137].

Traditional, formalised project management approaches based upon established bodies of knowledge generally assume an organisational context of team member colocation [138]. And, although claims are made of agile methods providing greater flexibility in the management of project scope than classical, 'waterfall' methods, through "…fix[ing] two things, schedule and resources" [139], this is usually achieved through similar colocation arrangements. In contrast, open-source approaches need to accommodate interaction of geographically distributed resources [140].

In environments in which participants partake in a 'bazaar' of "differing agendas and approaches" [141], rather than in a 'cathedral' of "solemn controlled ceremonies" [142], project approaches which rely upon the Talyoresque assumption of being able to impose a "one best way" of working is thus undermined as the participants shape the process. Further, the project management bodies of knowledge have themselves been subjected to a call for a move to an "open source", domain-specific approach [143].

The impact of globalisation upon how projects operate is further evidenced in the emergence of "crowdsourcing", which has already taken hold as a means by which projects form the team which both define their requirements and the means of production [144, 145].

Use of blogs and message boards as new tools for the generating requirements and vision for software [146] and in construction projects [147] have been identified. Coupled with this, tools have been developed [148, 149] which explicitly support such approaches to capturing requirements from contributors regardless of location.

The inevitability of project management having to move on from established agile methods at some point in time has been long recognised even with the agile community. Two of the Agile Manifesto's "authors" [7] have made such calls: Jim Highsmith [150] notes that "creativity, not voluminous written rules" are required; Alistair Cockburn suggests that methodologies should be committed to on the basis of specific project characteristics [151] and should pursue "just-in-time methodology construction" [152].

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Conclusions

We have previously declared [1] that our initial 'phylomemetic tree' was an early attempt to "depict the inferred evolutionary relationships among various tools and methodologies pertaining to project management, and to illustrate how they have adapted in response to various environmental pressures".

This paper has continued that exploration, with a necessarily-narrower focus upon 'agile' methods. In so doing it has provided further details of the tree's branches and nodes. In keeping with our original declarations, we expect that the expansion, and revision, of the tree will occur; much can happen with phylogenetic trees over time as understandings of relationships between biological entities are re-visited, and new notions accepted [153]. These changes can occur as new scholarship revisits history and arrives at additional, plausible inferences of relationships in project management.

The challenge of researching evolution is that it is unlikely to achieve completeness of understanding of the past; by its very nature it is a somewhat subjective exercise. What we can state is that there is no single metanarrative which can provide an explanation of the current state of project management, nor foretell its future. However, if there is a basis for explaining its evolution, it is that it is both a consequence of its environment, and, on occasion, a shaper of it.

The memetic paradigm frees us to stand back and examine how these factors interact, without assuming any grand design or predestination. This also allows us to infer how the interaction will continue: the future of project management may well be 'agile'; but not as we know it.

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