

Social Responsibility, Human Centred Systems and Engineering Ethics: A New Manifesto for Systems Engineering Design Praxis

B. O'Neill*, Larry Stapleton.**

*INSYTE, WIT, Ireland, email: boneill@wit.ie

**INSYTE, WIT, Ireland, email: larrystapleton@knewfutures.com

Abstract: Praxis is defined in the Cambridge English Dictionary as “the process of using a theory or knowledge in a practical way. Michael Cooley was one of the founding members of the Human Centered Systems(HCS) movement where human tacit knowledge is valorized and the human is empowered with technology and automation at the service of, and controlled by, the human. This paper proposes a set of ethical guidelines, in the form of a Manifesto, for a systems engineering design praxis. The rationale is to detach from “the one best way” that the Agile Software Development process has become, to value tacit knowledge by giving the client the right to reject, to rebalance power from the designer to the client and to slow down or depressurize the development process. This Manifesto emerges from the ongoing work on the digitization of the Cooley Collection by the interdisciplinary team members of the Insyte-Cooley Research Lab in the Luke Wadding Library of Waterford Institute of Technology. Work on this manifesto has raised serious questions – is the systems design process that involves interdisciplinary teams, responsible design and development of non commercial but socially beneficial systems, a very different and emergent model? Is it compatible with, a very different design approach? An ideology is presented, from which, as the lab progresses a supporting methodology specific to complex digital cultural heritage systems is evolving.

Keywords: international stability, knowledge engineering, culture, ethics

1. INTRODUCTION

When a systems design engineer comes into an organisation to develop a system he/she does so with an inherently strong element of power and control. In essence the engineer is re-engineering the everyday work practices of the employee and often the employee feels that they have no control over it. They fear being made redundant.

According to Marion Hersh, 2014 “...the power structures associated with science and technology can act as barriers to ethical behaviour by engineers and other professionals.”

Many workers fear that accepting a new system with some automation is the start of a downward spiral towards full automation in the future at the expense of the workers' job and livelihood. The Human Centered Systems (HCS) approach to design causes surprise in users when they are given the freedom to request, accept or reject automation of a task. At the core of the HCS approach is the high regard in which tacit knowledge (that which we know but cannot tell (Polanyi, 2009)) is held.

In regard to the use of the HCS approach Fiona Murphy has successfully laid out a Human Centered Framework for eliciting users embedded(sticky/tacit)knowledge requirements during Information Systems Development (Murphy, 2008).The “Lucas Plan”(Wainwright & Elliot, 2018) in the 1970s was the genesis for the HCS movement for which Michael Cooley was later to receive the Right Livelihood Award (the equivalent of the Nobel Peace Prize) in 1981.

Cooley talks in his seminal book “Architect or Bee” (Cooley, 1987) of his experience of his mother being made redundant to technology after twenty years, with no pension, and her reaction to it. He says “But, for all her anger, she was resigned. Shrugging her shoulders, she repeated to herself, as if she had to convince herself, “Well, I guess that’s progress.””

It does not have to be this way. There can exist a human-machine symbiosis which values the tacit knowledge of the human in combination with the computational power and logic of the machine (Gill,1996a). One of the key elements of HCS is that automation should augment the work practices of the human and not replace the human in the system.

An important idea suggested by Claudio Ciborra (Ciborra,1999) is the idea of looking at new technology through the lens of “hospitality”. Brigham and Introna discuss how Ciborra’s ideas were put to use in the installation of a Vehicle Mounted Data System (VMDS) for the Hereford and Worcester Fire Brigade (Brigham & Introna, 2009). In the Cooley Collection the new technology is also welcomed in as an “invited guest” - thereby opening up opportunities for investigation and potential acceptance of technology in relation to the discipline of the host i.e. the curators. This approach has proved highly significant in formulating a new direction for human-centred design by leading to the evolution of a new methodology in this field. The Insyte-Cooley Research Lab have set about developing this “Manifesto” in relation to HC systems design for complex digital cultural heritage systems.The work involves an inter-disciplinary team of librarians, technologists and students.

2. ETHICS IN SYSTEMS ENGINEERING

2.1 Ethical factors effecting culture, international stability and sustainable development.

Factories who automate the production of goods and offer poorer quality items at a cheaper price severely effect the ability for artisans and traditional crafts people to make a living. (Stapleton, Smith & Murphy (2005))

This has, in the past, wiped out many traditions in indigenous communities. With this have gone customs and unique skills handed down from ancestors and passed onto descendants. UNESCO is the body charged with promoting cultural diversity and it does so by means of guidelines in the form of globally recognised conventions. The 1972 UNESCO convention divided cultural heritage into two parts i) tangible cultural heritage and ii) intangible cultural heritage (UNESCO,1972). Both are important as a holistic way of preserving cultural heritage. Intangible cultural heritage draws on the stories associated with tangible items and by doing so breathes life into the physical forms. Tacit knowledge in the form of storytelling, customs, rituals, crafts and performing arts hold a unique place in the preservation of cultural diversity. Automation and the global march of progress threaten cultural diversity and lead to inability for artisans to make a living and support their families which is a threat to sustainable development and in the long run to international stability. (Stapleton, 2019)

2.2 How ethical is the current way of designing and developing systems?

The Agile Software Development Manifesto was, when created in 2001, a new means of including the user in the software development lifecycle through regular communication and feedback loops. It provided an alternative to traditional 'plan based' methodologies where the user requirements were gathered and stable at the start of development and would undergo minimal if any change, as the project developed. Agile introduced flexibility for change along with rapid software development.

It is important to state that Agile is not a methodology but is a set of values and supporting principles, an ideology, which informs the selection of appropriate supporting methodologies e.g. Scrum, Kanban, Extreme Programming, to name a few. Common to all of these methodologies is the division of the customers' requirements into multiple release cycles. It is driven by speed over evolutionary understanding.

The key to successfully using Agile is to select the right methodology for the particular project and organisation and ensure that the methodology aligns with the Agile Manifesto. In many cases there is not a 'right' methodology and the team have to adjust or create a methodology to suit the particular project and its circumstances. It is Agile if it adheres to the 4 values and 12 principles of the Agile Manifesto.

G.J. Miller lists a number of criteria necessary for an Agile approach to be successful:

- 1) Skill and experience of the team – Highly experienced
- 2) Stability of requirements – Low stability
- 3) Customer availability – High availability
- 4) Company culture – Low management control.

Miller also states that whilst the popularity and availability of the methodology are important, acceptance by the organisation and the ultimate success of the project is based on additional factors which are the project characteristics, organizational culture, and customer availability.” (Miller,2013)

H. Lindvall would argue that the three most important success factors that lead to adoption of Agile are culture, people, and communication. (Lindvall, 2002)

2.3 Problems with Agile

It is eighteen years now since the Agile Manifesto was written and the Agile software development process has, itself, become widely adopted and 'traditional' and is coming under review. One of the main problems is that, when using and adapting supporting methodologies, the focus on the Agile ethos has been lost.

Agile is being incorporated into everything: “Organizations are introducing agile and lean software development techniques in operations to increase the pace of their software development process and to improve the quality of their software. They use the term *DevOps*, a portmanteau of development and operations, as an umbrella term to describe their efforts. “ (Erich,Amrit, Daneva, 2015).

In a recent survey of DevOps Concepts and Challenges L. Leite states “ ... whatever the structure an organization adopts, it is clear that the DevOps movement has irreversibly blurred the frontier between developers and operators, even for organizations that have not yet fully embraced DevOps”. (Leite, 2019)

Agile has now become “the one best way”. The values and disciplines of the Agile ethos are being lost sight of. There is a disconnect.

Martin Fowler one of the creators in 2001 of the Agile Manifesto highlights this disconnect when he talks about Taylorism and states that there are problems associated with Agile one of which is - “...the Agile Industrial Complex and this imposition of the one-best-way of doing things. That's something we must fight against.” (Fowler, 2018)

The Agile software development process is at odds with Claudio Ciborra as is evident from his writings on 'hospitality' where the technology is an invited and, therefore, welcome guest. Ciborra states that “Through hospitality technology is made human: the humanization of systems can be a more intriguing challenge then the virtualization of reality” (Ciborra, 2002).

Sinead O'Neill introduces Ciborras idea of technology and hospitality in relation to e-agriculture and the uptake of technology by traditional farming communities.

According to O'Neill Ciborra “believed systems development methods failed to understand the *actors* or other persons who

have vested interest in the system and the systems development process often ignored important insights about the context in which technology is deployed” (O’Neill, 2019). The Agile software development process does not align with Mike Cooleys’ views which are in total opposition to any form of Taylorist “one best way” and the imposition of same on workers. Cooley in his book *Architect or Bee* states “In my view, the computer is the Trojan Horse with which Taylorism is going to be introduced into intellectual work. When a human being interacts with a machine, the interaction is between two dialectical opposites. The human is slow, inconsistent, unreliable but highly creative, whereas the machine is fast, reliable but totally non-creative”. (Cooley,1987)

Agile is also at odds with Karamjit Gills views of Human Machine Symbiotics because, with Agile, there is the possibility that human tacit knowledge could be looked upon as a liability to the correct functioning of the system.

“I find a deep concern that individuals feel frustrated because their common sense and knowledge, and their practical experience, whether as a skilled worker, a designer, a mother, a father, a teacher or a nurse, are less and less relevant and are almost an impediment to ‘progress’. ” (Gill,1996b)

The Agile Software Development Manifesto is imperfect as Phillippe Hohl discusses in his paper on the origins of the manifesto, the contributors’ views from today’s perspective, and their outlook on future directions (Hohl,2018).

3. THE ROLE OF MANIFESTOS

A manifesto represents guidelines for change. Some early examples can be traced back to Europe of the 16th Century; most famous manifestos include the Declaration of Independence in the U.S.A. (Declaration of Independence, 2019) and the Communist Party Manifesto (Communist Manifesto, 2017). The Communist Manifesto was written by Karl Marx and Friedrich Engels and published in 1848. Since then it has been recognized as one of the world’s most influential political manuscripts. Even after the fall of the Berlin Wall in 1989, and the collapse of communism in Russia and Eastern Europe, its authority and influence remain for many.

Manifestos, have also come from the field of art and have led to the foundation of new art movements. The Futurism art movement, for example, was founded in Italy in 1909. The Futurist Manifesto was published on the front page of the French paper *Le Figaro* and was so provocative and violent that it caused the editors to print a disclaimer.

The Futurist Manifesto was one of multiple manifestos, written by the Italian philosopher and writer Filippo Tommaso Marinetti (Futurist Manifesto, 2019). The beauty of a Manifesto is that it takes the form of a short document which can be distributed easily and can aid in gaining traction for change. The creation of a Manifesto has often been the first step in the formation of a ‘movement’ which when adopted by a mass of people has led to great change and historically to revolution.

In, the area of computing, in 2001, the Agile Software Development team created the Agile Manifesto. This provided the ideology behind the Agile Software Development process

(Agile,2019). Agile is now being reviewed again by the writers of the original manifesto.

3.1 Basis for a new Manifesto:

The librarians involved in the digitization of the Cooley Collection can choose to request, implement or even reject proposed technical solutions if they feel that the original way of performing the task is better. This returns the power and control to the user. A human machine symbiosis is, thereby; embraced where the tacit knowledge of the curators/librarians is valued and the technology is a valuable aid to them in their work. **They** make the decision to request, implement or reject e.g. whether to use AI/neural networks to digitally transcribe handwriting in old documents – the librarians decide.

The onus also moves away from rapid development and is replaced with careful, thoughtful, reflective development which may take slightly longer (long cycles) but the benefits outweigh any perceived disadvantage.

Agile Manifesto Values	Problem/Challenge	Human Machine Symbiotics Alternative	Citations/References(Which support alternative and challenge)
Individuals and interactions OVER Process and tools	Processes e.g. methodologies have become more important than the Agile ethos. Power and control is still with the software developer. Tacit knowledge is not valorised.	Multi disciplinary team have complete control on how they intend to do the work- valuing tacit knowledge.	Fowler, Martin,(2018) Transcription of keynote at Agile Australia https://martinfowler.com/articles/agile-aus-2018.html [Last accessed: 30th October, 2019]
Working Software over comprehensive documentation	Working software is the measure of success – imposition of “one best way” of software development. Working under triangular constraints of scope, budget and time.	Software is invited in and signed off by the users. Merit in some documentation being used as a communications tool. Software solution only used when deemed more useful than specialist tacit knowledge.	<u>Ciborra</u> , Claudio (2002), <u>Information complexities</u> : challenging the wisdom of systems, Technology as a guest; the influence of the stranger page 114 Cooley Cooley, M.J. (1987b), <i>Architect or Bee?</i> Hogarth Press, London, Identifying the problem page 16 Fowler, Martin,(2018) Transcription of keynote at Agile Australia https://martinfowler.com/articles/agile-aus-2018.html [Last accessed: 30th October, 2019]
Customer Collaboration over contract negotiation	Customer doesn’t have ultimate power to reject software solution if it falls below specialist tacit knowledge available. Power is with developer. Customer has to be available.	Customer has the right to refuse the software solution if it is felt that the tacit knowledge of the user is superior. Meeting flexibility.	Right to say no to the technological solution provided.
Responding to change over following a plan	A less pressurised development process (cycles slower with valuable client/user interaction to inform development – evolutionary understanding.).		Agile does this but new Manifesto is slowing the cycles down.

4. THE NEED FOR A NEW MANIFESTO

Has the Taylorist “One best way” seeped into systems design engineering? Have we become like the Bee in Cooleys book

“Architect or Bee” (Cooley, 1987) where we create the same thing over and over again using the same methodology rather than being like an architect where every job is different and requires renewed creativity in design and necessary back and forth communication with the client? There is a need for a new manifesto in relation to systems engineering design particularly in the area of knowledge work that places the human at the centre of development and valorises his/her tacit knowledge.

In the work on the Cooley Collection the tacit knowledge, skill and scholarship of the librarians is honoured and continual communication with the stake holders and developers is very important. To this end the team have been using the Human Centered Systems approach as espoused by Michael Cooley.

Tacit knowledge cannot be automated and is a uniquely human trait which when removed from the system (by attempts at encoding) effects the overall flexibility, quality, effectiveness and ethics of the system. “Man’s capacity to think is his most outstanding attribute. Whoever speaks of man will therefore have to speak at some stage of human knowledge”. (Polanyi,1959)

Whilst the Agile Software Development Manifesto does recognise the need for continual communication it is felt that power and control are ultimately still squarely in the court of the systems design engineer. The resultant system gets adopted even if it results in a form of a technological straight jacket to be worn by users.

The proposed new Manifesto values the tacit knowledge of the users in the design and development of the system and most importantly places the decision to request, accept or reject the technological solution at the feet of the user. The technology has to be invited in initially. This shifts the balance of control and power from the systems design engineer to the client. The resultant system is then technologically wrapped around the user.

The systems created by adhering to these values show responsible system design in action producing socially beneficial products, in this case, the curation of knowledge on behalf of society.

By over automating systems in the past workers have been deskilled and invaluable tacit knowledge has been lost. “Deskilling refers to the loss of expertise in an area where the computer is merely competent” (Dreyfus & Dreyfus,1988). This has affected wider society.

The systems engineering design process needs to respect sustainable development in the long run. Dietrich Brandt states that “Human-centredness as a societal force must not stop at any borders but has to become one main force to drive technology changes all around the globe.” (Brandt, 2006)

In the area of the creation of socially beneficial systems of a non commercial nature for knowledge work - is there a case

for slowing down the design and development process? The rationale is that these are human centered systems and need to involve the developers and clients in frequent discussion

regarding the technologies being suggested as a viable solution, the impact that these solutions have on the work practise(s), and whether this impact is acceptable or not. The process of development may involve long cycles.

Is it possible that removing the commercial aspect from systems development allows for the use of a different model of systems design for socially beneficial systems by using a responsible design method? This type of complex system involves interdisciplinary teams which can provide surprisingly creative solutions. This is a major factor in the creation of a new model of system design for a cultural heritage system.

4. SYNTHESIS

HCS Manifesto for Systems Development: A Statement of Core Values and Ethos

1. We reject	automation of human work unless invited by the individual performing the task.
2. We reject	the domination of techno-centric thinking and the power dynamics it creates
3. We embrace	tacit knowledge
4. We embrace	building relationships of trust and understanding with those who steward our techno cultural artefacts.
5. We embrace	open ended childlike curiosity, the raising of new questions and looking at old problems through different angles without fear of derision.
6. We embrace	both success and failure because of the valuable knowledge gained from them.
7. We embrace	the widespread sharing of knowledge gained from the experiences along the way.
8. We embrace	the challenge to materialize the digital humanities stewards vision.
9. We embrace	human creativity, collaboration and problem solving in the form of “makers” ¹ .

10. We embrace	socially responsible systems and socially useful products.
11. We embrace	acknowledge and anticipate post solution “bricolage” (virtuoso tinkering) as a natural occurrence striving to harness benefits while minimising entropy.
12. We embrace	the dedication of craftsmanship in sculpting viable solutions.
13. We embrace	support and encourage the unique and colourful people we work with.
14. We embrace	and invite in all those who feel marginalised.
15. We embrace	opportunities to guide eager minds in the ways of HCS.
16. We embrace	the diligent safeguarding of artefacts and embedded wisdom in our care during development.
17. We embrace	safeguarding all stakeholders against negative risk (privacy violations or any injustice) during any endeavours that are informed by the system.
18. We embrace	a repeatable process over a methodology.

¹ makers: using human creativity and ingenuity to craft a physical solution

Primary measure of success: A systems development process that focuses specifically on the needs of the client and valorizes the role that tacit knowledge plays both in the development of the system and on a continuous basis post system delivery. A human-machine symbiosis.

5. CONCLUSIONS

Systems design engineers need to challenge the rigidity, control and power play inherent traditionally in the design of systems for fear of “imposing” a system on workers, and feeding into the already present fear and anxiety involved in the introduction of any form of automation. The HCS systems design approach realigns control and power with the client and

increases the chance of success for a quality system crafted and shaped to aid the user of the system. It is hoped that this seemingly “provocative act” of creating a Manifesto will refocus a light on the values and ethics important in Human Centred Systems that use a socially responsible process to produce non commercial and socially beneficial products.

This paper emphasises the difference between commercial systems design and non commercial systems design for the benefit of society. In the latter the power center needs to shift away from the system designer to the human at the center of the system. The humans’ tacit knowledge needs to be highly valued and respected by informing the design of the system to create a human machine symbiosis.

Questions that have emerged from this paper are - is there the need for this relentless pressure that comes with rapid software development when designing a non-commercial knowledge curation system created for and on behalf of society? Would a slower development approach be more appropriate?

This is not to say that all the rules are disregarded and a non-structured way of software development be adopted, on the contrary, it asks some very serious questions – are we dealing with a different kind of system design for knowledge curation which places the human and societal good at the center of it rather than profit? – is there a fundamental misfit with current methodologies which are used to develop systems for commercial gain? - is there a better/different ideology and supporting methodology required for the production of such socially useful non commercial systems and if so, what is it? Instead of following traditional methodologies, (Agile supporting methodologies now included) developed for designing systems for commercial gain – some of which harkback the Taylorist “one best way” - should we ask ourselves – is there a mismatch - is it now time to make a change? Within the Insyte-Cooley Lab in tandem with the genesis of this new Manifesto a supporting methodology is slowly evolving.

“We can only see a short distance ahead, but we can see plenty there that needs to be done.” (Turing, 1950)

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