

## A Discourse on AI and Society: Your calculus may be greater than his calculus But will it pass the Sullenberger Hudson River test?

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**Abstract:** This paper has been submitted as *Survey Paper* on technology development with the emphasis on *manufacturing* in view of their impact on humans, society, the environment and international stability. It deals with automation per se, the "Factory of the Past" and the "Factory of the Future" and "Industry 4.0", also referring explicitly to AI systems. It thus incorporates *Looking back* as well as *Looking forward*. Considering the complexity and the wide span of such a theme, we are expecting a discourse with a wide spectrum of participants. In the center of our paper stands the engineer, philosopher and author *Michael Cooley* from Ireland, and his recent poem *Insulting Machines*. It means that we are using the *narrative patterns of poetry* leading up to Cooley's fight for the - still controversial - concept of *Human Centered Technology Design*.

**Keywords:** Manufacturing Processes, Artificial Intelligence, Human-centered Design, Cultural Aspects of Automation, Ethics

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### 1. INTRODUCTION

This paper – and the corresponding session - is bi-directional: *Looking back* and *looking forward*.

*Looking back*, there are the *technology developments* which we all have been working for. Within the session, we are specifically referring to the approaches which we have been discussing within IFAC during the past decades: *Human-Centered Systems*. Many developments as triggered by the then new technologies on our planet, however, have become a worry and threat to society (despite the improvements in the lives of all of us around the Globe as never before envisaged).

*Looking forward*, we are presently compelled to take into view the next 30 years. We as engineers and scientists are confronted with two main lines of possible developments in the future:

*On the one hand*, new technological systems (e.g. AI) are emerging, and others are fundamentally changing. It means fundamental changes to our ways of living and acting – thus: Will we as humans still be *Masters of our own technology systems* in the near future? What different roles would be assigned to us then?

*On the other hand*, there is the *climate change* closely linked to *exponential growth* of world population – thus: Will we still be *Masters of our Globe* in about 30 years' time? What different roles would be assigned to us then?

In relation to these two views, we are referring to several people from the 19<sup>th</sup> century and the last 100 years who have been most influential in creating the world we live in today – with its great achievements as well as its great disasters and pitfalls.

We have made the engineer, philosopher and author *Michael Cooley* the central figure of this paper. During his active life, Mike has been most influential and controversial in his fight for Human Centered Technology Design. He has been our partner in discussion and cooperation for nearly 40 years, initially within our IFAC Technical Committee 9.2 (Social Impact of Automation), and later on within the present Committee 9.5 (Technology, Culture and International Stability – TECIS). He has also been strongly involved with the Journal *AI and Society* (AI&S, Springer, London). We will use his poem *Insulting Machines* (2013) to discuss in a wide-spanned manner the different questions coming into view as we think about *AI and Society*.

With this decision, we are following a different track altogether from how we normally write papers within our scientific community: we are not writing about technology per se and its problems; neither are we envisaging futures on the basis of our views of technology achievements and pitfalls; we are actually using the *narrative patterns of poetry* as they have been used by Mike Cooley in order to get his fundamental criticism of our present days and our futures across. But first of all in the subsequent paragraph, Mike Cooley will be briefly discussed and honoured.

## 2. AI, SOCIETY AND HUMAN-CENTERED SYSTEMS

In reflecting on AI and Society in the human-centered tradition, however, we turn initially to the seminal books *Architect Or Bee* (1987) and *Delinquent Genius* (2018) by Mike Cooley, and the seminal book *Computer Power and Human Reason* (1976) by Joseph Weizenbaum. The deep concern of instrumental reason articulated by Weizenbaum continues its march in the guise of Big Data machine learning algorithms. We see an increasing manipulation of data to support and control human interactions, institutional and organisational structures. Moving beyond their (algorithms) role as computational artefacts, what concerns us is how these algorithms take account of the limits of our 'entrenched assumptions about agency, transparency, and normativity'. Mike Cooley through his historical insights into the evolution of digital technology, from calculation to computation of the recent past, provides a stimulating narrative for understanding the impacts and implications of new digital technologies of machine intelligence and automation. His argument is that only by gaining insight into historical evolution and contexts can we "identify discernible laws of development, and having understood these laws to use them to scientifically predict what effects the equipment will have on our members in the future."

Cooley's main concern is the *misuse* of technology, which can amongst other things create a frantic work tempo for some and the dole queue for others. He recognises that technology and social organisation interact to elevate the nature of man's existence to a higher level, whilst appreciating that even the most sensitive faculty of man, that of memory and his nervous system, has now in many ways been extended by computer supported decision making. Although humans with their skill and ingenuity were able to create the technological change from the early stages to the advance of artificial intelligence, the society that has given birth to them tends to fail to keep pace with it.

Whilst grappling with the impact of automation on the one hand, and envisioning the common-good potential of augmented AI systems on the other, we face social challenges of governance, ethics, accountability and intervention arising from the accelerated integration of powerful artificial intelligence systems into core social institutions. With the exponential rise of big data flows in networked communications and their manipulating algorithms, the gaps in *translation* are now too vast to grasp and address, rendering us unable to engage with difference through the shadows of machine thinking. Augmentation and automation places the human in the predicament to accept the calculation of the machine without judgment.

We echo Cooley's concerns of 'socially irresponsible' science and ask whether we can transcend the instrumental reason of machine thinking to mould technological futures for common good rather than turning them into a single story of 'singularity'. Can we re-appropriate the idea of causality that has been taken by 'science' and reframe it in the making of everyday judgments and decisions? How can we harness

collective intelligence as a transforming tool for addressing complex social problems? Just as Cooley narrates his argument situated in the context of his days, we need to draw upon various AI narratives of the relations between society and the scientific project of AI and the challenges it poses for us to come up with possible symbiotic AI futures.

In exploring AI futures, we should take note of Cooley's reminder that the scientific project is always embedded within a particular social order and reflects the norms and ideology of that social order. In this perspective, science ceases to be seen as autonomous, as it internalises ideological assumptions. Thereby it is shaping the design of systems and tools and theoretical frameworks of its validation. Cooley notes that throughout history science has shaped ideas and critical knowledge which contributed to liberating humanity from the bondage of superstition and religion. Science, thus, acted as a key ideological prop of the outgoing social order.

*Darwin*, in making redundant earlier ideas of the creation of life and of humanity, and the *Galilean* revolution destroying the earth-centered model of the universe, illustrates that science is not just shaped by the ideological assumption but also shapes the rationalities that are practiced by society. *Cooley* thus makes us aware that critical oversight of emerging technologies of the artificial extends far beyond that of scientific abuses, to deeper considerations of the nature of the scientific process itself.

Cooley notes that it is true that the drive for scientific knowledge has provided the material basis for a fuller and dignified existence for the community as a whole, it must not however be a blind unthinking drive forward, shirking our social and political responsibility to analyse its effects upon society. Any meaningful analysis of scientific abuse must probe the very nature of the scientific process itself, and the objective role of science within the ideological framework of a given society. As such, it ceases to be merely a 'problem of science' and takes on a *political dimension*. It extends beyond the idea of important, but limited, introverted soul-searching of the scientific community, and recognises the need for wider *public involvement*.

Just as the old technology arrived at a historical breaking point at which the old society was deemed to be transformed into a new one, the technologies of the artificial are now beginning to generate a situation in which society is once again facing the spectre for a new transformation. The challenge is thus to create a strategic framework that facilitates this change in response to technologies of computerization and automation, for example in dealing with the disruption of social, economic and cultural life, especially when life becomes synchronised with the computerised environment.

Cooley asserts, however, that the rise of the contradiction of technology and society "cannot be resolved within the framework of a free enterprise system, since they are but manifestations of the irreconcilable contradictions between the interests of the exploiter and the exploited." For Cooley,

‘Socially irresponsible’ science not only pollutes our environment, it also degrades us both mentally and physically as mere objectified beings and reduces us to mere machine appendages.

This sentiment is clearly displayed in his poem entitled *Insulting Machines* which was originally published in the journal *AI&S* 28, 4, 2013.

### 3. COOLEY’S POEM: *INSULTING MACHINES*

*It is a graceful degradation bristling with  
Paths not taken*

*Supercharged by Taylor’s one best way  
with all the zeal of the monotheist.*

*Where Schumpeter shoves, Kondratiev waves  
and Gladwell points*

*All in hot pursuit of singularity.*

*Behold the strange phyla as they stalk their makers  
They too can walk, feed, talk and - some say - think.*

*We create devices and then they create us.  
Narcissus-like, we gaze into a pool of technology  
and see ourselves.*

*We acquiesce in our own demise  
setting out as participants  
and metamorphosing into victims.*

*The diagnosis is serious:  
a rapidly spreading species’ loss of nerve.  
Tacit knowledge is demeaned  
whilst propositional knowledge is revered.  
Who needs imagination when there are facts?*

*A human enhancing symbiosis ignored  
whilst a dangerous convergence proceeds apace-  
as human beings confer life on machines  
and in so doing diminish themselves.*

*Your calculus may be greater than his calculus  
but will it pass the Sullenberger Hudson river test?*

*Meantime, the virtual is confused with the real-  
as parents lavish attention on the virtual child  
whilst their real child dies of neglect and starvation.*

*Potential and reality are torn apart  
as change is confused with progress  
With slender knowledge of deep subjects-  
you proceed with present tense technology  
obliterating the past  
and with the future already mortgaged.*

*The court of history may find you  
intoxicated with species arrogance  
recklessly proceeding without a Hippocratic Oath.  
Meantime, the deskiller is deskilled,  
as a tsunami of technology  
rocks our foundations.*

*The multinational apologist solemnly declares  
“We should have the courage  
To accept our true place in the evolutionary hierarchy:  
namely animals, humans and post singularity systems”.*

*Now the sky darkens with pigeons coming home to roost  
and the mine canaries topple from their perches unnoticed.*

*That distant sound grows louder.  
Is it the life affirming energy of Riverdance  
or the clacking hooves of the Four Horsemen ,  
That music, is it ‘Ode to Joy’ or is it ‘Twilight of the Gods’?*

*As the embrace tightens into genteel strangulation-  
will the seducer in final deception whisper  
“Shall I compare thee to a Summer’s day ?”*

### 4. THE POEM’S ANALYSIS IN ITS CONTEXT

This paper aims at discussing in depth the controversies around AI and society. The poem by Cooley tries to describe the different views of both our present and our futures in a most concise manner. Thus we, the authors of this paper, are making use of this poem for these discussions by providing an in-depth analysis of this poem. For this task, we are relying heavily on Michael Cooleys’ own words from his book *Delinquent Genius* (2018). These quotations are written in *italics* within the paper.

#### **Taylorism: The one best way - Painting the picture**

*It is a graceful degradation bristling with  
Paths not taken  
Supercharged by Taylor’s one best way  
with all the zeal of the monotheist*

One of the authors of this paper, Brenda O’Neill, reports about her own experiences of Taylorism as reflected through factory life in the recent past:

“I am recalling memories of a factory in the city in which my family and I have lived for many generations. The time period is the 1970’s. I recall, as a child, playing in the front garden and waiting for my father to come home for dinner. The hooter on the factory always sounded at 2 o’clock. It had a distinctive sound (like an air-raid hooter) and rang out over the whole city. I knew when I heard it that my father would be pulling up in his car at any minute as we always had dinner at 2 o’clock.

In later years my sister worked in this factory and so I heard stories of the regime that existed there. Things like: piece work, toilet doors being pushed open if you spent too long in the bathroom, the crushing of the factory workers as they all tried to get in through the front door when that siren rang out.

I can recall, in later years, passing the factory and the strong smells coming from it. It had no air conditioning and used a lot of animal glue - (air conditioning hadn’t been heard of at the time) and in the hot summers of the Irish 1970’s, working in the asbestos roofed factory must have been like hell on

earth. There were a number of “supervisors” some of whom gave the workers a very hard time. Many of the workers suffered from what was then called “their nerves” and what we would now call “a nervous breakdown” because of the constant stress under which they worked.

There was a constant onus on how many pieces you needed to get done within a certain time. Constant pressure prevailed. Employees lived in fear of being fired and losing their livelihood. When I was old enough to figure it out I realised that this was an implementation of Taylor’s time and motion studies – Taylors’ “One best way” and I wondered: Best for whom?

It was implemented with all the zeal of the monotheist i.e. the belief in a single all-powerful god – that God being the *scientific method*. And the factory that I remember was only one example, it was replicated in many other towns and cities, not only in Ireland but across the world.”

Frederick Winslow Taylor (1856 –1915) was an American mechanical engineer who sought to improve industrial efficiency. Taylor was one of the intellectual leaders of the Efficiency Movement and his ideas were highly influential world-wide. Taylor summed up his efficiency techniques in his book *The Principles of Scientific Management*. His approach is also often referred to as Taylor's Principles, or Taylorism.

*“Initially, society used to think of factories in the familiar terms of steel mills or Ford-like production lines in the automotive industry. The factory model has spread plague-like from these more obvious starting points to become an all pervasive model of how we should organise ourselves.”* (Cooley, 2018, p31)

This Taylorism concept was, thus, fundamentally challenged by Mike Cooley and many others in the last decades of the 20th Century. Mike Cooley was a man who understood deeply what it means for factory workers, artisans and traditional communities to work under this kind of a scientific culture. This led to the creation of the Lucas Plan in the 1970s by Cooley and his co-workers. The workers then argued that State support for the - financially weak - Lucas Aerospace Corporation would be better used developing socially useful products and production rather than continuing to supply military contracts. This proposal did not get implemented.

Cooley also points to the widespread use of the factory model, e.g., in farming as seen in scientific layout of fields, chemical-intensive farming and egg production, but also in our services like hospitals and hotels as well as cultural and educational domains. Standardisation is the death knell for cultural diversity. In education, standardisation and interchangeability have become key issues. Cooley states that this is problematic:

*“But this approach is not without its deep contradictions and dilemmas. If it is possible to produce this conformist*

*mechanistic fodder for the “real world” there is the related problem that they must not be so conformist as to be totally void of some spark of originality. Otherwise where will the product innovation programmes and new markets come from? On the one hand, too much originality, creativity and imagination would be perceived as systems disturbance and would be unacceptable.”* (Cooley, 2018, p37/38)

These examples show that in the course of the technological world we live in, Cooley speaks rightly of many paths not taken.

*“We are locked into a sort of crazy bicycle economy where we have to keep frantically pedalling forward, for if we ever slow down the bicycle will topple over. Islands of sanity do remain, but the seas of destructiveness and irresponsibility are ever rising to submerge them.”* (Cooley, 2018, p168),

The results of this destructiveness and irresponsibility are evident today in the current state of our planet. Robert Frost (Frost, 2011) in his poem “The Road Not Taken” states “But I, I took the one less travelled by and that has made all the difference.” Michael Cooley showed astounding ‘bravery’ in taking the road less travelled by. This led him to being one of the first recipients of the *Right Livelihood Award* in 1981- the equivalent of the *Nobel Peace Prize*.

## Scientific Approaches

***Where Schumpeter shoves, Kondratiev waves and Gladwell points  
All in hot pursuit of singularity.***

One of the most influential economists of the 20th century, Schumpeter popularized the term "creative destruction" in economics. His “gale of creative destruction” describes the process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating the new one” (Caballero, 2019).

Nikolai Dmitriyevich Kondratiev (1892 –1938) was a Russian economist: He believed that Western capitalist economies have long-term (50-to-60-year) cycles of boom followed by depression. These business cycles are now called "Kondratiev Waves” (Corporate Finance Institute, 2019). These cycles constantly feed the industry.

Malcolm Timothy Gladwell (born 1963) is a Canadian journalist who published *The Tipping Point: How Little Things Can Make a Big Difference* (2000). The term "Tipping Point" comes from the moment in an epidemic when the virus reaches critical mass and begins to spread at a much higher rate.

## A Dystopian Vision: The Singularity

***Behold the strange phyla as they stalk their makers  
They too can walk, feed, talk and - some say - think.***

The term *phylum* was coined from the Greek meaning "race, stock". Does it mean here that these robots may soon be considered a new race pretending to live on our planet next to us, the human race? Are we going to see soon that such humanoid robots can think? Are they starting to stalk us humans like a lioness stalks its prey?

Michael Cooley describes the plot of this special relationship as follows:

*"The action centers on a perverse form of relationship in which one partner is the artificial creation of the other. As the story unfolds, we can behold a bizarre metamorphosis in which the artificial partner becomes increasingly real and the real partner becomes increasingly artificial".* (Cooley, 2018, p5)

There is the relentless march of artificial intelligence (AI) progressing in pursuit of the 'singularity' i.e. the moment when computers become smarter than humans. AI development is on this route – has it reached critical mass already or is it close to it? Is Artificial General Intelligence (AGI) the point of critical mass and therefore the tipping point of which Gladwell speaks?

The *singularity* is the point in time when AI controls man. When AI reaches Artificial General Intelligence (AGI) which is that of a human: then self-improving recursive AI algorithms will very quickly create an AI super-intelligence. Most of the promoters of the singularity see this super-intelligence as being a positive aid to human existence. However, a super-intelligence is still a machine. How will this machine be contained? Can it be contained? If it gets access to the internet then it will learn at a ferocious rate by tapping into common sense databases with inference engines like the *Never Ending Language Learner* (NELL) (Mitchell, 2019) being developed by Carnegie Mellon University, or CYC created by Douglas B. Lenat (Lenat, 2019).

There are those who are researching how to create a "friendly AI" but technology is moving so fast now that the development of AI is far outrunning this "friendly research". Super-intelligence devoid of human feelings is no longer a tool to be used by humans. It is the Master in the Master-Slave relationship of I-it (Buber, 2000) and we as humans are the slaves. This kind of super-intelligence devoid of empathy is analogous to a human psychopath. Humans have no more significance to it than a piece of string. It will try to protect itself the only way it knows how – it will stop anyone from turning it off. So any humans who try to turn it off will be looked upon as a threat. Why is no one doing the lecture circuits talking about this? It may simply be the case because we as humans with human intelligence cannot talk about or comprehend a super-intelligence multiple times more intelligent than us (see Barrat, 2015).

*"We have now become far too smart scientifically to survive much longer without wisdom."* (Cooley, 2018, p10)

## Narcissus and Us

*We create devices and then they create us.  
Narcissus-like, we gaze into a pool of technology  
and see ourselves*

*We acquiesce in our own demise  
setting out as participants  
and metamorphosing into victims*

Narcissus, a beautiful Greek hunter of the ancient mythology, was getting thirsty after hunting when he leaned over the water of a pool to drink – and he saw himself in the bloom of youth. Narcissus fell deeply in love with his own image, as if it were somebody else. He eventually realized that his love could not be reciprocated and thus he turned into the gold and white flower we now know as 'Narcissus'.

We, however, see ourselves as we are reflected back to ourselves, not through a reflection in a pool as Narcissus did but through technologies, e.g., social media, Instagram etc... We re-invent ourselves through these technologies and fall in love with our own reflections just like the ill-fated Narcissus in the legend. We, as a society, are slowly coming to the realization that we are turning into victims of our own technological creations as we are becoming fully dependent on them and today, we cannot even imagine a future life without them.

*"I hold that we create technologies as distorted mirror images of ourselves. We then gaze mesmerized, dazzled at those technological images and consciousness is numbed by what we see. This is narcissism in both the classical and modern sense."* (Cooley, 2018, p106)

## Tacit Knowledge versus Facts

*The diagnosis is serious:  
a rapidly spreading species' loss of nerve  
Tacit knowledge is demeaned  
whilst propositional knowledge is revered.  
Who needs imagination when there are facts?*

Cooley refers to the "lack of nerve" currently being experienced on an epidemic scale by humans as the reasoning facilities of computers (especially with the rise of AI and Big Data) have made them unsure of their own ability to reason.

*"A dangerous metamorphosis is in progress when we begin to regard the artificial as more important than the real; or, worse still, if we begin to be incapable of making a decision as to which is the better since we cannot recognise one from the other. Cultural and technological developments over the last ten years are rapidly driving us in that direction."* (Cooley, 2018, p20)

We as a species are indeed losing our nerve by checking and double checking our actions against AI outputs. We thus experience loss of faith in our very own human abilities and skills - our tacit knowledge. Tacit knowledge is the kind of knowledge that is difficult to transfer to another person by

means of writing it down or verbalizing it, e.g., the ability to speak a language, ride a bicycle etc. Our inability so far to capture such tacit knowledge and implement it into those systems may be the one thing that actually saves us from our own success as we strive to create ever more realistic copies of ourselves.

Our culture conditions us to think that when we have achieved something either great or small, we have done so in a highly structured way; however, Michael Cooley states that:

*“In point of fact, this is seldom the case. Accidental occurrences, unplanned encounters, capacities to recognize an opportunity, brainwaves, flashes of inspiration, passing stimulus remarks by colleagues, an inexplicable interest in a subject and a motivation are the real and unstructured ways in which we proceed through life.”* (Cooley, 2018, p62)

In contrast to *tacit knowledge*, the term *proposition* means here the formal or *explicit knowledge*, e.g., knowledge which can be true or false (nothing in-between). It has been used by Cooley when he is referring to *propositional knowledge*. Such propositions show up in modern computer languages – they can be characterized by Yes/No or One/Zero – nothing in between is allowed. We tend to place such objectified knowledge high on a pedestal. Therefore, imagination seems not to be needed anymore when we are surrounded by propositions and facts. Creativity, however, and imagination, love, respect, care, tenderness are all human traits which cannot be replaced by facts.

### Human-Machine Symbiosis?

***A human enhancing symbiosis ignore whilst a dangerous convergence proceeds apace-as human beings confer life on machines and in so doing diminish themselves.***

The relationship between human and machine is changing at a fast rate. We as humans are conferring life on machines. Thus within this process, we are changing our relationship to humans around us. One example is Sophia which has become a Saudi-Arabian Citizen. Sophia is a Hanson Robotics AI robot (hansonrobotics, 2019). It has been given citizenship as if it were a human in Saudi Arabia. It is argued that this does not elevate a machine to human status but it nevertheless denigrates humans to machine status. Michael Cooley warns against this:

*“One thing they will forget at their peril, human beings are very bad and incompetent as machines. If we reduce ourselves to the level of machines and try to compete with them, machines in their narrow sense will always be better than we are.”* (Cooley, 2018, p169)

What then is the difference between a machine and a human? Some argue that the difference is that humans are born with inherent dignity whilst machine or AI systems are not; others that our ability for language differentiates us from machines,

and others again argue that it is this *tacit knowledge* which differentiates humans from machines.

Our human personality develops with the I-Thou encounter of two humans through their communication (Buber, 2000). It includes for us as humans to negotiate with our partner in communication even if we do not really know what is going on inside our partner at that moment – and we always do have the chance to *ask*. With those ever increasing advances in artificial intelligence this I-Thou relationship is slowly being replaced by some new "I-it" relationship with machines. With this process, both the human-machine relationship and the human-human relationship are becoming blurred.

It has become very difficult even for system experts to find out or to guess why advanced AI systems may behave in an unexpected way at certain actions. Thus we as humans have started to un-learn to *ask the system*. The EU has very recently taken up this challenge by passing a parliamentary decision: “...when consumers are interacting with a system that automates decision-making, they should be properly informed about how it functions, about how to reach a human with decision-making powers, and about how the system’s decisions can be checked and corrected.” (EU, 2020)

Initially the I-it relationship was analogous to the Master-Slave relationship where the Human was viewed as the all-knowing Master and the AI was the Slave. Thus it seems that this I-it relationship with machines is now moving towards an I-thou relationship which in the past was only the preserve of human relationships – and now with the *Slave* appearing as the new *all-knowing Master!* As Kathleen Richardson recently pointed out, this new human-machine relationship is even being further fuelled by the relationship of humans with humanoid sex robots. (Richardson, 2019).

*“There are now many serious engineers and scientists who assert that the created is already surpassing its creator. The technological toys we have created are now so sophisticated, so elegant, so precise, so powerful, so ‘intelligent’, that they can surpass our own best endeavours, so these scientists casually refer to the human brain as the only computer built by amateurs”* (Cooley, 2018, p6)

Recently the concept of the *Digital Twin* has been suggested in order to model complex processes from reality within the virtual world by extensively making use of AI. It allows for the testing and optimization of such processes in a kind of virtual 3D laboratory setting in advance of – or in parallel to and in close interaction with – these processes as they are taking place in reality. As one example, Delbruegger & Rossman (2019) explain: The concept includes “fast feedback loops during system development ... and can be used as a search space for optimization algorithms.” So far the concept has even been introduced successfully in factory design but also in healthcare: “This can ultimately lead to a virtual patient, with detailed description of the healthy state of an individual patient” (Digital Twin, 2020). Today nobody can really imagine that such a concept may develop further into the sphere of modelling a proper *digital twin* of some human

personality per se - but what if we were to experience it some day? Is Mike Cooley already envisaging in his writings our digital *identical twin*, our digital *clone*?

### **Tacit Knowledge and Experience**

***Your calculus may be greater than his calculus  
but will it pass the Sullenberger Hudson river test?***

US Airways Flight 1549 was an Airbus A320 which after take-off from New York City's LaGuardia Airport in 2009, struck a flock of Canada geese and consequently lost all engine power. Unable to reach any airport, Sullenberger as the responsible pilot glided the plane to a ditching in the Hudson River off Midtown Manhattan. All 155 people aboard were rescued by nearby boats. Sullenberger was a former fighter pilot and a most experienced airline pilot. He was also a glider pilot and expert on aviation safety.

It becomes visible with this report that a computer system (in the poem addressed as YOU) may be greater at maths than Captain Sullenberger (here addressed as HIM) - but we can be certain that it would not be able to land such a crippled plane safely in the Hudson River. The automated system would not even decide on such a problem-solving strategy. Here the criticism of Lisanne Bainbridge comes into view. She suggested as early as 1983:

“If the human operator is not involved in on-line control he will not have detailed knowledge of the current state of the system. One can ask what limitations this places on the possibility for effective manual take-over, whether for stabilization or shut-down of the process, or for fault diagnosis...The straightforward solution when shut-down is simple and low-cost, is to shut down automatically. The problems arise with processes which, because of complexity, cost or other factors (e.g. an aircraft in the air) must be stabilized rather than shut-down. Should this be done manually or automatically?” (Bainbridge, 1983)

After the accident, Captain Sullenberger's decision to ditch the plane was tested and retested with several pilots by the air crash investigators at a flight simulator. All pilots could make it back to the airport within the time span which Sullenberger had at his disposal in the cockpit at that incident. He, however, asked them to add to this time the extra seconds that it would take the pilot to actually decide on the course of action, and when this was done: none of the simulated landing attempts made it safely back to the airport.

### **Technology versus Society?**

***Meantime, the virtual is confused with the real-  
as parents lavish attention on the virtual child  
whilst their real child dies of neglect and starvation.***

Many scientists today tend to break down everything by applying rules to it – Mike Cooley is suggesting here that even childhood itself is at stake to being abolished as it involves so much *tacit knowledge*. This knowledge which

“we know but cannot tell” has also been described by Polanyi as early as 1958. Some decades before Cooley but similar to him, Polanyi rejected the claim that *experiences* can be reduced into *data*. In his book *Delinquent Genius*, Cooley describes a discussion he had with a leading American Professor who was developing Expert Systems in the medical field. When he asked him what he thought of Polanyi this scientist said earnestly:

“‘Polanyi is a pain in the arse’. *I immediately divined that this was not a medical diagnosis at all, but rather his primitive way of saying that he didn't like Polanyi. It's a bit like that with childhood. For the reductionists, childhood is just one big pain in the arse.*” (Cooley, 2018, p40)

### **Ethics and the Hippocratic Oath**

***Potential and reality are torn apart  
as change is confused with progress  
With slender knowledge of deep subjects-  
you proceed with present tense technology  
obliterating the past  
and with the future already mortgaged.***

***The court of history may find you  
intoxicated with species arrogance  
recklessly proceeding without a Hippocratic Oath.***

Mike Cooley is deploring the lack of commitment among engineers for new, more ethical ways of doing engineering. If his claims were taken seriously today it may lead to renewal of the ancient *Hippocratic Oath*. Indeed, the demands for some new Hippocratic Oath of Engineering have presently come up once again.

The *Hippocratic Oath* is an oath of ethics historically taken by physicians. It requires a new physician to swear to uphold specific ethical standards. The oath is the earliest expression of medical ethics in the Western world, establishing several principles of medical ethics which remain of paramount significance today.

In recent history, there have been several attempts to create such an oath for engineers worldwide. As one example, we may refer to the *Fundamentals of Engineering Ethics* (2002) by the *German Association of Engineers VDI*. At that time the document was created in some communication with the IFAC Technical Committee on Social Impact of Automation. It is describing the professional responsibilities of engineers. Actually the document experienced very little visibility or impact in those days, neither nation-wide nor internationally, as may be mentioned here.

As another example of some more recent concern about such ethical stance, the EU may be referred to here: “The High-Level Expert Group on Artificial Intelligence (AI HLEG) has as a general objective to support the implementation of the European Strategy on Artificial Intelligence. This includes the elaboration of recommendations on future-related policy development and on ethical, legal and societal issues related

to AI, including socio-economic challenges” (EU-Ethics, 2019). Thus the approach includes explicitly the issues of *ethics* and *society*. This EU-based approach, however, has been questioned in the following way: “Because of its composition, the HLEG has been criticised for being dominated by business interests” (Algorithmwatch, 2019).

One more nation-based example may be mentioned here. In Germany, a State-wide approach has started in parallel to the EU approach, by the National Academy of Science and Engineering *acatech* (2020). Their view on AI and society has been stated as follows, in brief: “Putting humans first... Dialogue-based technology communication is the key to technology acceptance - new technologies can only succeed if they are accepted by society – and technology acceptance is not something that can be artificially manufactured.”

Therefore this group is aiming at dialogues which are urgently needed across all our societies. After all we need to take into account the fundamental changes which are on the horizon, particularly concerning working life at large. As the (also Germany-based) group *Lernende Systeme-Germany's Platform for Artificial Intelligence* has said, in brief: “There is reason to believe that jobs will be transformed substantially and that new skills are required. Cognitive, social and methodological abilities - such as independent learning, creativity, basic IT-knowledge or systematic thinking...” (Lernende Systeme, 2020).

It remains an open question how the discussion of these issues may develop during the next decades. These issues will certainly remain an important theme within the IFAC community.

### **The new Hierarchy**

***Meantime, the deskilled is deskilled,  
as a tsunami of technology  
rocks our foundations.***

***The multinational apologist solemnly declares  
“We should have the courage  
To accept our true place in the evolutionary hierarchy:  
namely animals, humans and post singularity systems”.***

During the past decades, this controversial viewpoint of the new hierarchy has been put forward by some computer experts to describe the advent of the new generation of AI and its implementations.

*“The forms of science and technology which have done so much obvious damage to nature and the environment are also doing us, as individuals, damage on a massive scale. In our technological narcissism we have created technologies in our own image and then so titivated and perfected that technology that we come to see it as superior to ourselves.”* (Cooley, 2018, p217)

### **Warning Signs**

***Now the sky darkens with pigeons coming home to roost  
and the mine canaries topple from their perches unnoticed.***

The results of our frenzied toiling in the implementation of a scientific culture are now beginning to be experienced by all of us. There are warning signs which are being ignored, warning signs as obvious as the *caged canaries* (birds) that in the past, miners would carry down into the mine tunnels with them. If dangerous gases such as carbon monoxide collected in the mine, the gases would kill the canary before killing the miners, thus providing a warning to the workers to exit the tunnels immediately.

*“For the first time in history, as far as I can see, the young, in large numbers, now display pessimism, apprehension and downright fear of the future”* (Cooley, 2018, p172)

This statement by Mike Cooley has been proved correct and is visible in the latest global demonstrations of school children against climate change, spearheaded by the young Swedish climate change activist, Greta Thunberg. The warning signs are obviously being heard by the youth.

### **Twilight of the Gods**

***That distant sound grows louder.  
Is it the life affirming energy of Riverdance  
or the clacking hooves of the Four Horsemen***

*Riverdance* is a theatrical show consisting mainly of lively traditional Irish music and dance by committed young people.

The *Four Horsemen* of the Apocalypse are described in the last book of the New Testament of the Bible, the Book of Revelation by John of Patmos, at 6:1–8. This prophecy describes a period of time when a quarter of the population of the earth would be killed: To the *Four Horsemen* " were given power over a fourth of the earth to kill by the sword (war), famine, and plague and by the wild beasts of the earth".

***That music, is it ‘Ode to Joy’ or is it ‘Twilight of the Gods?’***

These verses refer to the German poet Friedrich Schiller: his *Ode to Joy* (written 1795) is best known for its use by Ludwig van Beethoven in the final movement of his Ninth Symphony.

*Götterdämmerung* (Twilight of the Gods), is the last in Richard Wagner's cycle of four music dramas titled *Der Ring des Nibelungen* (The Ring of the Nibelung, or *The Ring* for short). It received its premiere in 1876, as part of the first complete performance of the Ring. The title refers to a prophesied war in Norse mythology, taking place among various beings and gods that ultimately results in the burning, immersion in water, and renewal of the world. The title of this opera has been taken up by the German power metal band Blind Guardian, with their song "Twilight of the Gods".



Michel Cooley sees an end coming and wonders which form it will take. Will it be a utopian world heralded with delightful music, dancing and joy, or a dystopian world heralded by ominous music and followed in close quarter by The Four Horsemen of the Apocalypse?

### The Final Embrace

*As the embrace tightens into genteel strangulation-  
will the seducer in final deception whisper  
“Shall I compare thee to a Summer’s day ?”*

This last line has been quoted from Sonnet 18 by William Shakespeare. These well-known verses of love are reprinted here, slightly condensed:

*Shall I compare thee to a summer’s day?  
Thou art more lovely and more temperate  
Rough winds do shake the darling buds of May  
And summer’s lease hath all too short a date...*

*But thy eternal summer shall not fade  
Nor lose possession of that fair thou ow’st  
Nor shall death brag thou wand’rest in his shade  
When in eternal lines to Time thou grow’st....*

With these lines, Shakespeare was envisaging the life of his beloved as *one eternal summer*. Mike Cooley, however, may have thought of comparing the time span of our human race on this planet somewhat similar to merely *one single summer’s day* and its passing beauty.

### 5. CONCLUSIONS: MIKE COOLEY’S INFLUENCE,

Michael Cooley founded – with many others - the international movement Human Centered Systems (HCS) which led to the development of ‘anthropocentric’ systems in Germany and the EU, and informed ‘socio-technical’ systems thinkers in the U.K, Ireland and Scandinavia. HCS valorises human tacit knowledge and strives to augment, but not replace it with automation (Cooley 1989). Thus the overall aim of the movement is to keep the operator within the loop and in control of the system. For this task the operators need to be supported with corresponding tools and with systematic and continuous training in order to counteract un-learning during those long time periods when nothing happens.

Cooley’s commitment has been continued with the activities of the IFAC Technical Committee 9.2 *Social Impact of Automation* during the 1980s and 1990s in the past century. Subsequently this concept of human-oriented automation has been further developed within the IFAC Committee 9.5 TECIS (Technology, Culture and International Stability) up to the current days.

In a time when huge focus and investment is on Artificial Intelligence (AI) and the creation of automatons are formed in our own image and likeness, the contribution of Michael Cooley has never been more profound and needed. Like

many an Irishman Mike Cooley is recognised more abroad than in his own native country. Ask any Irish computer science graduate who Michael Cooley is and see the response.

This is all about to change. The *Luke Wadding Library* in Waterford Institute of Technology in the South-East of Ireland is a strong instrument for this change as it has been fortunate to acquire the Mike Cooley Collection including his original writings and their basis materials. A new research lab has been formed – the Insyte-Cooley Research Lab. It is open for research into all questions on our technological and societal future, and today, undergraduate and post-graduate students are very interested in working with the collection. It is a trans-disciplinary lab comprising researchers from all disciplines, supported by the librarians, technologists and the students.

*“Conventionally, a system is only regarded as being scientifically designed if it displays the three predominant characteristics of the natural sciences. That is to say, predictability, repeatability and quantifiability. That by definition precludes intuition, subjective judgement and tacit knowledge. It excludes imagination, emotion and above all, the intentionality and purpose of the user”.* (Cooley, 2018, p208)

Society is largely unaware that in time it will owe an immense debt of gratitude to Michael Cooley for challenging the sacred cows of the scientific methodology and in doing so establishing the Human Centered Systems approach. HCS states that technology should assist but not replace the human, that there is a healthy relationship that can exist between technologies and humans in the form of a human-machine symbiosis. As Kagermann (2019) recently pointed out concerning specifically the Human-Machine Interface (HMI) under the impact of AI: “Therefore, the gap between man and machine is permanently narrowing. Every one of us is already confronted with HMI – even in our private lives.” And further-on: “...the digital transformation can enable a novel, human-centered manufacturing system in which humans concentrate on life-long skill improvement and continuously create high-value-added work. Essentially, this system revitalizes HMI, allowing both humans and machines to play a role in shaping digital society.”

This human-machine symbiosis is becoming even more relevant now in the development of systems that we hope to be both non-commercial, and beneficial to society – in the near future more so than today. We expect these systems to be created to also maintain cultural diversity as promoted by UNESCO (2005) in its globally recognised guidelines.

The then President of Ireland, Michael D. Higgins, pays homage to Cooley’s book *Delinquent Genius* when he states:

“What is particularly moving in it is that it takes all of these issues that have been raised in different fora, and in different ways and locates them in a biographical experience of a brilliant scholar. There is something immensely hopeful in

this, the sheer power that comes from retaining one's early curiosity, harvesting it through scholarship, and delivering it for the benefit of mankind" (Cooley, 2018 - preface by M.D. Higgins).

Let's leave the last word to Mike:

"The most fiendish ploy of the Delinquent has always been to chant the siren cry: "I am the one and only way". The 21st Century can and must belong to those who have the courage and common sense to reject this. Our future lies with those children, women and men who, in their very ordinary way, do care and can have within them, that long suppressed and extraordinary genius that resides in all of us and which now beckons us to heal our plagued planet and cure our disoriented selves." (Cooley, 2018, p217)

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