INTRODUCTION
This edition contains three papers which were the outcome of a panel that was held in October 2011 at Westminster Business School on behalf of the British Computer Society’s (BCS) Sociotechnical Specialist Group.

The origin of these papers, which explore what we mean by technology, come from a discussion that has been running on a social technology website called LinkedIn (Coakes, 2011) and under the auspices of the International Journal of Sociotechnology and Knowledge Development (IJSKD) Discussion Group. Although a journal brings structured papers where ideas are assembled in a sequence that make their grasp easier, the conversation on LinkedIn was far more fluid and meandering. I hope to convey a sense of that so the liveliness of the dialogue, the twists and turns, the thoughtful and sometimes a little random nature of real time conversation.

What I include here is a summary of the main points made in the three papers plus an edited and condensed version of the LinkedIn discussion. But first a few words about the articles so you gain a flavour of their subject matter and use this article to set the scene and introduce a topic that captured the interest of a very diverse group of practitioners, academics, students and for all ages. We hope this journal can allow some of that enthusiasm and passion to diffuse wider than the 30 or 40 people involved in this fruitful episode.

The first paper outlines a practitioner’s view of a systemic relationship between categories and argues we are blind to the collective effects of technology until, like global warming, there is an inescapable requirement to acknowledge them. Roy Woodhead, its author, says that the word ‘technology’ itself is seen as too blunt a label for the complexity it corresponds with. To differentiate between an instance of technology (e.g., a laptop computer) and the interconnected socio-technological view requires new words. He calls the instance view a “Technology-Instance” and the holistic view, the amalgamation of all Technology-Instances is called a “Technology-Collective”. He argues that whilst we may be able to control Technology-Instances, the Technology-Collective, which results from the emergent properties from all technology-instances, this aggregated view is uncontrolled because it is not recognised as something that needs to be controlled. He concludes that technology is a reciprocating relationship between Technology-Instances designed to perform functions
and the Technology-Collective which emerges out of the collective actions of Technology-Instances. All technology is designed with the intention of producing added value, to make living that bit better, and in ways we often call ‘progress.’ However, our causal theories of the world are sometimes inadequate and so some technologies have unforeseen effects that lead to disvalue for humans.

In contrast to Roy’s pragmatic-realist perspective, Per-Arne Persson, a retired academic and long time social scientist, presents a social constructivist perspective. He pointed at factors that contribute to the difficulties in understanding technology, and by providing examples that demonstrate the conceptual movement from the concrete to the abstract as we try to design, classify, and understand technology in our environments.

He says that Technology is no longer mainly substance, a physical thing. For Per-Arne it is the conceptualisation of what counts as technology that needs to be the subject of deeper enquiry. A technology is, or may be, reduced to a budget category and the people who handle this category may be totally unaware of the technology’s physical and social properties. When you read the seemingly commoditised term “technology,” you do not necessarily realize it is an abstracted view that is being considered. He told a story of a chain hung in a pigsty which had the effect of calming boisterous pig and so for us could be construed as a technology but for the pigs could have been symbolic of something else. The point is, the chain, a man made instrument had an effect the farmer valued. Per-Arne is arguing that technology operates on many levels of abstraction. We need to be careful when framing a particular definition of it as such may simply be one particular perspective amongst many and thus a parochial slice of a much richer phenomenon.

He continues saying that when we talk about understanding technology we should include the design and manufacturing phases, its gestation phase as well as its birth, life and retirement. We should be able to predict the consequences of it but this assumes knowledge that may in fact be partial. Indeed, his second question, about how to make technology intelligible, can be answered in two ways. One he says is that it is a matter of “knowing.” The second way is concerned with the design of technology, and about how it is “named.”

The third contribution in this collegial exploration is from Kamaran Fathulla, an academic from Essex University, who has a long standing passion for technology management. Kamaran was concerned with re-thinking our relationship with technology. Technology he says has always had a dual nature, its physical being and its ‘essence’ - both can be good and bad depending on the moment of evaluation, the situation and perspective of the evaluator. In his presentation he quoted Wolfgang Schirmacher (1983), who said:

“Our understanding of technology must deal with a phenomenon which will likely decide the survival of the human race .... An erroneous judgment on the nature of technology could have fatal consequences... What we know about technology appears to be insufficient”

Kamaran continued discussing what is missing from our current views of reality is the richness of the everyday real world and how dominant views have shaped our views of experienced realities. He also pointed out how the categories through which evaluation is made are subject to bias and oversight. So we need a schema to check our perspective is not unnecessarily confined. Early views saw technology as an objective external force that could have deterministic impacts as characterised by the steam engine and notions of empire. Later views saw technology as more of a product of shared interpretations or interventions. More recently a soft-determinism has thought of technology as an external force whereby the impacts are moderated by human actors and organisational contexts.

To summarize, these three papers are the outcome of an on-line debate and a panel with open discussion that has been externalised
and provided for consumption by our audience - the journal readers. We hope you enjoy the discussions in this edition of the journal. Before we turn to them though I would like to convey an impression of the conversations in LinkedIn, the sense of community that grew out of the exchanges. The starting point for the LinkedIn discussion was a question I posed to our readers at large: “What do we mean by technology?” I have anonymised comments but left the meandering structure of a real life dialogue as opposed to the highly structured papers that follow.

The following quote sets the context for what follows and a link to the BSC and its focus on Information Technology:

“I can see that without taking a more pragmatic approach the discussion can easily drift towards hundreds of shades of possible meanings of technology, and it will eventually die out. It is nice to discuss but the discussion should have its purpose.

Let me take a different approach and ask the question: what do we want to achieve by defining technology? What will we do once we differentiate between technology and (presumably) non-technology? I can understand the motivation of BCS, as it renamed itself to be a ‘Chartered Institute for Information Technology’. So, it may be an exercise in self-definition.”

My own final comment in the LinkedIn discussion was

“I now invite you to add to this discussion (Coakes, 2011) and contribute a paper on its contents and contribution to the debate to the journal!”

With this brief introduction I leave further reading and reflections to our readers!

The LinkedIn Discussion – A Condensed Version

Edited by Roy Woodhouse, Per-Arne Persson, Kamaran Fathulla, and Elayne Coakes

Editor: What do we mean by technology?

The stage was set by the above question by referring to classic definitions and what is seen as the genesis of thinking of what the Greek named “technologia,” involving systematic treatment, perhaps what we call technology. However, history has more examples on how terms have been coined and then redefined, reflecting shifting perspectives. As regards technology both social connotations and scientific views were mentioned.

After a slow start the question and the opening remark initiated a considerable web discussion. Actually, the first respondents wondered why so few joined the conversation. Those who successively joined the discussion, over a dozen participants by the end, came from both academia and industry. The activities culminated in the early fall, up to the end of September, and were less frequent after the mid-October seminar in London as the focus moved to producing the papers in this journal. At this occasion three of the contributors presented their views (see Roy’s, Per-Arne’s, and Kamaran’s articles) and many attended as members of the audience, and an active one too!

It was apparent that the seemingly straight forward question challenged the respondents. “Technology” is often taken for granted and people seldom appear to think twice about the concept or phenomenon. Clearly, “technology” is more than artefacts in the form of physical objects. One early respondent listed objects, knowledge/know how, procedures, techniques, methods, and processes and ended his comment:

“...And let’s not forget the sociotechnological view that sees technology as systems in which
people and technological objects interact. So our first realisation is that there is not a single view of it as many often assume. Unless we become more sensitive to what counts as technology we run the risk that it controls us, that our choices are given and so not as free as some presume. And there is another great question, “Do we control technology or does technology control us?”

Another respondent pointed to the phenomenon of multiple views not only of technology but also how problems and solutions occasionally can end up in antagonistic dualities (e.g., Schumpeter’s Creative-Destruction). The arguments led to a statement by the first respondent that few people see themselves as slaves to technology; in fact this person saw the controlling effect technology has on us as “the biggest problem we face.”

The notion that technology is controlling people and societies seems difficult to fathom at first. This difficulty illustrates the challenges to be overcome before someone can understand and seek to counter a powerful agent whose ‘power’ may in fact stand above critique. Following this line of argument leads to the conclusion that centuries of obvious technical and scientific progress may have been achieved by silencing critical perspectives that did not suit the mainstream. As such, our view of technology may have been functioning like a distorted lens or analogous to seeing and understanding reality through a prism. Technologies clearly display a strong rhetoric power. Scientific and engineering communities face challenges when trying to open up and inspect what is seen as normal, or rather to question the idea that technology is distinct from nature, existing outside us humans. Sociotechnology claims to do just this, to open up for inspection the relations between the social and the technical domains that co-exist.

Still in the first phase of the discussion, a respondent referred to Arthur C Clarke’s third law which asserts that “any technology if it is sufficiently advanced is indistinguishable from magic”. This respondent meant that technology could easily be seen as an illusion, of being magic-like, even designed to appear infallible, overwhelmingly capable (e.g., the latest generation of mobile devices), but we must not forget technology is fallible because it is designed with assumptions (e.g., the throwaway shopping bag that proved an environmental problem because the plastics did not degrade).

One respondent introduced a temporal perspective which illuminated the differences and the consequences, between ancient flint knives and, for example, the computer. A single device can be used for multiple purposes. However a flint knife has a limit to its usefulness whereas a computer currently seems boundless. This boundless source of ‘uses’ brings us to a new dynamic and one where it is necessary to ask whether the computer networks serve people or if people serve them. As we encounter more and more examples of cyborg technologies (e.g., blind people gaining sight through the implantation of a microchip in their brains) then the boundaries between people and machines will start to blur even more.

At this point in the discussion it reached the idea of man-machine interaction and led a newcomer among the respondents to refer to Anthony Giddens’ Structuration Theory and that technology is often open for re-interpretation, even reinvention. Technology allows expansion of the human “think and act space” and thereby issues of power and freedom of action become important. At the same time as intentions can be implemented, technology also means restrictions and canalization of action in to narrow channels that limit human serendipity.

Respondents again recalled Ancient Greek philosophy, this time by referring to Wikipedia (in itself an example of how technology can be designed and used):

“The word technology comes from Greek τεχνολογία (technología); from τέχνη (téchnē), meaning ‘art, skill, craft’, and -λογία (-logia), meaning ‘study of’.” (http://en.wikipedia.org/wiki/Technology)
Some respondent concluded: “So what we really mean by technology is the study (or discourse) about techniques. We can now have a discussion about what we mean by techniques...”

However, others did not believe a singular focus on technique was adequate; they are an element of technology but not technology itself.

There was agreement that the number of perspectives on technology is large, something that should surprise us given many began this conversation assuming technology is nothing more than the device such as a computer. Neither the discussion, nor this compressed version of it, claim that the arguments exhausted the topic, on the contrary. What was good was the absence of a desire to win arguments. This conversation was a dialogue where people put forward ideas to see whether they stood up on scrutiny, but at the same time wanted to learn from other people. It was a wonderful example of multidisciplinary enquiry linking academics, students and practitioners from the IT industry and beyond.

Words are fundamentally important in such a discussion as the goal is to check we all share the same meanings as we exchange ideas. There are a few related terms like technique, procedure, tool and method that are used and at least signal technology. Some meant that it was necessary to explore multiple perspectives as a collective effort – because individuals’ limitations are too obvious. In fact, the various forms of knowledge that Aristotle saw are useful especially if we see his synthetic paradigm as necessary in order to merge meaning through the combination of categories and so when trying to grasp a concept of truth:

**Techne**: Craft knowledge  
**Phronesis**: Practical knowledge  
**Episteme**: Theoretical knowledge  
**Nous**: Understanding (possibly intelligence or intuition)  
**Sophia**: Wisdom.

Further comment came as follows here:

“To to focus only on Techne is to deny the role others play. Phronesis is closely akin to technological thinking for example. I argue we must not become prisoners of the lens we look through. Techniques, methods, means-ends, are part of this discussion but they are not the only factors. Phenomenology for example looks at how technology interacts with the human experience. Don Ihde, from a Critical Theory perspective, also looks at technology through a different lens.”

For Aristotle one cannot have wisdom without also having the other modes of knowing. That is, they blend in the act of grasping the truth. So to focus only on Techne, and by implication of technique, is to deny the role others play in understanding how everything works, be that in Nature or in manmade systems such as the economy. Phronesis, practical intelligence, is closely akin to technological thinking for example, but is different. When someone argued “We must not become prisoners of the lens we look through” there was a desire to glimpse the light at the end of the tunnel as in Plato’s allegory of the Cave.

One respondent commented:

“What is intriguing, among several topics, is the common separation between the necessary ‘techne to design and build artefacts’ and then the ‘techne when/for using them’.”

I will touch a little more on the Greek philosophers and their view on knowledge. Roy Woodhead claimed that the word technology is too blunt, too imprecise for what we need to untangle – what should also be considered is whether the word knowledge is far too blunt also. Numerous philosophers from Democritus, Socrates, Plato and Aristotle to more modern philosophers have developed elaborated views
of different kinds of knowledge that are relevant to our journal. For our treatment of technology it seems worthwhile to point at a few of the central ideas.

“When one looks more carefully at this differentiation it becomes clear that Aristotle distinguishes between practical knowledge (techne and phronesis), on the one hand, and theoretical knowledge or theoría (episteme, nous and sophia), on the other. Against this background techne is the realm of knowledge contingent to the acquisition of skills for the purpose of making tools (production). Phronesis is the practical-ethical knowledge of human beings and action, which is not just universal, but also contingent and particular and therefore part of the human existential praxis.4 Theoria, though, is concerned with the universal, eternal, and non-contingent knowledge of ‘nature’ or the ‘divine.’” (Duvenhage, 2000, p. 96)

Duvenhage also points at action-oriented techne, and we can conclude that these aspects/types of knowledge have to be brought to the table together for a socially acceptable outcome. Later philosophers (Duvenhage mentions Gadamer) have found that these old ideas are still applicable.

When writing this I wanted to give you a flavour of the way new arrivals brought new topics and which non-academic practitioners seemed to enjoy. One such ‘new vantage point’ arrived when a respondent formulated a question that led to an interesting dialogue:

“I’ve been lurking on this conversation for a long time. I have a question: Is bread a technology in your view? I mean this as a serious question.”

The answers varied between bread as an artefact, yes a technology – useful for various purposes, that making bread involves several technologies.

After a while bread was described as a product of knowledge, ingredients, technology, and compared to making aircraft. Some technologies were associated with low-tech and some high-tech. This pointed to a distinction between science and technology, that science “has allowed us to push what counts as technology to much higher levels” and at the same time it was the invention of technologies such as the microscope which enabled science to advance.

One “reminder” in this interaction was when a respondent argued:

“This could take us back to (Max) Weber’s insistence that culture, history and other human processes intertwine in ways that are analytically difficult to trace. But they are still necessary if we are to understand things like well - what is bread?”

After this point in the conversations the focus moved to the subject of culture. The codification of knowledge and its transmission through technique to produce an object such as a loaf of bread or a silicon chip have cultural aspects such as common denominators of how they are made or how they are used. There are elements of art (techne). A respondent says here:

“As for culture, I see that as the product of some people shaping the values, norms and beliefs of other people so they behave in certain ways. Again, this follows a chain between ideas, practical insights that enable implementation and execution in the real world. So for me, culture is also a technology. There may be local attempts to create alternative cultures (e.g., Punk Rock Culture) but mainstream always dominates.”

The notion of culture led to a clarifying argument by one of the respondents who meant that:

“The concept ‘culture’ was discovered and exploited politically by people in work life in the 1980s and soon operationalized or rather began to be operationalized within management (and the accompanying management consulting industry) - actually it has been
deliberately treated as a technology (commodity?). A few models have been made for the repetition of the seemingly controllable process of manufacturing “culture”, using it as a tool for managerial control (leadership?). It is regarded as consisting of values (fundamental) and practices. Before the 1980s terms as “climate” or “ethos” were used."

We see here that culture “as a label on what people do, more or less in order to survive (also economically), or to secure their identity” is used as an instrument and as such an extension of management and therefore a kind of social technology in its own right.

One respondent criticized the tool perspective placed on technology. Even if individuals use tools (controls) these in turn are extensions, input/output devices for larger technological structures that Roy terms the Technology-Collective, often impossible to frame as part of human development. There are of course such aspects in our languages, specifically when we study engineered languages related to professions or engineering methods that become part of a culture.

One of the central topics when grappling with technology is the division of labour and specialization. Here a respondent says:

“The craftsman then makes the beam to the design of the engineer. Together, they produce a reinforced concrete technology. However, the craftsman does not necessarily know why a certain bar size was selected and why stiffeners were inserted and why the cement and water ratios are what they are. So in society the division of labour has also split craft-knowledge (Techné) and theoretical-knowledge (Episteme). It has done so in order to achieve greater efficiency. Here then is yet another indicator that some transcending system is at work.”

The division of labour is a designed consequence of specialization – one could say that technological diversification drives specialization whereupon new managerial coordination technologies become vital. That is, the needs of the technology-collective requires ‘needs; that others seek to satisfy such as the need for a professional management class and a skilled artisan class (e.g., the source of the marketers’ needs is often caused by technology, such as roads in winter needing tyres that can cope with snow). In the light of this, the before mentioned organizational culture can be given the role of coordination-technology or instrument – given that it can be operationalized (i.e., applied systematically). Some respondents argued that concepts and ideas can become technologies as much as things. For the realists, ideas do nothing until they are implemented in the real world. In light of this kind of difference of views we see the study of the philosophies of knowledge and of technology are justified. As one respondent claimed:

“So the relationship between culture and technology, its output(s), artefacts, definitely is important to investigate.”

This was acknowledged by another respondent who believed that there should be a mechanism of some sort between culture and technology in order to ensure the latter is an improvement. A few examples were given by respondents that show how human preferences as regards interaction with technology, if neglected, lead to rejection of the technology in question. Furthermore, where human involvement is replaced by technology as in the case of fly by wire or remote surgery, the experts noticed a loss of ‘feedback’ from the analogue experience which had to be mimicked to enable their prior experience to be replicated satisfactorily. One respondent talked of aircraft design and of feedback to pilots via controls, another talked about remote scalpel operations where physical feedback here related to the sensation whilst surgeons experience the act of cutting different types of tissue, a third gave an example from the car industry where drive by wire had to replicate the sensation of torque in a steering wheel.. It seems that how we design the allocation of task and responsi-
abilities between man/operators and machines is in the background to the consideration of what the technology is, an afterthought. One respondent added:

“As for providing ‘imitation feedback’ when operators ‘miss’ or ‘demand’ it, this can be a chancy business indeed. This is because often it is not clear even to experts what constitutes good or useful feedback. When radiologists shifted from plain old x rays to digital imagery, elements could influence both patient and operator safety to say nothing of operator compliance was ‘left out’. It’s not obvious or easy in such cases to identify what is valued and how to ‘reinstall’ it.”

The point here is that the designers of technology often lack the experience of technology users and so underestimate certain things that may well feed or be, modes of tacit knowledge or knowledge that is sticky to the process. Likewise, what if no one had ever driven a manual steer car? Would they need the feedback? If so, what does this tell us of the canalization of action in to narrow technical channels that limit exploration of human knowledge.

The discussion questioned what could count as a technology. One respondent believes everything created to achieve a purpose, and not given by Nature, is a good candidate for a technology. This approach sees the relationship between a mousetrap to the shop that sold it to the economy and legal systems and government and so on in a fully interconnected web of technological interdependencies. As one respondent remarked:

“Metaphorically, religion can be seen as a technology, even a drug. The key thing for me is the recognition that all technology-instances were created by humans and for some ulterior purpose.”

Yet another thread in this exploration of technology questioned the human-centric view of technology and introduced the fact that animals use tools. The respondent questioned whether technology has to be initiated by humans but examples from beavers building dams, chimpanzees using tools and weapons and such like meant the idea caught some interest but was abandoned quite soon. However, it would be interesting to develop this topic further, keeping in mind that when humans observe animals their behaviour is interpreted according to human frames of reference.

If these say “imitate” then the behaviour becomes different than with the considered and “insightful design” by an agent with foresight.

Remember also the Turing test. It questioned the basis of how artificial intelligence might be recognised and put forward the following: if it was impossible, within a constrained communication process, to distinguish between the responses from a machine and a human, then there was artificial intelligence at play, or rather the machine demonstrated intelligent behaviour.

It is a test of whether an idea has been formed that is influential, but we can never really know whether intelligence was involved or the machine simply applied a blind mechanical procedure akin to the conjurers ability to make us believe his trick was magic.

A parallel thread questioned the role of magic and rituals, introduced by another respondent who has studied this area extensively. He was triggered by the comment: “what biases may be at work on how we select the way we perceive?” and continued:

“This framework is what makes possible concealment or sometimes exposes what informs how a culture, a people, thinks about technology. I do think we don’t yet understand enough about how elites and any other kind of hierarchies interact with technology to make it seem plausible, desirable and logical (to have and use). To help you understand my own biases, my dissertation long ago was on German witchcraft and magic in which I took the position that magic is a form of work and knowledge and, not simply a “blind”, “primitive” impulse to perform ritual.”
The next turn in the discussion began after the mentioning of élites and led to the issue of control of technology.

“I think this notion of élites controlling technology is part of an illusion. I believe the reason doing xyz makes sense and ‘feels’ right is because the evaluation is done with respect to technological ends; the answer fits with some technological ambition so we assume it is correct.”

It seemed correct to him that powerful individuals may be able to influence short term effects (e.g., next 50 years) but the emerging macro-systems may lead to harmful effects for society. They are, without exception currently, not controllable on a global scale due to the way we collectively think and seek to manage technology; just as Feudalism was doomed with the emergence of labour markets necessary to drive deep ploughs that enabled surplus crops (i.e., producing more value than alternative solutions), so will other modes of organising society become outdated.

Consider the aggregated effects of societal growth based on fossil energy; there are many benefits. There are also some downside effects from the associated technologies that those in power cannot control. Maybe élites can profit from emergent technologies, profiting from them early on, but if the downsides start to emerge then conflicts of interest mean those powerful élites either have to change or stop what they are doing or cause global risks such as holes in the ozone layer. There are systemic effects between technologies and the social systems that rely on technologies for their existence; the élites and everyone else simply surf on the waves, but they do not ultimately control the waves, the Technology-Collective does.

Another argument demonstrated, the whole idea of the ‘blessings’ inherent in technology exposing more facets. The respondent meant that “there is at least in N. America a tendency to assume that ‘good’ technology democratizes and that ‘better’ or ‘best’ technology can help (in some automatic often unspecified way) level the playing field. He pointed at Giddens and Foucault as thinkers that give us some tools/technologies to map out these relationships.

We got an example, from Per-Arne who studied for decades the development of the political aspects of technology, and applied them to Roy’s term Technology-Collectives. It became obvious to him that the discussion related to Giddens abstract systems and expert systems that replace social systems (see reference list). During the 1950s, the new label for this computing machine became information technology, apparently a means to point at its benefits in organizational life. When Sweden’s defence politicians and planners introduced the Program Planning Budgetary System in the late 1960s (PPBS, copying the Pentagon’s idea) proponents claimed it all revolved around the digital computer that would allow real-time monitoring and continuous budget revisions. All HQs and staffs, regiments and garrisons got their terminals and some local computing capability (at last, law and order in the defence economy). But new hierarchies evolved.

The Supreme Commander hesitantly accepted this system because he would get more control of the Services’ budgets. The Department of Finance was also happy as superior controllers, as was the Secretary of Defence as it meant control of the Supreme Commander. More important, the system was politically marketed as a means to decentralize power to those who were responsible for operations, training, etc. Now key decision makers could get information and make informed decisions and flexibly adapt their businesses. The mantra was about the computer leading to informed decisions. Stimulated by the democratizing visions, local IT-initiatives mushroomed: Now was the time to use the new power made available by the computer; freedom at last. Certainly, there was a technical system and technologies, but the dominating system was:

“The beliefs, thinking and the routines, there was a new PPBS language, and new careers
emerged. Centrally, it became harder to counter arguments from subordinates who used the political idea of decentralization (including democratization?) to apply for resources for local IT projects. Rationalization was the word of that decade, too. The computer was by then since decades seen as the precondition for efficiency [so] said the National Institute of Defence Organisation and Management. The logic chain was: Computing - better and more rational business processes - better information - better decisions.”

A near-breakdown came when one respondent brought his frustration to the surface:

“Taking the situation to extremes, ‘technology’ is a ten-letter word (in English, that is) that can be used to describe any construct we like, if we collectively agree that such an attribution is valid. Therefore ‘technology’ can be an artefact, a process to make artefacts, an organization that implements a process, a consideration to make such an organization, social impact of such a process, organization or artefact, means to discover social structure, any human activity in general (as humans are altering their environment) the civilization, the society; just about everything. Throughout this thread we have touched upon the majority of those views.

While we are free to choose whatever we want (or discuss endlessly what it is that we want), we have to understand [the] implications of it. So, - for example - if we restrict ‘technology’ to physical artefacts, then the British Computer Society should not accept software engineers, as software is not physical. On the other hand, if we accept that the society is a technology, then BCS should develop a programme for ‘Charted Social Scientist’.

The selection - for me - comes with the fact that the definition should be useful - otherwise it will be simply abandoned. So: what is the purpose of this exercise? What will we do (barring book-writing) with the definition? Why is it important for us to make the distinction?”

The conversation again turned to what words being used meant. Maybe English is too blurred a language. We need a more precise way to discuss the nuances that could be interpreted as the meaning-in-use for the word technology. So, there may be gains from returning to the Greek thinkers and trace the words that have become too blunt.

Other arguments for a more thorough study of technology, towards a collective and integrated meaning of technology, were:

“1. The richness of the subject (i.e., technology) and the depth of its relation to humans. Thus its impact is great on our present and future.
2. We may be constraining the discussion at a low level, or call it operational level if you like, and may need to move the focus to one level higher to arrive at a collective or meta meaning that makes sense to all. Some of shades of meaning may in fact be one of the same or overlap with others and we need to sort of disentangle the terminologies.”

One of the topics we can discern was about the drivers behind technology: One specific instance of technology creates the need for other technology-instances. For example, the invention of mass produced cars, the need for a highway code, and then all the security technologies which actually were not specifically dealt with until the late 1950s when the rate of accidents became alarming and countered by several types of technical solutions; that is, one technology begets another.

The respondents reasoned and formed a list of technology attributes.

1. Technology is an externalization of a knowledge-artefact by an individual that can be used by others in a social structure;
2. Technology is neutral, it does not have any social value (good or bad) attached with it;
3. The knowledge-artefact externalised is used by society to build /(destroy) its supra-structure;
4. Human society grows as a self-sustaining living network;
5. Technology provides the structure on which this network is developed (human race co-evolves over technology and can very well destroy itself by its own hands);
6. Consider the impact of following on society (Discovery of fire, hunting tools, vaccines, Atomic energy, reaching the space, communication network, Water, Electricity, Food supply, etc).

The second bullet, of the neutrality of technology, met objections. It may be correct that science strives for value-free results (not only “knowledge”) but in the sociotechnical discourse every claim for ‘value-free something’ should be scrutinized indeed.

Values, trust and technology became one of the later currents in the discussion. Trust in technology has been studied extensively, specifically in control systems, large energy plants and transportation systems. One respondent underlined that for him motivation to study technology comes from the issue of the:

“Design of a technology that can be trusted. Not necessarily secure, not even always safe, but trusted. Something that can break, that can burn our fingers, but that can be still accepted. I do not see trustworthiness as an embedded property of the technological artefact itself (trustworthy car’), but rather as a property of a process by which the technology is being integrated into the society.”

It is hard to say if it is possible to formalize contracts (especially implied contracts that are unwritten) between designer and society. Within engineering’s IEEE and other professional bodies are codes of practice and codes of ethics. Even if harm is unintended, technologies can be turned in surprising directions as was the case on September 11 when civil planes were hijacked and used as weapons.

It is clear, as a respondent underlined, that trust has to include operators, but future operators may be totally detached from original intentions and design rationales and so a technical solution becomes a black box, a working mystery. Almost two hundred years ago, dynamite became the blessing for those who built society (e.g., railroads, canals, mining), and then competing nation states stumbled into what became the Great War. Dynamite destroyed was used with devastating effect as a weapon to destroy ‘strategic targets.’

The notion of design mode versus use mode (Orlikowski, 2001) is worth considering.

Another term of merit is systems thinking even if we know that the framing of a system can be arbitrary and therefore fallible.

As the date for the BCS panel meeting approached then the conversations searched for convergence towards what might hopefully be a conclusion. One respondent wrote:

“I am more and more convinced this communication could or even should be the platform for a conference on the topic we think aloud about (writes).”

And what about continued work? One respondent suggested that

“Having read the mail I see significant and encouraging parallels between the various viewpoints but there is a need to, if you don’t mind me saying, to disentangle the issues and reveal the underlying connections.

A good exercise we could undertake would be to list key words which we think are important to the discussion. Then we can see if the end list can be processed to remove repetition, ambiguity, etc., and arrive at a useful, meaningful, and rich understand that captures all of our views. Derive an integrated vocabulary/taxonomy of the meaning of technology.”

One of Roy Woodhead’s statements is close to a concluding remark and I choose to use it at this point in the comments:
“I see this as dealing with a layered effect as technology is inside technology and again is inside technology. So I also see the word ‘technology’ as too blunt for our use and in the paper I’m working on for the IJSKD journal, differentiate between ‘Technology-Instance’ and ‘Technology-Collective’. Even this distinction lacks the precision we need to describe what is going on.”

Certainly the discussion spurred interest and a sense of camaraderie was evident. One respondent asked:

1. Should we be satisfied with a definition of what technology means in itself and that is it?
2. How does a definition relate to other non-technical perspectives such as Ethics, Economical, Social, Aesthetic, Communication, etc.? Do we use our technology to derive these other perspectives? Or what? Do we say that technology has a dominance over all else? If not, then what is the nature of the interlinks?

Again, I can look at the Greek philosophers and their elaborated system of ideas. I will end by citing one of the respondents who commented at the seminar:

“It was good the other night and I sense we are all converging on a topic which could keep us engaged and busy for a long time.”

I believe our mission is starting and that is to understand the relationship between social systems, technology and knowledge. I hope the sense of community that sprung from the LinkedIn discussion can be seen in this write up. Further, I hope the following three papers will add yet more questions so that we move beyond naive stages of thinking we understand why things are as they are, when economic crisis, global warming, starvation and obesity on the same planet shows us clearly something is not quite right.

**SUMMARY**

The focus of the debate has been driven by the need to make sense of technology and hence its immense and critical impact, both for the present and the future, on us humans, society, and our environment.

The path towards this noble goal is not easy as the debate demonstrated. The issue is complex because of the multiplicity of views held by people as to what they think technology means and is. The difficulty in such a situation is to arrive at a framework within which views are shared and seen to be complementing each other rather than antagonising or being dismissive towards each other. What we achieved on LinkedIn is a respectful dialogue whose goal was to learn rather than win arguments and score points.

Listed is a selection of extracts from the debate demonstrating the diversity of what means to say technology:

1. Do we control technology or does technology control us?
2. There are Technology-Instances which combine to produce emergent properties that become the Technology-Collective.

   “There is not a single view of it as many often assume”

3. We may be constraining the discussion at a low level or call it operational level if you like and that we need to move to one level higher to arrive at a collective or meta meaning that makes sense to all. Some of shades of meaning may in fact be one of the same or overlap with others and we need to sort of disentangle the terminologies.”

4. Greek philosophers from Democritus, Socrates and Plato to Aristotle developed an elaborated view on different kinds of knowledge.
5. According to Anthony Giddens’ Structuration Theory: “technology to a certain extent always is open for re-interpretation”

6. Another respondent reminded about the phenomenon of multiple views not only on technology but also how problems and solutions occasionally can end up in antagonistic dualities.

Finally, the influences of established philosophies particularly scientific ones have not helped either. This is best captured in the words of one responder:

“Following this argument leads to the conclusion that centuries of obvious technical and scientific progress may have silenced critical perspectives, functioning like a distorted lens or analogous to seeing and understanding reality through a prism.”

What this debate and the three papers hope to achieve is to invite readers into a seeing and debating the essence of technology and its impact on us in a wider and richer approach than has so far been possible. Only through such an open minded and holistic context could we avoid the perils of what our own advances in technology could unleash on us and our wider world.

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REFERENCES


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