

Certification and Legislation

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Preamble

One of the mandates of each of the series of meetings on complex technical systems has been to review, rewrite, edit, amend, and elaborate upon initial position papers based upon insights and interactions that occurred at the meeting itself. I think this is a most laudable aim and one I was able to follow in previous papers (Hancock, 1991, 1993). However, on this occasion, I found that my understanding of certification in a socio-technical context was extended to such a degree that I felt constrained to develop a different paper from my other submission (Hancock, this volume) based upon the metaphorical, analogical, and literal relation between certification and legislation. I offer it with sincere thanks to Tony Debons and the other members of the 'why' group whose comments were so stimulating.

Introduction

I wish to compare the process of certification with how we develop and apply legislation, especially as it relates to individual behavior. Embedded in this parallel are analogical, metaphorical and literal relations as, at heart, certification must in some form intersect with legislation at a national, international, and global level (for complex aerospace systems at least). Behind legislation, particularly that which applies to individual action, lie assumptions about moral and social behavior. These are of course under continuous review and critique with such arguments taking more or less violent characteristics. However, we accept certain assumptions about behavior superimposed upon which are human created laws. We recognize that law in this sense is not strictly synonymous with law in a scientific sense (although the respective comparison is most instructive). There is continuous dispute about interpretation in legal circles and indeed judges, solicitors, lawyers, attorneys, barrister, and juries would be redundant if legal concepts were completely determined (this does not of course imply that scientific laws are without challenge). At a certain level, laws are empowered to *control* society. In a similar manner, certification is viewed by some as an effort toward control over certain events and processes. If, in the face of an undetermined environment we cannot guarantee control, at least certification is a representation for a *desire for control*. While systems are faced with the

vagaries of an uncertain environment, humans can be constrained more by law in their behavior since legislation is essentially arbitrary (and therefore is perceived as differing from scientific laws). However, we can imagine situations where individuals engage in unintended actions which result in transgressions of the law and also imagine circumstances in which we ask whether it is justifiable to transgress the moral basis of law (e.g., killing dictators). Therefore, the simile is partial since we seek certainty as an adjunct of control, but recognize that we cannot ubiquitously or even frequently achieve such an aim.

When control and certainty apply they are looking forward in time. That is, control is for a purpose and certainty statements always look to the future (since we believe the past to be determined). However, the function of *compliance* is one predominantly of enforcement. In legal terms, compliance to behavior is achieved by the force of power and punitive action. The majority of legal compliance comes from self-reference and appropriate laws which recognize enlightened self-interest (e.g., traffic laws). Compliance in certification terms is similarly framed. There is much hope that self compliance by professionals throughout the process means that best self-interest will achieve the best possible result. However, certification can be used as a tool of penalization. In essence, we *hope* professionals in system design and certification behave like law-abiding citizens, not needing policemen running around after them to ensure they behave properly. We *fear* that certification will be used as a bludgeon to cower individuals into compliance. The analogy is not complete since designers and system developers have to explore boundaries of what is known (in advanced aerospace systems), however most individuals do not 'press the envelope' of the law. The fallacious criticism of G. B. Shaw is appropriate here.

Only fools and idiots seek to change society. Therefore all societal change is affected by fools and idiots.

At the heart of this fallacy is the enlightened designer who seeks constructive ways to facilitate change. If compliance is an insurance function that oscillates between the past and the future, *accountability* is a historical process that seeks to attach individuals to the decisions and actions that they take. In law, we can happily talk of "diminished responsibility" when individuals for differing reasons are unable to recognize the consequences of their actions. Similarly for certification we cannot indemnify completely a design as we cannot have complete knowledge of all potential interactive conditions. Accountability then can only be used when in the process of design test and evaluation something was neglected which *could have been known at the time*.

One of the most important facets of certification in complex systems is the problem of technical evolution and non-stationarity. That is, we are trying to hit a moving target with something which is inherently time-locked. Systems evolve and change quickly, and it is dauntingly difficult to keep certification going at the same pace. There is, of course, a parallel in law at present, where for technologies like DNA and computer systems, legislation literally cannot keep up. Hence, the old question emerges. How to provide stability against the background of instability. For some, the greater the instability the greater the need for stability; for others the greater the need for flexibility. These are not mutually exclusive aims in adaptive systems.

I believe there are strong parallels between certification and legislation. They each represent human attempts to place arbitrary frames upon diverse and unpredictable entities. They should each recognize that such frameworks are by constraint, often arbitrary and therefore cannot provide perfect fits. However, their presence appears preferable to their absence. In a real

sense, science is also a member of this movement which is part of the human appeal for comprehensibility in the face of the incomprehensible. In that way, certification seeks nothing new but is part of a time-honored tradition which begins when the child must first make some sense of the "blooming, buzzing confusion." I have not explored the full spectrum of links and relations between certification and legislation. Also, I have not stated the obvious literal links where certification is, in actuality, a legal process. However, I hope the brief comments can help frame my final summary which asks the reader about their central beliefs of human society.

Summary

It might appear that there are inherent differences between my two observations on certification. I submit that there are none. In drawing parallels between certification and legislation, I imply a strong advocacy of neither. I am still naive enough to be an optimist. In the end we can come down to one's opinion of people. Do we have to generate minimum standards of behavior and conduct against which to hold the lowest common denominator, or can we aspire to self-generated standards which inspire the application of a highest common factor? The aged, the jaundiced, the worldly-wise will sadly shake their head and quietly admit to the former pessimism. This is so especially in light of the apparently immovable bureaucratic behemoth of social institutions. However, we have seen massive social change in the past decade and if survival is a requirement, pluralism is essential. It is all, I submit, a matter of education and a matter of social self-enlightenment. Sadly, to many we seem to be headed, as a global society, in the wrong direction. While life has become more comfortable, at least to those of us who rely on and benefit so much from the higher realms of technology (but we should note, still a small minority of the planet's population), it does not seem that life has become progressively more fulfilling. Indeed, many of the ex turn-on, tune-in, drop-out generation still hanker after the elysian 'escape' (Wooley, 1993). However, I shall end this essay with a phrase that my father was most fond of: 'it only needs a small candle to change a large darkness.' I think the nature of how we deal with our technology and the promises and indemnities with which we vest it directly relate to our view of the future. I like Kennedy's observation:

Some see the world the way it is and ask, why? I see the world the way it can be and ask, why not?

Let us hope that seeing the world the way it is does not blind us to the world that can be before it is too late.

References

- Hancock, P.A. (1991). The aims of human factors and their application to issues in automation and air traffic control. In: J.A. Wise and V.D. Hopkin (Eds.). *Automation and Systems Issues in Air Traffic Control*, NATO. New York: Springer-Verlag.
- Hancock, P.A. (1993). On the future of hybrid human-machine systems. In: J.A. Wise, V.D. Hopkin., and P. Stager (Eds.). *Verification and validation of complex systems*. Martinus Nijhoff: The Netherlands.
- Hancock, P.A. (1993). Certifying life. In J. A. Wise, D. J. Garland & V. D. Hopkin, *Human Factors Certification of Advanced Aviation Systems*. Daytona Beach: Embry-Riddle Aeronautical University Press.
- Wooley, B. (1993). *Virtual Worlds*. Blackwell: Oxford.