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Post-normal science in postnormal times

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ABSTRACT

Post-normal science (PNS) was a herald of postnormal times. For Functowicz and Ravetz contemporary issues in which 'facts are uncertain, values in dispute, stakes high and decisions urgent' necessitate PNS. PNS deals with the postnormal character of contemporary challenges by bringing the contextualised insights of non-scientific stakeholders to bear through the formulation of 'extended facts'. However, while the contextual content of 'extended facts' caters to the indeterminate character of postnormal issues this remains in tension with an implicit assumption that outcomes reflect the quality of the 'facts' informing them. This paper takes the claim that postnormal times involves 'that we abandon. . .ideas of 'control and management'' seriously by arguing that science should be the servant of outcomes framed in, primarily, societal terms, rather than the other way around. This argument is illustrated using the example of fashioning an effective response to climate change.

1. Introduction

> Normality is like determinism, both timeless and dated, an idea that in some sense has been with us always, but which can in a moment adopt a completely new form of life [1].

> We need to negotiate our way towards new normal times [2].

Post-normal science (PNS) was conceived as a means of confronting the increasingly 'normal', post-normal character of numerous contemporary challenges in which conventional distinctions between the spheres of facts, values and politics break down [3]. Inspired initially by global environmental issues PNS is widely considered paradigmatic of the shift from a traditional 'predict and determine' model of science to a more contextually sensitive 'assess and consult' one. While enormously successful and influential in this regard this article argues that contemporary 'postnormal times' [4] necessitate a more fundamental shift. PNS involves integrating the contextually informed insights of lay stakeholders with those of technical stakeholders in 'extended peer communities' so as to generate 'extended facts'. These help temper the technocratic character of traditional decision-making by engaging broader uncertainty and, although this is not always explicitly flagged, helping stem technical hubris. 'Extended facts' only go part way to addressing the imperative to ensure that proposed solutions are effective, endure and are widely accepted, however.

Although 'extended peer communities' help ensure that the solutions proposed are contextually informed PNS reproduces the traditional logic which assumes that superior outcomes rest upon the quality of the 'facts' informing them. This 'rational decision-making' approach, whose machinery is further detailed below, is predicated on securing an 'optimal' solution, perceived in ultimately determinate terms. While the sense of certainty underlying this has always been suspect postnormal times signals its death warrant. Taking the oversight of the broader community implicit in 'extended peer

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communities' to heart this article advocates an approach focused upon community evaluation of different outcomes conceived in terms of 'forms of life'. Tapping into Sardar's plea for 'imagination and creativity' [5] 'forms of life', a term borrowed by STS scholars from Wittgenstein, correspond to the complex interdependencies between culture, the specificities of everyday life, and the technoscientific achievements that result from (extended or otherwise) factual claims. A familiar contemporary example is automobility. A quintessential contemporary 'form of life' automobility is as much about day-to-day routines, the form and content of contemporary built environments, and the quality of urban air-sheds as it is about automobiles. While this continues the post-positivist trajectory of which PNS is part it also constitutes a discontinuity by subordinating science to an envisioning of outcomes in, primarily, societal terms rather than conceiving of them as fundamentally technical in character. This argument is developed here using the example of fashioning an effective response to climate change.

In practice political decision-making is less 'rational' than PNS allows for with outcomes rarely dictated by 'facts' [6]. While current institutional configurations tend to insist, explicitly, that postnormal challenges are framed as technical problems they are commonly, but implicitly, resolved politically [7]. While this implicit recognition of the complexity of postnormal challenges is not new the emergence of the further 'complexity, chaos and contradictions' characteristic of postnormal times [8] is taxing current institutions to the point where failure is becoming recognizably 'normal'. Matters as various as the global financial crisis and climate change signal the fragility of existing ways and means of decision-making and threaten the apparent, prior, consensus regarding their legitimacy. While an emphasis upon 'forms of life' is discontinuous with the ongoing tendency to privilege science in accounts of decision-making it resonates with, the implicit dimensions of, political practice. This is not to condone this practice, however, but rather to argue for the reinstatement of effective societal oversight by making the implicit in political practice, explicit. These dimensions of political practice have been well illuminated by Foucauldian scholarship.

For Foucault the content and character of contemporary life is moulded and shaped by structures of power constituted not only through politics, as generally understood, but also by the intimate interdependencies between governmental politics and other significant cultural formations, such as science. Foucault argued that from about the 18th C government became a technical exercise involving the facilitation of individual self-regulation focused upon compliance with governmental imperatives. He maintained that contemporary neo-liberalism sustains and reproduces itself through a plethora of mechanisms that induce and maintain individual behaviours conducive to the *status quo* [9]. While these forms of self-government are achieved via 'normalisation,' a term describing the way individuals self-police adherence to societal 'norms', the broader mechanisms by which such behaviours are achieved have been called *technologies of government* [10]. Although originally coined to describe 'human technologies', such as 'scientific management' and the nineteenth century invention of the 'popular schoolroom' [11], the author has recently shown how these ideas apply to techno-scientific achievements such as air-conditioning [12].

Air-conditioning, globally pervasive today, not only conditions air but also bodily dispositions, clothing habits and the form and content of built environments, in addition to displacing more traditional adaptive approaches to thermal comfort, while also significantly adding to rising energy consumption [13]. This influence is witnessed by fundamental cultural shifts, such as the decline in the *siesta* [14], giving air-conditioning all the hallmarks of a 'form of life' [15]. Analogous arguments apply to automobility. Residents of Houston tend to be far more inclined to car use than those of Zurich because car use is inscribed into Houston, both materially and culturally, far more than it is into Zurich. In other words, to paraphrase Marx, while people make choices these are rarely made in circumstances of their own choosing. In the same way that the residents of Houston 'choose' to use their cars far more than the residents of Zurich, people in air-conditioned buildings 'choose' to dress differently to those in non air-conditioned ones. These 'choices', however, are far from unfettered but rather profoundly shaped by a complex of interdependent influences constituted through policy, infrastructure, culture and, learnt, habit. Effecting substantive change to such 'forms of life' requires engagement with this nexus of influences rather than simply with particular technical aspects of them. By focusing upon the 'circumstances' structuring human choice-making, and facilitating informed choice regarding changing them, broad based societal evaluation of 'forms of life' has the potential to both further democratise decision-making and improve it's quality.

A focus on 'forms of life' is particularly well suited to broad-based societal oversight and evaluation because it encompasses the circumstances of everyday life. For most people it is these circumstances, and the character and content of outcomes, that matter, rather than the scientific and technological considerations that, at least explicitly, provide the fodder for political and policy debate. However, a focus on 'forms of life' not only facilitates community engagement but also engagement with issues in their entirety. In the case of automobility, for example, a focus upon 'forms of life' would mean deliberating not just car use, transport alternatives, the design of the built environment and land-use planning, but also the forms of community and lifestyles associated with automobility and transport. Community members typically conceive outcomes in analogously integrative terms rather than more circumscribed technical framings commonly adopted by technical experts. By engaging the nexus of interdependent influences constituting responses to issues of concern, rather than one, or other, aspect of them, this approach empowers citizen engagement with issues in their entirety. This approach has ramifications for the pervasive contemporary concern with risk, uncertainty, ignorance and complexity. These symptoms of contemporary anxieties regarding the erosion of the certainty once, commonly assumed, offered by natural science tend to shrink in importance in the deliberation of 'circumstances'. After all we expect the unexpected in the 'circumstances' that are our daily lives. These contingencies rarely overpower our ability to manage our affairs, however, precisely because we structure them to accommodate the unforeseen. While the larger scale of broad-brush societal

'circumstances' presents a more significant challenge we should not underestimate our species innate abilities in uncertainty management.

Numerous intersecting 'forms of life' such as automobility and air-conditioning structure contemporary existence. The inherently energy and material intensive character of these, underwritten by the traditional paradigm of economic growth, presents a significant challenge to the imperative for low carbon 'forms of life' that an effective response to climate change demands. Developing such a response requires engaging with current carbon intensive 'forms of life' and both conceiving of effective alternatives and of the means by which they might be implemented. This challenge is discussed in the following section.

2. Addressing climate change: facilitating a climate friendly 'form of life'

Key features of the predominant yet narrow, technically focused approach to contemporary challenges are spelt out in the conventional 'rational decision-making' model. This revolves around: (i) problem definition; (ii) the formalisation of a desired end-state; and (iii) technical characterisation of current conditions in order to scientifically structure the perceived problem. Objectives are then generated focused upon a technically 'optimal' solution, which are implemented and monitored so as to iteratively recalibrate the initial problem frame in a continuing manner. This model does not simply privilege 'technical characterisation' and 'technically 'optimal' solutions' but, in practice, those 'characteristics' and 'optimal solutions' preferred by the technical practitioners most influential at particular times and places. A key reason for the rise of air-conditioning, for example, was the success of early 20th C American engineers in achieving the ''scientification' of comfort' in the face of opposition from others promoting non-mechanical alternatives [16]. PNS provides a corrective to the implicit privilege this model grants science through licensing non-expert involvement in the characterisation of current conditions and in deciding the 'optimality' of selected solutions. Here, I argue that another step, entirely removing the implicit privilege granted science, is required.

Dominant discourses regarding how climate change should be addressed echo the techno-centric focus of 'rational decision-making.' Resolving climate change is, for the most part, couched in terms of mitigation and increasingly, as we become aware that climate change is occurring more rapidly than we might wish, adaptation. The former concentrates on the replacement of carbon intensive supply-side energy technologies, namely fossil fuel ones, with less carbon intensive substitutes such as renewables and nuclear power by way of a carbon price signal. While potential demand-side efficiency improvements are widely acknowledged to be substantial, achievable in the near-term and cheap, progress on this has been very limited because of a simplistic emphasis on technological efficiency and, arguably more simplistic still, insistence that consumers are *homo economici*. The latter, adaptation, currently has a decidedly 'postnormal' tone with initiatives such as UNICEF's: ''Saving lives through swimming lessons in Bangladesh'' [17] in the developing world and much focus upon the protection of property and infrastructure in the developed. For the most part then climate change is conceived as a technical problem to be resolved by technical means, with the narrow interests of different parties taking a high profile in the framing of these responses and substantive 'rationality' notable by its absence.

This lack of substantive 'rationality' is most marked by the failure of the *status quo* to acknowledge, and engage with, the primary problem underpinning climate change, and multiple other contemporary problems, which is the continuing energy and material intensive character of contemporary industrial society. Recently subject to a thoughtful and well-structured policy framed analysis by Tim Jackson [18] and underscored by other recent studies such as Graham Turner's 'A Comparison of Limits to Growth with Thirty Years of Reality' the *status quo* remains obstinately wedded to business as usual. Needless to say Turner's conclusion that ''the observed historical data for 1970–2000 most closely matches the LtG [limits to growth] 'standard run' scenario.[which].results in global collapse before the middle of this century'' [19] has received little acknowledgement and recognition. Criticisms of the 1972 *Limits to Growth* [20] study at the time, particularly that it failed to account for the declining intensities in energy and resource use resulting from technological advance, informed the idea that Sustainable Development, as articulated in the 1987 *Our Common Future*, required conventionally conceived economic growth [21]. While contrary to the evidence this view still, apparently, underpins the perspectives of contemporary governments.

Why then, in the face of these significant challenges, should critical attention be refocused away from the technical characterisation of problems to more desirable 'forms of life'? The essence of the response to this question is both that our current 'form of life' is the primary problem, and that this focus addresses the systemic character of our current predicament, which technical characterisations tend to both overlook and are poorly equipped to engage with. Air-conditioning and automobility are two examples of the primary problem - the material and energy intensive character of the production/consumption system, that we label 'the economy.' However, for governments today not only does 'the economy' constitute, for all intents and purposes, contemporary industrial societies but, counterfactually, they discern their primary task as being to 'grow' it in conventionally conceived terms. Resolving humanities current quandary is, thus, apparently a matter beyond the wherewithal of both traditional technical methods and contemporary governments.

This quandary requires a fundamental rethinking of the kind of societies we aspire to and then abstracting from this which technologies, which science, which economics might best serve this purpose, rather than the other way around. While this agenda might be advanced by rethinking particular elements of it, such as Tim Jackson's promotion of a new macroeconomics [22], more effective will be considered and strategically conceived integrative responses. While the substantive detail of such a response to climate change is beyond the scope of this article some initial observations regarding the potential for such response are outlined below after a firmer account of the integrative character of the primary problem.

2.1. The age of shopping

The material and energy intensive character of our economy is structured into the form and content of our material environments, our technologies, our practices and behaviours, and our culture. One, particularly key, aspect of this – the 'form of life' that is shopping – illustrates this well, although shopping is commonly misunderstood. Jackson, for example, attributes '[t]he 'iron cage' of consumerism' to the 'relentless pursuit of novelty' [23]. While an attachment to 'novelty' does capture some of the individual psychological character of consumption, this focus upon individuals reproduces the 'methodological individualism' of economics diminishing the many ways that contemporary consumption is structured into our culture, institutions and ways of being. The 1956 invention of the indoor shopping mall, for example, at Southdale in Minneapolis, was specifically facilitated by two antecedent developments: air-conditioning and the kind of urban sprawl spawned by automobility. Air-conditioning made ''interior spaces larger, more comfortable, more controlled and more difficult to escape...radically alter[ing] the way that time was spent in public.'' [24]. The attendant car spaces, commonly at least as big as the mall, testify to the complementarity with automobility.

This complementarity, however, bears witness to another. Mall and freeway patterned urban sprawl is an urban form exported from the US to the rest of the world, including the authors hometown of Sydney, in the decades ensuing WWII. Urban sprawl is increasingly derided not only for it's energy and materials intensive character but also for the lifestyle it offers. Arsenault, for example, discussing the Southern US concludes that, in tandem with other developments such as malls and TV, ''even if, on balance, residential air conditioning strengthened the nuclear family, the impact on wider kinship networks probably went in the opposite direction'' [25]. He further notes how these developments ''changed the southern way of life, influencing everything from architecture to sleeping habits...contribut[ing] to the erosion of several regional traditions...[including]...a preoccupation with kinship, neighborliness, a strong sense of place, and a relatively slow pace of life'' [26]. In the author's experience urban sprawl not only places significant constraints on the mobility of those without cars but also gives rise to lifestyles that contrast poorly with the more vibrant street life characteristic of many Asian and European cities. The trend in design for urban sustainability is, increasingly, to mimic such denser, yet typically more vibrant, urban forms that contain travel needs by design and facilitate the provision of urban services and utility requirements via greater population, and thereby, infrastructure densities. Such considerations are, or should be, at the forefront of policy attention today with ongoing investments in malls and freeways committing future generations to needless waste at the expense of more sustainable, and potentially liveable, options.

'The age of shopping' exemplifies some of the most fundamental contradictions of postnormal times. As Sardar discusses the fascination with technical optimality, conceived as efficiency, that has been a hallmark of modern 'normal' times now faces the 'Jevons paradox' [27], commonly labelled the 'rebound effect' in discussions of energy efficiency [28]. This insight that the savings from efficiency gains are, invariably, expended on further energy/material intensive investments should not, however, be viewed as a 'paradox' in 'the age of shopping'. Rather, under current conditions in which the continuing structural facilitation of further consumption focuses corporate, technical and political activity, and the exhortation to spend provides a constant backdrop to life, this 'paradox' has, unsurprisingly, become a 'norm'. The obdurate character of 'the age of shopping' runs even deeper than this, however, although it's historically contingent character is suggestive of how things might be made otherwise. The early 20th C American invention of a technical 'norm' for thermal comfort, now globally inscribed into both buildings and people, continues a far longer trajectory because, while counterintuitive, it turns out that ''[p]hysical comfort... had to be taught and learned'' [29].

John Crowley documents [30] the way comfort, as understood today, was invented through changes in values, material environments and behaviours from the 18th C onward. This involved ''political economists, moral philosophers, scientists, humanitarian reformers, even novelists... g[iving].*comfort*.a new physical emphasis as they reconceptualised values, redesigned material environments, and urged the relearning of behaviours'' [31]. Many of our consuming habits and practices, commonly assumed 'natural' in character, were similarly historically constructed. So, for example, the rise of reticulated water and waste disposal systems, inspired in great part by Edwin Chadwick's 1842 *Report on the Sanitary Condition of the Labouring Population of Great Britain* [32], has fundamentally shaped current domestic consumption practices and arrangements. Further domestic habits and practices were then conditioned by the domestic appliances and whitegoods that emerged early in the 20th C in response to the requirement of growing networked electricity distribution systems for a stable base-load, to ensure stable utility income streams. In other words much, if not most, of the content and character of contemporary consumption is historically contingent, could have been different and, therefore, might, given the political will and resources, be made different again.

So, the energy and material intensive character of contemporary 'forms of life' is interwoven through the ubiquity of political economy, shopping malls, systems such as air-conditioning and automobility, and mundane domestic practices. While dominant narratives, particularly those of an economic kind, tend to grant these a 'natural' status this is falsified by their historically contingent character that underscores how they could, given the circumstances, be made different. A focus upon the evaluation of current 'forms of life' and future ones we might aspire to, engages with both the systemic character of the *status quo* and articulates future goals in systemic terms. Currently, however, much groundwork is required to make this, even potentially, feasible. The systemic character of the *status quo* tends to remain opaque and a particularly pressing requirement is for further, near-term, illumination of this character. The development of such insights are constrained by the residual vestiges of positivism that elide the complex ways in which our world is constituted through numerous interdependent relationships between not only people, and people and things, but also how these are bound up with entities

and categories that transcend such distinctions such as *comfort*. It turns out, however, that this is less an issue for the community at large than it is for the technical elites we might expect to be focused by these matters.

2.2. Making things different

While substantive 'rationality' may be notable by its absence at the governmental level Functowicz and Ravetz's intuition that civil society lacks little in this department is witnessed through the numerous, flourishing bottom-up initiatives focused upon addressing climate change. Some of these very much echo the integrative arguments outlined above. The transitions towns movement [33], for example, focuses upon the development, and implementation, of an 'Energy Descent Plan' for a particular local area focused upon substantially reducing local dependence on external energy resources, building community and increasing the availability of local resources (of all kinds). Starting at Totnes in Devon in 2006 there were at the time of writing, in March 2010, 278 'officially designated Transition Towns' in 15 countries [34]. Notable is the movement's emphasis upon personal change and on the quality and structure of processes, matters commonly overlooked by the, technical, ends focused 'rationality' characteristic of the *status quo*.

The dynamism of the transitions towns movement is echoed by a host of related initiatives such as local climate action groups [35] and the international campaigns to which many of them subscribe such as 350.org [36]. The latter plays on the figure of 350 parts per million (ppm) of CO_2 in the atmosphere identified by many scientists as the highest safe upper level concentration of CO_2. At the time of writing this concentration stood at nearly 389 ppm [37]. The 'Peoples Climate Summit' *Klimaforum09* that occurred in parallel with the FCCC COP15 meeting in Copenhagen, December 2009, bears witness to all this at the global scale. The main website banner for this iterates the slogans: 'new ways of thinking'; 'new cultural values', and 'new ways of organising society' [38] echoing the argument above. Again a notable feature is an emphasis on process.

The artistic community is emerging as a particularly significant group articulating ideas resonating with those developed here. The 'Rethink' site, for example, focused upon 'contemporary art and climate change' and associated with an exhibition of Nordic art paralleling COP15 has sections devoted to 'rethinking' not only art but also politics, nature, social life, technology and borders [39]. The associated online forum notes that the interdisciplinary character of climate change demands "a broad cultural discourse. . .transcending conventional borders and interfacing with many domains, including politics, art, technology, nature, sociology, and philosophy, among others" [40]. Similar sentiments are increasingly common across the artistic community. The UK's RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce) is, for example, prominent in this particularly it's Arts and Ecology Centre [41]. This aims to "widen and deepen the theoretical base, to increase activity and engagement by artists and ultimately to play an energetic part in affecting policy and provoking change" [42]. This community is also notably quick off the mark. Blogging in February 2010 Rob La Frenais of *Arts Catalyst* notes "[w]ith the breakdown of Copenhagen, artistic strategies for intervention in radically re-thinking infrastructure become increasingly important" [43], something instantiated at 'Planetary Breakdown' in March 2010 [44].

The above examples suggest not only that the community at large possesses the substantive 'rationality', notable by it's absence at the governmental level, but also the energy, commitment and vision and to make it count. Markedly lacking, however, is much evidence of major links between such community initiatives and those technical elites, such as those in universities, working in the areas most pertinent to effecting change. History is, again, instructive with universities from their 12th C beginnings "not, generally speaking, the locales in which new ideas developed. They suffered from 'institutional inertia" [45]. The current bout of 'institutional inertia' has many dimensions. The increasing disciplinary specialisation of many in the academy simply renders specialists incapable of comprehending the systemic character of current problems and potential solutions. The positivist framing still typical of much specialist education commonly predisposes those so trained to discount arguments of the form presented here while much research funding acts to affiliate the funded with their, primarily *status quo*, funders. While there are many counter-examples to this 'inertia' they remain, for the most part, isolated both from mainstream practice and from initiatives in the community at large, matters readers of this article may wish to address.

3. Conclusions

The systemic character of post-normal issues transcends the ability of traditional, technically focused decision-making to deal with them. Such issues not only break down conventional distinctions between the spheres of facts, values and politics, but also are systemically co-constituted through matters as diverse as: political economy; the form and content of our material environments; our technologies; our practices and behaviours, and our culture. Conventional decision-making tends to elide the complex ways in which numerous interdependent relationships between not only considerations such as these but also entities and categories that transcend them, such as *comfort*, act to make up our world. The evaluation of 'forms of life' is one way in which this complex can be engaged. 'Forms of life' encompass the complex interdependencies between culture, the specificities of everyday life, and the technoscientific achievements that constitute them, facilitating both community engagement with, and the evaluation of, the entirety of issues.

This is well borne out by the contemporary dynamism of community engagement with climate change. In contrast to the more narrowly technically framed, and distinctly limited, responses of governments many community initiatives are focused upon both 'forms of life', in the sense of dealing with the everyday specifics of responses, and broader socio-cultural considerations. These initiatives tend, however, to operate without substantive involvement of the technical elites working

in areas most pertinent to the changes envisaged, undermining both the potential of such initiatives and the legitimacy of these elites and their *status quo* backers. This is accentuated by the way governments continue a fundamentally unsustainable business as usual economic growth trajectory suggesting that the mantle of 'rationality' now rests with the community at large rather than with those once conceived as 'the authorities'. Needless to say this is a state of affairs that those who sense some affiliation to the latter would be well advised to address.

Reorientating attention to the societal implications of proposed solutions to post-normal challenges can be characterised as the problematisation of 'normal' society, understood in a Foucauldian sense, rather than the PNS problematisation of 'normal' science. Foucault remains controversial in left-wing circles because he directed attention away from conventional centres of power – governments, corporations and so on – and onto the relationships between them and the governed that produce, maintain and sustain the power of the *status quo*. This view, however, not only discounts the potential of change from below but also the way a democratic polity requires relationships of this form in order to function effectively.

On one level there's nothing new in these ideas. In 1999 I described 'post-normal politics' as equating to:

> . . .a thoroughly democratic polity in which state level political power acts as mediator for a complex web of decision making bodies, many analogous to extended peer communities, distributed throughout civil society. . .such that matters of technological innovation, scientific research, the environmental impacts of infrastructure development and also lifestyle and other singular personal and community level issues become properly the province of intense societal debate and consideration focused upon the construction of broad-based public knowledge [46].

This article suggests that rather than 'broad-based public knowledge' 'intense societal debate and consideration' is better focused on evaluating 'forms of life' and, but more troublingly, questions the role of 'state level political power'. With many in the wider community articulating alternatives to the *status quo*'s ongoing allegiance to unsustainable economic growth the former, rather than the latter, can now lay claim to the mantle of 'substantive rationality'. The *status quo* appears unable, or unwilling, to countenance an alternative to the dominant neo-liberal model of governance in which people self-govern on the basis of material self interest. This model took some centuries to develop and implement [47] a temporal luxury we don't now possess. The current dynamism of civil society in addressing this is encouraging but without assistance from better resourced societal actors may fall short.

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[47] See: Hacking op cite, note 1; Foucault op cite, note 7; Rose op cite, note 8; M. Poovey, A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society, The University of Chicago Press, Chicago/London, 1998.