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The temporal gaze: the challenge for social theory in the context of GM food

ABSTRACT

The temporal gaze in socio-environmental theory can take many forms. Time may be added to existing approaches without disturbing the *status quo* of theory and methodology. Alternatively, focus may be on the time–space of socio-environmental existence or typologies constructed of the complexity of socio-environmental time. Finally, phenomena, processes and events may be conceptualized as timescapes. Through the focus on genetic modification of foods, the paper demonstrates the pertinence of this timescape perspective for social theory and socio-environmental analyses. A thorough-going temporal gaze is important because a) such reconceptualization forms an integral part of rethinking the social sciences' relationship to nature and environmental matters; b) the implications at the level of theory tend to be glossed over and ignored; and c) it is central to changing practice at the level of public and personal action. The paper thus uses a timescape perspective to set out substantive and conceptual issues that present some of social theory's challenges for the new millennium.

KEYWORDS: Timescape; socio-environmental theory; GM food; contextualization

INTRODUCTION

When, in 1979, Anthony Giddens set out the time challenge for social theory he formulated the Theory of Structuration to overcome the dualisms of structure and agency, system and process, synchronic and diachronic analysis. 'An adequate account of human agency', he argued at the time, 'must situate action in *time and space* as a continuous flow of conduct' (1979: 2) and 'grasp the *time–space relations inherent in the constitution of all social interaction*' (1979: 3). Drawing on the philosophical traditions of Heidegger, Husserl and Kant, Giddens set an ambitious agenda for social theory – possibly too ambitious since few theorists have managed to bring time to the centre of their theoretical enterprise. Instead, we find that with few exceptions (Adam 1990 and 1995; Game 1991; Nowotny 1994[1989]; Young 1988), social theorists have responded to that challenge

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in a minimalist way (Delanty 1999) or ignore it altogether (Callinicos 1999; Craib 1992; May 1996). Where theory is focused on a particular social theme or institution the picture is more encouraging. Here, time has been variously utilized for the analysis of postmodern economies (Harvey 1989; Lash and Urry 1994; Urry 1995), understanding the impact of information technology on globalized local social organization (Castells 1996; Rifkin 1987), making sense of the changing patterns of industrial work (Ingold 1995; Schor 1992; Young and Schuller 1991), and establishing its gendered nature (Davies 1990; Jurczyk 1998) as well as, finally, for theorizing the contemporary culture–nature relations of industrial societies and associated socio-environmental hazards (Adam 1998; Macnaghten and Urry 1998). Despite these partially encouraging responses to a difficult challenge, however, many theorists find it difficult to maintain the temporal gaze not just across the breadth of their work but even within a given piece of research. In his more recent books even Giddens has not sustained what he suggested was a necessary precondition to adequate explanations of the contemporary condition.

Where time is the explicit focus of empirical social science research, problems arise not around the consistency of the gaze but with retaining in the study the complexity of social time identified at the theoretical level. In studies of time in work and organization, for example, social time tends to revert to the neutral medium in which events take place and on the basis of which economic exchange is possible (Balbo and Nowotny (eds) 1986; Blyton et al. (eds) 1989; Carlstein et al. (eds) 1978; Melbin 1987; Schor 1992; Zerubavel 1981; Young and Schuller 1991). That is to say, the neutral, decontextualized, empty time of calendars and clocks remains the unquestioned medium and the parameter within which socio-environmental activities are experienced, constructed, recounted, recorded and commodified. However, 'this neutral medium', as Ermarth (1998: 357) insists, 'is achieved not found.' It is a 'particular convention', a construction of industrial culture that has been 'naturalized' and 'universalized' to become time *per se.*

> [T]he problem has been that the theorizing generally stops short of a thorough analysis of the conventions by which we maintain this 'time' . . . in the sense we assume it – as a neutral, homogeneous medium extending infinitely and 'in' which mutual relevance can be measured – [it] belongs to a fairly unique phase of Western culture: one in which European humanism underwrote empirical science and its technologies, just as it underwrote representation in politics and art. (Ermarth 1998: 356)

The difficulties of taking time seriously get further compounded when socio-environmental issues and the impact of innovative technology become the focus of social theory attention. From the inception of sociology as an independent discipline, 'nature' and the physical world were considered to be outside the disciplinary boundaries of social science. Cultural phenomena and processes, it tended to be reasoned, are the domain of social science enquiry whilst natural scientists explore and deliberate on the workings of nature and the cosmos. Not until nature came to be recognized as socialized, acculturated and socially constituted was it possible to consider the environment a legitimate subject matter for social scientists, just as time had to be defined as social before theorists could incorporate it into the mainstream of social science (Adam 1990: chs 5 and 7). Where an absolute, dualistic distinction had been maintained between social and natural time, the qualitative time of difference tended to be projected onto the social realm whilst the neutral, invariant, empty quantity, symbolized by the clock, designated the time of nature. This, as I have argued extensively in previous work (Adam 1988, 1990), is quite unacceptable given that the quantitative medium is the social invention and tool for socio-environmental control and, equally pertinently, its invariable neutrality exists nowhere in nature where time is marked instead by rhythmic repetition of the similar, by seasons and by contextual patterns of growth and decay. Moreover, with this social science strategy of designating nature and time social, the underlying dualism of nature and culture has been upheld for both and the traditional disciplinary boundaries have survived unscathed. Thus, it has been my argument over the past decade that the socialization and acculturation of time and nature go some way but not far enough towards adequately theorizing the contemporary social condition and the hazards that accompany the industrial way of life. The challenge for social theory as I see it is to expand the temporal gaze to depths and breadths that had so far fallen outside its field of vision, to touch the deep structure of social and institutional relations and thus to reach 'parts' and processes that other social theories can't reach.

In this article I want to show how the various ways of taking time seriously have very different effects on what we see and understand. Through the focus on debates surrounding genetically modified (GM) foods I consider their respective potential socio-environmental effects before mapping some of the pertinent features of a timescape perspective and exploring the conceptual challenges that arise from it. Finally, I reflect on the contemporary role of social theorists in a world where the construction of theories is inescapably implicated in the creation of socio-environmental futures. Initially, however, there is a need to give a brief outline of the issues and the context of the GM debate in order to provide the necessary backdrop to the development of temporal arguments.

THE GM FOOD DEBATE: A BRIEF OUTLINE OF ISSUES AND DEBATES

In Europe at the turn of the millennium the GM food debate is played out in newspapers, on radio and on the television. The players tend to be clearly and predictably defined: multinational companies and the scientists they employ are singing the praises of their products and casting opponents in the role of irrational, ignorant, politically motivated scaremongers. The majority of governments across Europe have come down cautiously on the side of business and science, assuring the public that they would not take that position if there were any doubts whatsoever that public safety could be compromised. There tends to follow a rider, however, to the effect that, of course, no activity is 100 per cent risk free. 'Safe' as European citizens have learnt during the BSE crisis, can only ever mean 'safe in the normal sense of the word'. Scientific advisors to governments tend to be not quite as unreservedly committed to this technology. In the UK, for example, they have recommended a moratorium on planting the first commercial crop until more scientific evidence about safety has been gathered. Across Europe, Non-Governmental Organizations from Friends of the Earth, to National Trusts and Consumers Associations are united in both their unease about genetically engineered food and their distrust of misplaced certainty and assurances about safety. The UK campaign for a five-year freeze on the commercial growing of GM crops, for example, is now supported by 56 different organizations including retailers and church groups (*The Ecologist,* Editorial, 29(3): 205). On 1 June 1999 Prince Charles took the unusual step to write a hard-hitting ten-point newspaper article in the *Daily Mail* in which he asked pertinent questions, all of which are still begging answers. In Austria, a referendum involving 1.2 million citizens resulted in Austria seeking to become a GM-free zone (Nottingham 1998: 139–40, 183). GM protesters in the UK regularly sabotage crops and by Spring 1999 the High Court ruled that 'environmental protesters could not be banned from interfering with GM crops' and 'that they had sound public interest arguments' (reported in *Farmers' Guardian,* 'Points of View', 23/04/1999: 10). Farmers are caught in the no-win middle, threatened with ruin either way – if they do not follow this latest competitive trend and if they do. Organic farmers loose the very basis of their existence since the mobility of the genetically modified materials means that the clear boundaries between conventional, GM based and organic farming can be no longer guaranteed and maintained.

The media present the diversity of views but have taken on the mantle of public protector and champion of the people's justified fears. Their reports speak the language of risk and hazards, of deception, greed and cover-ups. To symbolize the pervasive public unease, they use emotive and evocative imagery: 'scientists playing god', producing 'Frankenstein foods' and 'mutant crops', setting loose a 'genie that will never go back into the bottle', thereby creating an 'Orwellian future'. The spectre of the BSE crisis lurks ever ready just below the surface and is regularly drawn upon to serve as salutary reminder that assurances about safety by governments and scientists with vested interests are inescapably worthless in a context of fundamental uncertainty.

In the USA where GM crops have been grown commercially since 1995 – with 45 million acres of corn, soy beans, cotton, potatoes, canola and oilseed rape grown during 1998 alone – there seems far less public concern. However, a number of problems are emerging now that commercial GM crops have been established for a number of years. GM maize has caused damage to the caterpillar of the monarch butterfly (*Daily Mail,* 01/06/99: 10; *Independent,* 21/05/1999: 1, 3, 5), as well as lacewings and ladybird-eating prey (Ho 1998: 151). Transgenic oilseed rape has cross-pollinated with its highly fertile weedy relative which meant that in subsequent generations the new weedy plants were found to be herbicide tolerant (*New York Times* 07/03/1996: B14, reported in Rifkin 1998: 89). Major crop pests such as Colorado beetle, tobacco budworm and the diamondback moth have developed resistance to the *Bacillus thurringiensis* which has been spliced into a number of crops in order to 'free' them from attack by these pests (Rissler and Mellon 1996: 43). As Ho (1998: 151) points out, 'transgenic crops with insecticidal genes or herbicide-resistant genes actually favour the evolution of resistances'. US social analysts such as Jeremy Rifkin (1998: 75) have published extensively on the subject matter and his early publication with Ted Howard (Howard and Rifkin 1977) turned out to be highly prophetic. Rifkin's (1998: 75) warning that the 'long-term cumulative impact of thousands of introductions of genetically modified organisms could well exceed the damage that has resulted from the release of petrochemical products into the earth's ecosystems', does not seem to have been heeded by the US public. Europeans, in contrast, have responded with unusual strength of feeling to GM promoters' pronouncements that GM food is here to stay, that it is the future and that we had better get used to it. They are making their voices heard through opinion poles and demonstrations, by creating and joining anti-GM organizations, and by switching in large numbers to organically produced food.

Changing nature to better suit human need and desire, is of course an ancient cultural activity going back some ten millennia of agriculture and the domestication, breeding and hybridization of animals. Archaeological records indicate that ancient Egyptian cultures had mastered bread-making, fermentation and brewing techniques more than four thousand years ago. Thus, there is nothing new in the *motivation* to alter nature to improve the products of this nature–culture interaction in the direction of increased economic efficiency and productivity. The last 300 years of industrial activity, however, have seen this drive towards efficiency and productivity exponentially intensified. Towards this end the *methods* and the scale of their effects have dramatically changed, with geno-technology the latest in a long line of truly innovative methods to increase economic efficiency.

Time, of course, is a central factor in the industrial definition of efficient production. When time is money then speed becomes of the essence since the faster something moves through the system the shorter the time capital is tied up in production and the lower the labour costs and interest payments involved. Seen from the vantage point of industrial production, the genetic modification of crops and animals is merely the logical progression in a direction that begun with the dawn of human civilization. However, the way we understand the technology and its associated changes at the threshold of the new millennium, as I shall show below, depends not just on who is presenting the argument on the basis of what interests but also on the temporal assumptions that are brought to the analysis. As they are currently conducted, the media debates are time-blind; the temporal issues involved are either left implicit, ignored or negated. The arguments tend to be presented with two sides holding incompatible, diametrically opposed views. These can be summarized as follows:

In praise of geno-technology: GM technology will give us bigger, better and larger quantities of more nutritious foods. GM food can look and taste better. It can be stored longer and decay can be held at bay. It will reduce the need for herbicides and pesticides. It can be resistant to diseases, pests and adverse weather conditions while being tolerant to herbicides and pesticides. This in turn increases productivity and the potential to alleviate world hunger. Genetic engineering improves on nature, contributes to sustainable development and increases bio-diversity. Since GM crops are 'substantially equivalent' to conventional crops, their safety is assured and thus there is no need for extensive testing.

Arguments focused on the threats posed by GM food production and consumption are focused primarily on five issues: the mobility of GM materials, the increased use of herbicides and pesticides, the wider environmental implications, the limited and insufficient nature of the safety tests, and the effects on human health and the world's poor. GM materials, opponents thus point out, are mobile in a multiple sense: through reproduction, the food chain and pollination by wind and/or insects. This mobility means that, once released, genetically modified organisms (GMOs) cannot be contained within their intended boundaries and when herbicide-resistant crops cross-pollinate with weeds there is the potential for creating superweeds. Moreover, when boundaries between GM and non-GM crops cannot be maintained, choice is effectively eliminated for consumers. In addition, the effects on wild life are not just unpredictable but unknowable whether this be through killing off important links in the food chain, creating incompatibilities within plants which can turn them into poisons for other species who rely on this food source, or the extinction of entire species. Human resistance to disease may be weakened and the susceptibility to allergies heightened. Most importantly, in all cases contamination is irreversible: once released, GM materials cannot be recalled. 'Substantial equivalence', opponents agree further, is a vague and highly inappropriate criterion to underpin safety regulation on this matter. GM foods should come under the same strict legislation as drugs and the safety tests should be in independent hands rather than those of the companies whose commercial interest is at stake. Finally, opponents insist that GM food is not intended to feed the world's hungry but rather to feed company profits. World hunger is not an issue that is solvable by merely increasing the total quantity of globally available food. Rather, starvation is a distributional, political and economic issue. Since the production of GM food is a highly commercial enterprise, motivated by the promise of enhanced efficiency, productivity and profit, money will be needed to buy that food. The world's starving will therefore not be the ideal customers for this intensely farmed designer food.

Point by point, the opponents of GM food accuse the protagonists of lying, of riding roughshod over public opinion and fears, and of being motivated by nothing but selfish greed. The proponents, in turn, brand all who oppose GM foods alarmist, politically motivated, green lobbyists who are not only ignorant of the scientific facts but also deny those in developing countries a better standard of living and of bringing economic ruin to innocent farmers. In addition a substantial number of journalists place themselves firmly on the side of the opposition, albeit after first giving a full and 'objective account of the facts'. Thus, at suitable high-points in the debate the public is reminded of 'the facts' involved and have re-explained to them what genetic modification *is*. I will quote Joanna Blythman's explanation, as this encapsulates the UK media's approach to presenting the GM 'facts'.

> *What is genetic modification?*
> Genetic modification involves a gene from one living creature being isolated and spliced into the DNA of another plant or animal to give it new characteristics. For example, in America a gene from an Arctic fish has been inserted into tomatoes to make them frost resistant.
> The giant biotechnology companies which have developed crops in this way claim that they will give us better and more nutritious food, reduce our use of pesticides and save the world from hunger. They present GM foods as an unthreatening extension of long-accepted selective breeding techniques which have already been used to develop new wheat hybrids and cattle breeds.
> But selective breeding never went beyond the limits of what might occur in nature through cross-pollination, hybridisation and mating. It was only carried out within established species barriers: corn with corn, pigs with pigs and so on. Modern genetic modification is substantially different. It produces instant changes and allows genes from totally diverse species to be swapped around.
> This cutting and splicing of genes based on experiments as to how a gene behaves in a test tube does not tell us how the gene operates in its natural context or how it might behave in another species. Molecular biologists can only guess at the ramifications such changes would have in the food chain.
> But these techniques are being applied to food production at breakneck speeds. (Joanna Blythman, *Daily Mail Weekend,* Saturday, 10 April 1999, pull-out supplement p. 2)

In response to her own question about the risks involved she continues, 'the risks posed by GM food make the hazards of BSE pale by comparison'.

Despite the very limited nature of the media 'analysis', there can be no doubt that the approach, the message and the media's solidarity on the issue are effective in that wide-spread and deeply felt concerns about GM food have put on the public agenda and thus facilitate political debate on the matter. This clearly differentiates the European and US way of handling the enormous economic opportunities, the complexities of the awesome scientific advances and the potentially monumental health and socio-environmental hazards that seem to come as an integral and inescapable part of the package.

On the basis of this technology people's lives world-wide are going to be more thoroughly transformed in the early part of the next millennium than they had been over the past one or even two thousand years. The significance and extent of these changes, I want to suggest, is too important for analyses to be left to the transnational corporations and their scientists who seek the economic rewards, to politicians caught up in the mindset of global economic and scientific competition and to journalists whose prime task it is to sell maximum copy and increase their viewing figures.

Social theory has much to offer here. Its imput to the analysis could provide much needed breadth, depth and sophistication. To be effective in the public domain, however, social theorists would have to achieve fundamental changes in both the medium and the message. It is not enough, in other words, for social theorists to write for fellow academics and students in a language that is inaccessible and perceived by most non-academics to be exclusionary. Creative thinking and activity are needed to overcome the tradition without at the same time 'throwing the baby our with the bath water'. I shall reflect on the public role of contemporary social theory at the end of this paper. First let me demonstrate how an explicit focus on time affects the analysis and how different ways of taking time seriously alter what we can see and understand.

THE GM FOOD DEBATE IN THE KEY OF TIME

Take 1: Add-on Clock Time

The most conventional way of taking account of time in analyses of the GM debate is to simply add time questions to those of space and quantity. This means, to questions of 'what', 'where', 'how large' and 'how much', we add questions about 'when', 'for how long', 'in what time-frame' 'in what sequence' and 'at what speed and intensity'. To temporally extend analysis in this way is conceptually benign because it does not interfere with existing frames of meaning and empirical scientific investigation since the time involved is that of calendars and clocks which is principally external to events.

Adding clock time to the debates on genetically modified foods would thus mean a mere shift in emphasis and focus, illuminating issues that previously had been left unaddressed. Thus, for example, in addition to establishing the potential space of contamination and the numbers of animals and the types of crops affected, the focus would move to questions about when trials are being conducted and over what period, so as to establish spatial and temporal patterns of both desired and potential undesired effects. There would be questions about whether or not the time-scale of the tests matches (and therefore is appropriate to) the time-scale of the potential threats involved. Furthermore, when time is added to the analysis, genetic drift is no longer merely an issue about mobility over space and matter – that is, fields, crops and other species – but about temporal mobility and the length of time such drift can continue into the future. When the answer has to be ‘for ever’, it dramatically changes the gravity of the issues involved. Consequently, we are dealing with something altogether more serious when the planting of GM crops does not just affect neighbours’ fields but all of time, all future, from now to the end of time.

Once we begin to ask detailed questions about the chronology and sequence of events and actions, successes and failures, predicted outcomes and surprises, we leave behind the established parameters of the debate and thus make it more difficult for the promoters of GM food to respond with the standard answers. Since a lot of the answers to these questions would have to be ‘don’t knows’ and ‘can’t possibly predict’, the science involved begins to look less certain and substantially more humble. Similarly, if we enquire about the speed and intensity at which the innovations are introduced and tested and with which changes are being forced upon a reluctant public, we may get less flannel about world hunger and more about companies’ need to get a fast return on their capital outlay, about competitive markets and the need to be first with any innovation, about how time is money and speed of the essence, about exit strategies, that is, the need to have made the profit and sold the company before trouble strikes and litigations begin to roll in.

All of these ways of bringing time into the picture operate with the time of clocks and calendars. This socially constructed time is a neutral, decontextualized, quantitative objective medium which is external to the events it measures. It can thus be added without disturbing the methodology and framework of the analysis. On the contrary, on the basis of its abstract, objective quality, clock time is utilized as the common denominator that binds humans, animals, crops, fertilizers, scientific competition and the global market into a universal temporal framework of analysis and comparison across incommensurables.

Take 2: The Importance of Context

To recognize the mutual dependence of time and space and to understand environmental processes and events with reference to their inescapable inter-dependency would be a second way of taking account of time in socio-environmental analyses. In this case there is an appreciation that time and space constitute an indivisible unity where space always implicates time and vice versa. This means acknowledging that it matters to the state and productivity of a plant, for example, whether it is day or night, summer or winter, in Africa or Greenland, at sea level or in the mountains of Wales. It means appreciating further that the state of the plant's life-cycle and its position with reference to other plants and animals have a bearing on its existence. Space and time constitute the context and context matters.

Such acknowledgement of the importance of context, however, has to be viewed against a background of scientific knowledge where *de*-contextualization is associated with the highest levels of truth or, to put it differently, where truth is inversely related to its dependence on context: true is what holds good irrespective of time and place such as mathematical relations and scientific statements about gravity, causality and motion. While de-contextualized truth continues to play an important role in the physical and mathematical sciences, in the life sciences such disembedding plays a far more paradoxical and contentious role. In the field of genotechnology, molecular biologists are divided in their approach to context. Reductionist genetic determinism, for example, is rooted in an understanding that excludes the wider context.

> For those imbued with the mindset of genetic determinism, the major problems of the world can be solved by simply identifying and manipulating genes, for genes determine the characters of organisms; so by identifying a gene we can predict a desirable trait, by changing a gene we change the trait, by transferring the gene we transfer the corresponding trait. (Ho 1997: 156)

It is this reductionist, decontextualized conceptualization of the workings of genes that underpins commercial exploitation of genetic research and its application in genetically engineered foods. Much of the evidence accumulated over the last twenty years of new genetics suggests, however, that a) no gene works in isolation; b) the genetic network is subject to layers of feedback from both the organism's physiology and the relationship to its environment; c) this feedback can facilitate mutations; and d) genes can transfer horizontally, that is, outside the original host organism (Ho et al. 1998: 148; and see Ho 1997; Holdrege 1996). This means that isolated facts can be properly understood only if they are conceptualized within their larger context. Since, moreover, context is not merely spatial this involves taking account of time. As Holdrege explains, 'the plant is never whole in space; the whole is created in time. Living in time, the plant successively pours its form into space. . . The "time-body" of the plant engenders its "spatial body" ' (1996: 40). Contextual understanding is thus fluid, processual and relational.

The work of the German molecular biologist Regine Kollek (1995a, 1995b) is helpful for clarifying the importance of context for the transfer of genetic material. Proteins or enzymes with identical biochemical properties, she explains, do not necessarily fulfil the same function. This means that the same material property, depending on its specific context, has a different ecological relevance. Not its DNA sequence but its position in a particular chromosomal and cellular context determines the function of a specific gene which means that the invisible time–space of interaction is central to particular material expressions. Beyond this internal influence of cellular context and position, furthermore, phenotypes are developing with reference to their extra-cellular contexts in interaction with their environments. Any geno-technological intervention, therefore, has ramifications at all these levels.

The controlled laboratory conditions of this experimental science produce specific, desired and highly predictable results about the action and function of individual genes. Since, however, the multiple layers and levels of interactions and contextual differences do not form part of the theoretical framework of the experimental science of molecular genetic engineering, its knowledge is only valid for the laboratory context. It does not apply, therefore, to the interactive reality of phenotypic involvement in the environment. In other words, the behaviour of a genetically altered organism in its environment cannot be deduced or predicted from its controlled laboratory conditions. Thus, whilst releases of genetically modified organisms, for example, may not necessarily result in a hazardous situation, the efficiency of the experimental manipulation nevertheless inescapably stands in an inverse relation to its predictability in the environment. Context matters. Its inclusion or negation affect what we understand and see.

Take 3: Profiling the Multi-dimensionality of Time

So far, time has been referred to in the singular only. Whether as the add-on social time of calendars and clocks or as the inescapable contextual counterpart to space, time was conceived unproblematically as a taken-for-granted dimension of social reality. Taking account of time in socio-environmental theory, I now want to argue, entails that we make the implicit explicit and recognize time's multiplex function and expression since time is not a single dimension but affects socio-environmental life on a multitude of levels and through choreographed clusters of temporal characteristics.

A number of social theorists have produced typologies that take explicit account of the multiplex nature of social time (Bergmann 1992[1983]; Elias 1992[1984]; Giddens 1979, 1981, 1984; Gurvitch 1964; Lauer 1981; Luhmann 1982; Mead 1959[1932]; Moore 1963; Schutz 1971). Since I have analysed in detail this body of work with its largely incompatible conceptualizations of the complexity of social time (Adam 1990 ch. 1; 1995), I shall just summarize the key features of the multi-dimensionality of time before outlining how a timescape perspective would encompass it in socio-environmental theory. Table I below sets out the basic structure of this complexity which in part or as a totality permeates our reality and its socio-environmental processes.

TABLE I: *The multi-dimensionality of time*

4 T's	PPF	Rhythm	
time frame	past	duration	beginnings
temporality	present	sequence	ends
tempo	future	repetition	pauses
timing		instantaneity	transitions
		simultaneity	

Time frames can be of a natural cosmic kind such as years, seasons, moons, days and tides. Alternatively, they can be of an embodied kind such as cycles of reproduction, digestion and cell renewal. Finally, they can be of a cultural kind, the way we have already encountered them above in the form of calendar and clock time where years, months, weeks, hours, minutes and seconds constitute the frames within which social activity is conducted.

Temporality denotes the time *in* things, events and processes which is unidirectional and irreversible: we grow older rather than younger; cars rust; growth is followed by decay. Equally, this is the time of regeneration, renewal, evolution and creativity. It is the time of change. It is the forming of form, the naturing and socializing of nature. It is *natura naturans,* the invisible productive power that brings forth the visible form of nature, the *natura naturata.*

Tempo is the speed and intensity of actions, processes of change and transformations. It indicates, for example, how fast innovations are introduced to a system which, in turn, has an impact on the scale of effects.

Timing and synchronization are integral aspects of interactions – be they natural, cultural or a socio-environmental combination of both.

Every thing, organism, being and event is located in the past-present-and-future continuum. Every being has a *past, present and future,* lives its past and present into the future. As an individual and a social entity, it has a history and a biography as well as a destiny.

The *duration-instantaneity* continuum refers to the degree of expansion in time along the time-frame or the past–present–future axis, as such it could be considered a sub-category of the time frame or the past, present and future dimensions of time.

Sequence, simultaneity and repetition refer to the way things and events follow each other, happen at the same time or are repeated to create a pattern or rhythm.

Actions, events and processes, although embedded in an overall rhythmic continuum, have *beginnings* and *ends.* They have *pauses* and are marked by *transitional periods.* Here the frame is not external to the action but is instead constituted by the event.

This temporal complexity permeates socio-environmental phenomena, events and processes and as such is vital to the temporal gaze. In this bare-bone state it tells us nothing yet about the length of duration or the particular speed of a change and its effects. The typology therefore prefigures Giddens' already 'socialized' temporal concepts such as *Dasein, dureé, longue dureé,* and his 'time–space distantiation' and 'time–space edges'. On their own, none of the three ways of taking time seriously outlined above would constitute a temporal perspective. For a sustained temporal social theory perspective we need to bring these elements together in a thoroughly social approach.

Take 4: The Timescape Perspective

In the timescape perspective these diverse ways of taking account of time are brought together and theorized as a coherent whole. A timescape analysis recognizes the temporal complexity of socio-environmental existence. It understands the relational recursive interplay between all its features and locates it in the hegemonic social relations of power and value that tend to set the ground-rules and parameters of socio-environmental debates. Timescape is conceived as the temporal equivalent of landscape, recognizing all the temporal features of socio-environmental events and processes, charting temporal profiles in their political and economic contexts. This in turn transforms the way clock and calendar time feature in the analysis: both loose their objectivity and neutrality and become instead an integral part of the 'social relations of definition' (Beck forthcoming) and power. Thus, a timescape analysis is not concerned to establish what time is but what we do with it and how time enters our system of values.

What we do with time and how we utilize the time–space dimension of existence to make it suit our purposes is so extensive that it would warrant a further article. To give an indication at least of the breadth of time-uses, let me just list a small selection, alphabetically ordered: we abstract, appropriate, buy, cheat, choose, colonize, commodify, compress, conquer, control, create, de-contextualize, devise scales, edit, enjoy, experience, fear, fix, hierarchize, impose, kill, live, measure, maintain, order, plan, prioritize, quantify, rationalize, reckon, (re-)generate, regulate, relate to, (re-)organize, represent, reproduce, (re-)structure, save, sell, slow down, speed up, steal, synchronize, tell, use and waste time.

The timescape analysis of socio-environmental matters such as the GM food debate thus goes beyond add-on time, recognition of the importance of context and the construction of typologies of social time. It brings contextualized temporal complexity to the heart of social theory in order to affect the social creation of socio-environmental futures. This last section offers a glimpse of what might be involved in such an approach.

When the temporal gaze includes the complexity of time over and above clock and calendar time and an undifferentiated acknowledgement of context, it changes both the perspective and the vision of a socio-environmental situation. It alters the questions and concerns we have about the current econo-political push to legitimize the genetic engineering of food. Thus, for example, when bio-chemists and molecular biologists produce genetically modified material in the laboratory, living (i.e. temporal) matter is taken out of its original interactive context and in the process of transformation becomes an isolated (thus a-temporal) entity. As soon as it is spliced into a new organism, however, it is no longer an isolated substance since, as Holdrege (1996: 104) insists, '*substances in organisms are processes not entities*' as such they are fundamentally temporal. Such a perspective questions the Newtonian belief in time-reversibility and makes inescapable what an a-temporal, spatial conception could ignore: namely, that there is an irreversible direction in the processes of life and social activity that originates in the asymmetry of interaction. Moreover, since the temporality of genes is only indirectly encoded in DNA and cannot therefore be deduced from the structure of individual genes, the embodied, embedded phenotypic and environmental outcome of their engineering is anything but predictable or certain.

The scientific manipulation of genetic material at the level of the genotype, we need to appreciate further, is only possible because way back in the evolution of life-forms all organisms share genetic origins and are thus genetically related. This means that even very distant species share nucleic acid sequences or functional genes, so that specific proteins and enzymes, for example, may be found in the cells of yeasts, algae, crustacea, insects, birds and humans. Only on the basis of this shared evolutionary prehistory, therefore, is the transfer of genes from one breed and species to another possible and the new genetically modified future achievable.

This past–present–future aspect of time is also centrally implicated in our understanding of sustainability since sustainability means meeting the needs of the present with resources evolved in the past without compromising the ability of others in distant times and places to meet their needs. This definition of sustainability emphasizes the regenerative capacity of nature as the source of sustainability. It means not just the productive but the reproductive and regenerative capacity of nature has to feature in environmental concerns. To what extent, we need to ask, are GMO's capable of reliably reproducing the intended rather than unplanned phenotypic effects? On what ethical rather than commercial grounds, we need to enquire further, could the global imposition of terminator seeds be justified? What is the legal and human rights basis on which farmers' ancient rights to the ownership of reproduction have been transferred to transnational companies?

When we acknowledge with Marx (1973[1857]and 1976[1867]) that clock time is not just an external frame and measure but an abstract medium of exchange, its link with economic value becomes discernible and its tight association with money visible. In a socio-environmental context where time is money geno-technology is the ultimate development in a long and impressive history of innovations in time–space distantiation (Giddens 1981), time-compression (Harvey 1989), time processing and absorption (Castells 1996). Much has been written about these rationalization processes in the field of work and production. With few exceptions (Adam 1998; Rifkin 1998) thus far geno-technology tended not to be analysed with reference to commodified time. From a timescape perspective, however, the genetic engineering of food is understood as the crowing glory of a long history of time rationalization: machines and Fordist methods to speed up production processes; Taylorism to rationalize individual workers' actions; flexibilization to adapt to the variable patterns of production, service and consumption; the 'Just-in-time' system to cut from production all elements of non-productive which means non-profitable time (and space); geno-technology to eliminate from the breeding process the time of generational succession.

From this perspective, the genetic engineering of food is about money. It is about the promise of massive time saving in the scientific production of change. This is achieved by controlling time: controlling maturing, ripening, ageing and decaying; controlling the seasonality of animals and plants; controlling generational sequence and reproduction. Control of time in the production process, as I have suggested above, is an integral part of the success of industrial capitalism and so is the control of nature and the geno-technological control of the processes of life. In a context where time is money, geno-technology holds the promise of very big money indeed. It has the potential of realizing the time rationalizers' dream: instantaneous change in unlimited quantities, effected not at the phenotype but the genotype. At a stroke, changes introduced in the present alter the life-course and evolution forever. However, this is also where we have to locate citizen and consumer unease with GM foods (Grove-White et al. 1997).

Genetic engineering operates in a realm that was previously the preserve of gods. Interestingly, it entails the same uncertainties. Just as humans were not privy to the future intended for them by the gods, so present and future generations do not know what the genetically engineered future holds for them. With the elimination of the scientific method of trial and error, the new genetic science is flying blind. In previous scientific research, trials were followed by success or failure and future research was adjusted in the light of these outcomes. In case of errors, steps could be traced back to find the fault and correct for it in future research. Genetic engineering has retained the trail part of the method but fundamentally changed the meaning of 'error' since there is no going back, no correction, no recall of the outcome. The experiment is for real. The effects are temporally unbounded and dispersed across time–space.

Such open-ended permeation of time and space has implications for the public and political demands on science to provide certainty and proof of connections between source and hazard, cause and future effect. This in turn makes the political quest for accountability futile. Not accountability but generalized personal responsibility should legally be imposed on scientists, company executives, shareholders and politicians. As creators of potentially hazardous futures they are inescapably implicated irrespective of whether or not causal proof can be established between their activities and time–space distantiated outcomes. There is no objective outsider position. Involvement in this technology is an inescapably moral and political issue.

A timescape perspective further acknowledges the impact of cultural time values. It accepts that it makes a difference to socio-environmental praxis whether time is valued as an economic commodity, a resource or a gift of god(s) and loved ones. It recognizes that it matters to present and future generations across the globe whether speed and instantaneous change are equated with the holy grail of economic efficiency and profit creation or with the nightmare of hurtling blindfold into an unknown and unknowable, uncontrolled and uncontrollable, unbounded future. At stake is cultural and intergenerational equity. The temporal gaze firmly fixed on the praxis of genetic engineering, we appreciate the potential of this technology to change socio-environmental life more drastically, fundamentally and irreversibly than all previous technological innovations put together.

Since media analyses barely scratch the surface of the temporal complexity of the issues, there is an urgent need for time-sensitive social theory to enter the fray given that a timescape perspective not only re-adjusts our understanding of nature, but also re-focuses attention on that which tends to be ignored in conventional analyses. An unease that is neither verbalized nor conceptualized or explained cannot be addressed and thus cannot be put on the policy agenda. The unexpressed implicit is easily brushed aside as irrational by the promoters of the technology and all it promises. Giddens' time challenge, therefore, has never been more pertinent, the need to rise to his challenge never more urgent. Today this challenge is extended by the need for social theory to achieve successful communication of its analyses across institutional, public and cultural boundaries. In this age of economic and political mergers and alliances social theorists too may have to find allies and establish new trans-institutional collaborative means for their analyses to reach the public domain of socio-environmental debate. A socially relevant, communicative, time-sensitive scholarly enterprise is both the challenge and the task that confronts social theory at the beginning of the new millennium.

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BIBLIOGRAPHY

Adam, B. 1988 'Social versus Natural Time: A Traditional Distinction Re-examined' in M. Young and T. Schuller (eds) *The Rhythms of Society*, London: Routledge and Kegan Paul.

—— 1990 *Time and Social Theory*, Cambridge: Polity Press; Philadelphia: Temple UP.

—— 1995 *Timewatch: The Social Analysis of Time*, Cambridge: Polity Press; Williston, VT: Blackwell.

—— 1998 *Timescapes of Modernity. The Environment and Invisible Hazards*, London/New York: Routledge.

Balbo, L. and Nowotny, H. (eds) 1986 *Time to Care in Tomorrow's Welfare System*, Vienna: Eurosocial.

Beck, U. forthcoming 'Risk Society Revisited: Theory, Politics and Research Programmes', in Adam, B., Beck, U. and Loon, J. v. (eds) *Risk and Beyond. Critical Issues for Social Theory*. London: Sage.

Bergmann, W. 1992 'The Problem of Time in Sociology: An Overview of the Literature on the State of Theory and Research on the 'Sociology of Time', 1900–82' *Time and Society* 1(1): 81–134 [first published in German in 1983].

Blyton, P., Hassard, J., Hill, S., Starkey, K. (eds) 1989 *Time, Work and Organisation*, London: Routledge.

Callinicos, A. 1999 *Social Theory. A Historical Introduction*, Cambridge: Polity Press.

Carlstein, T., Parkes, D. and Thrift, N. (eds) 1978 3 *Making Sense of Time, Vol. I. Human Activity and Time Geography, Vol. II, Time and Regional Dynamics, Vol. III*, London: Edward Arnold.

Castells, M. 1996 *The Rise of the Network Society*, Oxford: Blackwell.

Craib, I. 1992 *Modern Social Theory. From Parsons to Habermas*, New York: Harvester. Wheatsheaf.

Davies, K. 1990 *Women and Time. The Weaving of the Strands of Everyday Life*, Aldershot: Avesbury.

Delanty, G. 1999 *Social Theory in a Changing World. Conceptions of Modernity*, Cambridge: Polity Press.

Elias, N. 1992 *Time: An Essay*, Oxford: Blackwell. [first published in German 1984].

Ermarth, E. 1998 'Time and Neutrality: Media of Modernity in a Postmodern World', *Cultural Values* 2(2/3): 355–67.

Game, A. 1991 *Undoing the Social*, Milton Keynes: Open University Press.

Giddens, A. 1979 *Central Problems in Social Theory*, London: Macmillan.

—— 1981 *The Contemporary Critique of Historical Materialism*, London: Macmillan.

—— 1984 *The Constitution of Society. Outline of the Theory of Structuration*, Cambridge: Polity Press.

Grove-White, R., Macnaghten, P., Mayer, S. and Wynne, B. 1997 *Uncertain World. Genetically Modified Organisms, Food and Public Attitudes in Britain*, Lancaster: Centre for the Study of Environmental Change.

Gurvitch, G. 1964 *The Spectrum of Social Time*, Dordrecht: D. Reidel.

Harvey, D. 1989 *The Condition of Postmodernity*, Oxford: Blackwell.

Ho, M. W. 1997 'The Unholy Alliance', *The Ecologist* 27(4): 152–8.

—— 1998 *Genetic Engineering – Dream or Nightmare? The Brave New World of Bad Science and Big Business*, Bath: Gateway Books.

Ho, M. W., Meyer, H. and Cummings, J. 1998 'The Biotechnology Bubble', *The Ecologist* 28(3): 146–53.

Holdrege, C. 1996 *A Question of Genes. Understanding Life in Context*, Hudson, NY: Lindisfarne Press.

Howard, T. and Rifkin, J. 1977 *Who should Play God? The Artificial Creation of Life and What it Means to the Future of the Human Race*, New York: Dell Publishing.

Ingold, T. 1995 'Work, Time and Industry', *Time & Society* 4(1): 5–28.

Jurczyk, K. 1998 'Time in Women's Everyday Lives: Between Self-determination and Conflicting Demands', *Time & Society* 7(2): 283–308.

Kollek, R. 1995a 'The Limits of Experimental Knowledge: A Feminist Perspective on the Ecological Risks of Genetic Engineering', in V. Shiva and I. Moser (eds) *Biopolitics: A Feminist and Ecological Reader on Biotechnology*, London/New Jersey: Zed Books.

—— 1995b 'Zeit der Natur – Zeit der Kultur. Zum Verhältnis von Evolution, Züchtung und Gentechnik', in M. Schneider, K. Geißler and M. Held (eds) *Politische Ökologie*, (Special Issue) 8: 25–30.

Lash, S. and Urry, J. 1994 *Economies of Signs and Space*, London: Sage.

Lauer, R. H. 1981 *Temporal Man. The Meaning and Uses of Social Time*, New York: Praeger.

Luhmann, N. 1982 *The Differentiation of Society*, New York: Columbia Press.

Macnaghten, P. and Urry, J. 1998 *Contested Natures*, London: Sage.

Marx, K. 1973 *Grundrisse*, Harmondsworth: Penguin. [first published in 1857].

—— 1976 *Capital, Vol. I.*, Harmondsworth: Penguin. [first published in 1867].

May, T. 1996 *Situating Social Theory*, Buckingham: Open UP.

Mead, G. H. 1959 *The Philosophy of the Present*, A. E. Murphy (ed.) La Salle, Ill.: Open Court [first published 1932].

Melbin, M. 1987 *Night as Frontier. Colonizing the World after Dark*, New York: Free Press, Macmillan.

Moore, W. E. 1963 *Man, Time and Society*, New York: John Wiley.

Nottingham, S. 1998 *Eat your Genes. How Genetically Modified Food is Entering our Diet*, London / New York: Zed Books.

Nowotny, H. 1994[1989] *Time. The Modern and Postmodern Experience*, Cambridge: Polity Press.

Rifkin, J. 1987 *Time Wars. The Primary Conflict in Human History*, New York: Henry Holt.

—— 1998 *The Biotech Century. The Coming Age of Genetic Commerce*, London: Vitor Gollancz.

Rissler, J. and Mellon, M. G. 1996 *The Ecological Risks of Engineered Crops*, Cambridge, MA: MIT Press.

Schor, J. 1992 *The Overworked American: The Unexpected Decline of Leisure*, New York: Basic Books.

Schutz, A. 1971 *Collected Papers. Vol. I, The Problem of Social Reality*, M. Natanson (ed.) The Hague: Martinus Nijhoff.

Urry, J. 1995 *Consuming Places*, London: Routledge.

Young, M. 1988 *The Metronomic Society*, Cambridge, Mass.: Harvard University Press.

Young, M. and Schuller. T. 1991 *Life after Work: The Arrival of the Ageless Society*, London: Harper Collins.

Zerubavel, E. 1981 *Hidden Rhythms. Schedules and Calendars in Social Life*, Chicago: Chicago University Press.