

The Exhibition of People's Technology, 1972

Peter Harper in conversation with Simon Sadler

At the periphery of the landmark June 1972 United Nations Conference on the Human Environment (UNCHE) in Stockholm, in the Skeppsholmen Annexe of the Moderna Museet, the Exhibition of People's Technology proposed that environmental crises could be addressed through the low-tech solutions of alternative technology. Alternative Technology (AT) was a term in use since the eponymous conference at the Bartlett School of Architecture the previous February. It was a de-industrialising movement which extolled the small-scale, decentralised, labour-intensive, energy-efficient, environmentally sound and locally controlled. One of a number of UNCHE fringe events sponsored by the Swedish "PowWow" group, the Exhibition of People's Technology was organised by the UK editors of a new magazine *Undercurrents: The Journal of Radical Science and People's Technology*, launched that same year.¹ In 1976, its founder Godfrey Boyle co-edited a major and widely read survey of alternative technology, *Radical Technology*, with Peter Harper, to whom the term "alternative technology" is attributed (Boyle/Harper 1976). Harper, a student of biology and experimental psychology, was a key organiser of the Exhibition of People's Technology and in 1983 joined the pivotal Centre for Alternative Technology (CAT) in Wales, of which he had been a frequent visitor and occasional teacher since 1974.²

This article begins with Harper's recollections of the exhibition and then moves to a record and discussion by Harper of its contents. It concludes with a more free-ranging conversation between Harper and design historian Simon Sadler about the exhibition's philosophical and scientific context and implications, transcribed by Iris Xie.

Peter Harper's Recollections

I had many friends in Sweden, having been visiting since 1967.

The UN Conference on the Human Environment (UNCHE) was the first major recognition of the significance of the global environment and a Great Event.³ Naturally every young environmentalist and her dog wanted to be there, and I was no exception. I took part in a series of meetings in Scandinavia earlier in 1972 to plan various fringe activities.

¹ *Undercurrents* was published for the next 12 years (when it was merged into *Resurgence*). On the events around the 1972 Stockholm conference, see Chapters 3 and 4 in Scott (2016).

² Harper remarks: "As everybody else said, 'I didn't mean to stay'". He was there for 30 years.

³ It led to the setting up of the permanent UN Environment Programme in Nairobi and was followed by further important conferences in Rio 1992 (when the United Nations Framework Convention on Climate Change, UNFCCC, and the Convention on Biodiversity were signed by almost all major governments) and in Johannesburg 2002.

My friend Björn Eriksson, an engineer, knew Pär Stolpe, an official of the Modern Art Museum in Stockholm, who was in charge of the “Filialen” or Annexe of the Museum of Modern Art on the island of Skeppsholmen, walking distance from the city centre. Stolpe saw the function of the Filialen as experimental, to address cutting-edge topics, and he wanted to do something related to the theme of the UN conference. Björn and I conceived the idea of an exhibition of “alternative technology”, although in Swedish it was called “För en Teknik i Folkets Tjänst” which translates as “towards a technology to serve the people” (For a Technology in the Service of the People 1972).

In the months before, Björn and I drew up plans for what we would like to display and started to collect materials. We had no money or institutional resources to draw on, so we “begged, borrowed and stole”, leaning on friends and acquaintances and our own research and imaginations. Even so, the exhibition was a bit thin when we started, and we decided it just had to be a “work in progress” that would gradually bootstrap itself into something tangible by the end. This was very much in the grain of the age and in the improvisatory spirit of the subject-matter.

I arrived in Stockholm with my colleague Chris Ryan⁴ (Figure 3) and our partners Lyn Gambles and Barbara Hammond. Together with Björn, the architect Varis Bokalders⁵ and many other local contributors, we started to assemble pieces of equipment, models and explanatory texts. People would drop in from absolutely anywhere and spend a few days with us. I remember Godfrey Boyle⁶ arrived with some other members of the *Undercurrents* team, and set up floating inflatables around the island, allowing us to “walk on water” (see Figure 6). Richard Coon drove from London on his propane-powered motorbike – which was itself intermittently on display.

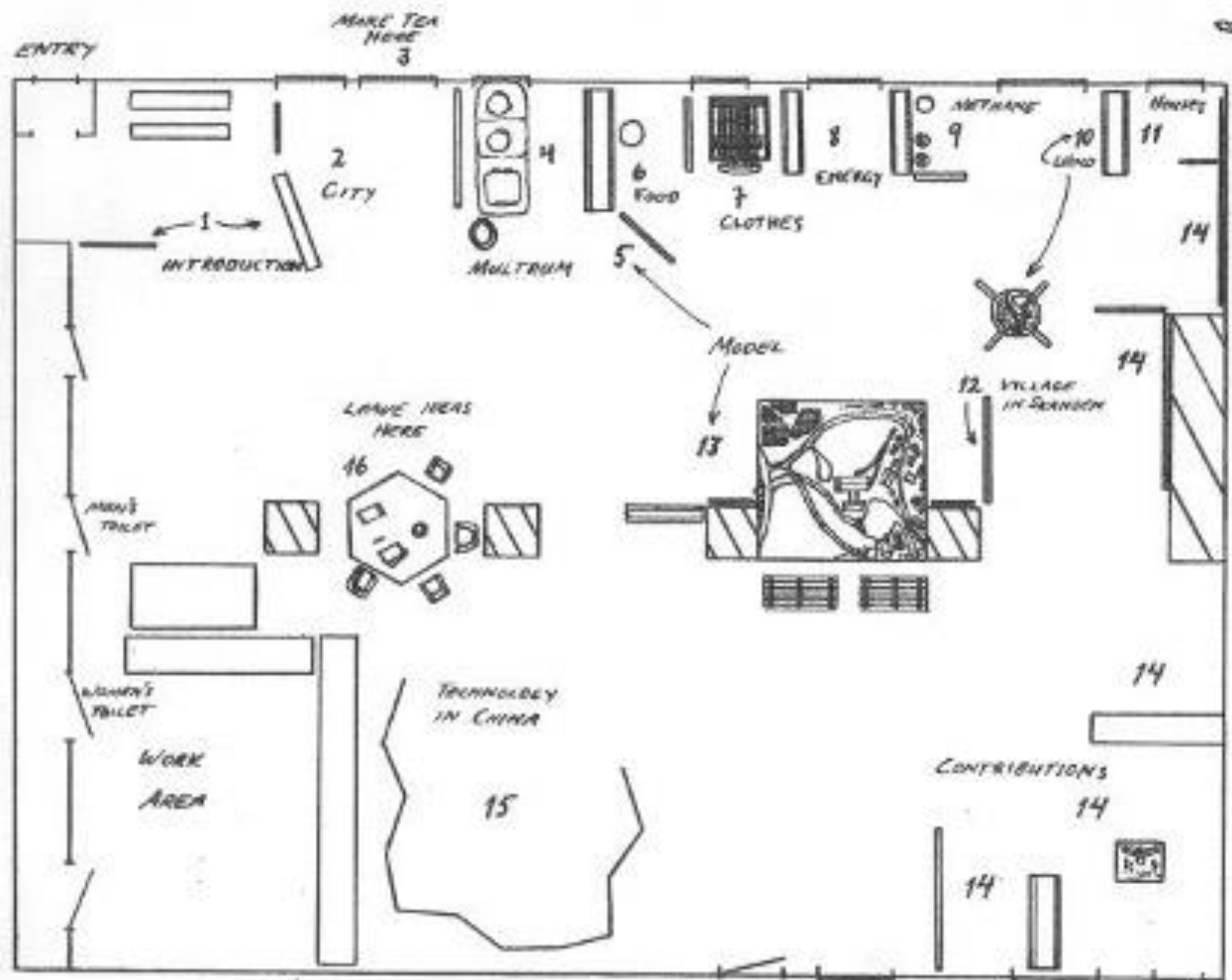
The eventual layout was something like the plan shown below (Figure 1), with “exhibits” around the outside and space in the middle for discussions, chatting and for visitors to make their own contributions. There was a landscape model of a traditional village that you could visit at full scale just across the bay in Skansen. Unfortunately, very few photographs have come to light, except some embarrassing images of myself with the ubiquitous and infinitely hirsute “1970 eco-face”.

⁴ Chris Ryan was a physicist who moved into design and town planning, eventually becoming Professor of Design at the University of Melbourne, with visiting posts in Sweden, Italy and the Netherlands. He was a founder of the alternative technology demonstration centre “Ceres” in Melbourne in 1975, a cousin, as it were, of the Centre for Alternative Technology in Wales (see Figure 3).

⁵ Varis became a distinguished architect and the author of many books including the magisterial *Byggekologi*, translated into English as *The Whole Building Handbook* (Block/Bokalders 2010).

⁶ Godfrey Boyle founded the alternative science magazine *Undercurrents* in 1971 and co-edited *Radical Technology* (Boyle/Harper 1976). He later became Professor of Alternative Energy at the UK’s Open University. Sadly, he died in July 2019.

Figure 1. Exhibition layout, *Exhibition of People's Technology*.



We were there all the time of course, and visitors could see everything being assembled, written, argued over, pasted up and (often) hastily modified. But it meant that we got to engage with them and often enough they stayed to help.

The image in Figure 2 tells something of the place and the process. Yes, that is the younger me with the 1970 eco-face. I am obviously showing something to two young women, who perhaps just dropped in to see what was going on. The floor is tiled, and the walls are bare, but there are semi-circular alcoves. There is a blank display board in the background. It was severe but functional and we liked being there.

Often, we would work till very late and then just curl up in sleeping bags on the floor, to start again the next morning.

Figure 2. Peter Harper, left, working on the Exhibition of People's Technology, Moderna Museet, Stockholm, in 1972, with unknown. Photograph: Björn Gustafsson.

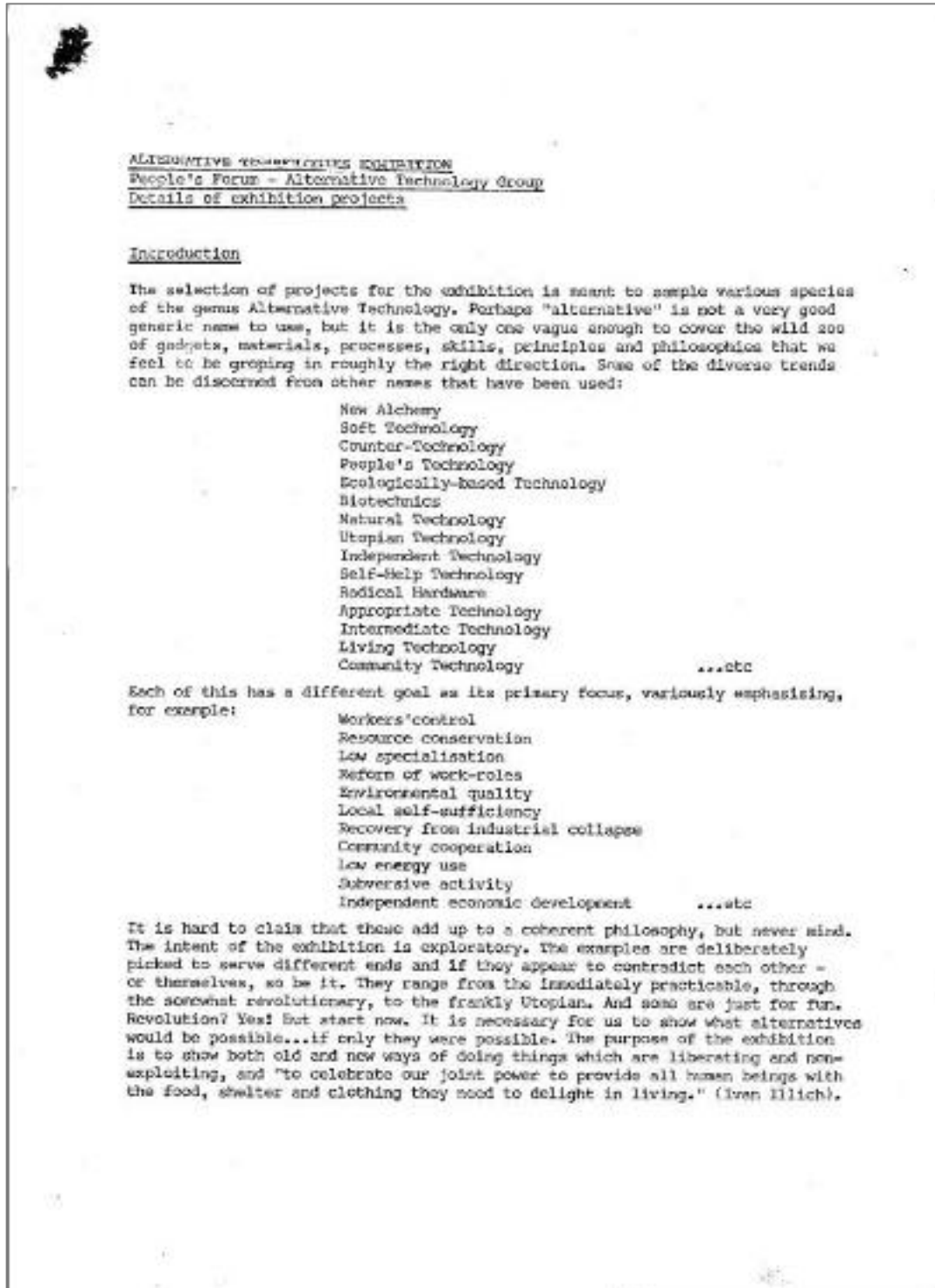


Figure 3. Peter Harper (right) and Chris Ryan preparing for the "Olympics of Pollution", a street-theatre event organised by PowWow during UNCHE. Photograph: Björn Gustafsson.



Before the exhibition, there were around two dozen separate ideas for exhibits, grouped into functional categories (food, transport, etc.). Most of these were based on already existing projects, many of an experimental nature, or on tangible pieces of equipment. The idea was that in each case we would have something to show, photographs, plans, objects and possibly results. It did not always work out so neatly, but it is surprising how “realistic” and prescient some of our choices were (see Figure 4).

Figure 4. Sample of the exhibition proposal, an unpublished mimeograph sheet available to visitors. Printing and photocopying were very expensive at the time, and the mimeograph process (also called cyclostyling, roneoing, gestetnering, depending on model) was the default method of reproducing text, or even line-drawings, as shown in Figure 1.



As a broad generalisation, our greatest mistakes were about scale. Lots of the principles are sound, but they only become worthwhile on a large enough scale, and we had strong bias against mass scale, favouring instead small local communities and households. We assumed that small is *always* beautiful, but actually it is only *sometimes*. This mistake is still being made!

Here are the candidates, with comments.

FOOD

- Aquaculture–horticulture rotation system
- Indoor fish–culture unit
- Hydroponics

I have grouped these together because they demonstrate a willingness to accept quite complicated systems, provided they can yield well on a smallish scale. We had a strong belief that “self-sufficiency” – self-provision in food – was not only desirable, but could be readily achieved without too much labour, and on less than a “fair allocation” of land. In the UK of the time we had about 1 acre (0.44 ha) per head, but not all is good growing land, so that suggests systems that (a) use less land area and (b) are independent of the quality of the land. Hence these intensive “ponics” systems.⁷

The aquaculture systems were based on those pioneered and reported by the New Alchemy Institute in North and Central America. We simply took their word for it. But they never really worked, either for the New Alchemists or in attempts to copy them at the Centre for Alternative Technology (CAT) in Wales. Later, commercial “aquaponics” systems were more successful in recycling nutrients to optimise growth of both plants and fish, including crustaceans. But as far as I know, it has never been adopted as a community-scale food system and certainly not at the single-dwelling level, as the New Alchemists attempted to demonstrate in their “Ark” project on Prince Edward Island. It simply failed: the yields were far too low relative to the capital cost and maintenance effort.

Hydroponics (soil-less growing) using cheap mineral fertilisers is much more reliable and is now used at vast commercial scales to produce salad crops. In the early days of AT, the hope was that minerals could be replaced by waste products like wood ash and urine, or fish manure from aquaculture. Well, they can to some extent, but the system is too fiddly and capital-intensive for a household to maintain, and it only produces vegetables, not staples with starch, protein and fats.

⁷ The suffix ‘-ponics’ (from the Greek for cultivation) was used by its inventor, William F. Gericke, to distinguish his strictly soil-less system from ‘aquaculture’ (Gericke 1937). Since then the suffix has been adopted for other systems such as ‘aquaponics’. Hydroponics is growing plants without natural soil, using an inert solid medium such as gravel or sand, irrigated with a solution containing soluble plant nutrients.

Having said this, if you really *have* to do it and you have the right equipment and very large amounts of money, it can be done, as witness the Biosphere 2 project in Arizona. Eight “Biospherians” survived for two years on what they could grow on an area of about 300 m² a head, partly using data from the New Alchemy experiments. Remarkable, but dazzlingly expensive. (See Allen/Nelson/Alling 2003.)

- Three-dimensional agriculture in New Guinea

This was derived from the systematic research and quantities measured by the anthropologist Roy Rappaport (2000 [1967]). To the western eye, it does not look like agriculture, but yet it keeps its practitioners fed on a few hours’ work a day. I think this was one of the inspirations behind Holmgren and Mollison’s notion of “Permaculture” that first emerged around 1978 (Mollison/Holmgren 1978). They noted that in the tropics, western-style plough agriculture usually fails catastrophically, and much subtler, multi-layered plantings work better, using mostly perennial species. This idea has been widely imitated in temperate areas like the UK under the banner of Permaculture, but for the most part has performed poorly. Just as Western systems often fail in the tropics, so tropical systems tend to fail elsewhere. In fact, the New Guinea system is not very “efficient” in terms of land, so it does not lend itself to intensive self-sufficiency.

Having said this, the notion of “forest gardens” is now widespread in temperate areas and could encourage dispersed production of tree-crops including high oil- and protein-yielding items such as nuts. (The *locus classicus* is *Forest Gardening* by Robert Hart (1996).)

- Soy culture as a source of protein

This is strangely prescient, because now, many decades later, soya production is big business and causing substantial deforestation in the tropics. But this is largely used to provide high-protein feed for livestock, not people. The point of the Exhibit was to show that soya beans could be grown in temperate areas and provide their own nitrogen. They produce meat-equivalent protein on only one-tenth of the land used by (say) cattle, so are excellent for intensive production – and are a staple crop.

At the time, a temperate-adapted soybean variety had just been introduced, but it generally performed poorly, and it is almost certainly better to grow “genuine” temperate legumes, of which there are many kinds. They are easily available to householders and are being used as the basis for all manner of high-protein foods and meat substitutes, largely on grounds of low carbon emissions, an issue we were unaware of in 1972.

HOUSING

- Traditional building materials

The rationale given was that these had been displaced by “modern” materials for commercial reasons, which we regarded as distasteful. The displacement is indeed a market effect, because modern materials are much cheaper per unit of service: usually stronger, more durable, easier to apply and so on.

Having said this, we can now note that many modern high-performance materials also generate high carbon emissions, while “traditional” materials are much better. As a result, there is growing interest in using low-carbon natural materials such as wood and “engineered wood” such as glulam, plywood and oriented strand board.

There are also many modern buildings that use low-carbon materials (earth, wood, bamboo, stone, slate, straw and reed) for the bulk of the construction, plus a small proportion of “industrial vitamins”⁸ (plastic membranes, steel ties, screws, glass, plumbing and wiring) that bring performance up to modern standards. The WISE Building at CAT in Wales is a good example. (Further examples can be found in *Vegetarian Architecture* (Bocco Guarneri 2020).)

I think many Swedish visitors had been attuned to our strange messages by the publication that year of Gösta Ehrensverd’s *Före-Efter* (“Before and After”) (1972) which painted a picture of how life might be after the collapse of civilisation – widely discussed at the time.

- Non-western house forms

In the febrile 1970s, there was much criticism of the “nuclear family” and the dwellings produced to house it. If families could be non-nuclear, what patterns might be more suitable? These are reasonable questions, although subsequent experience suggests that the nuclear pattern is the overwhelmingly preferred form in modern societies.

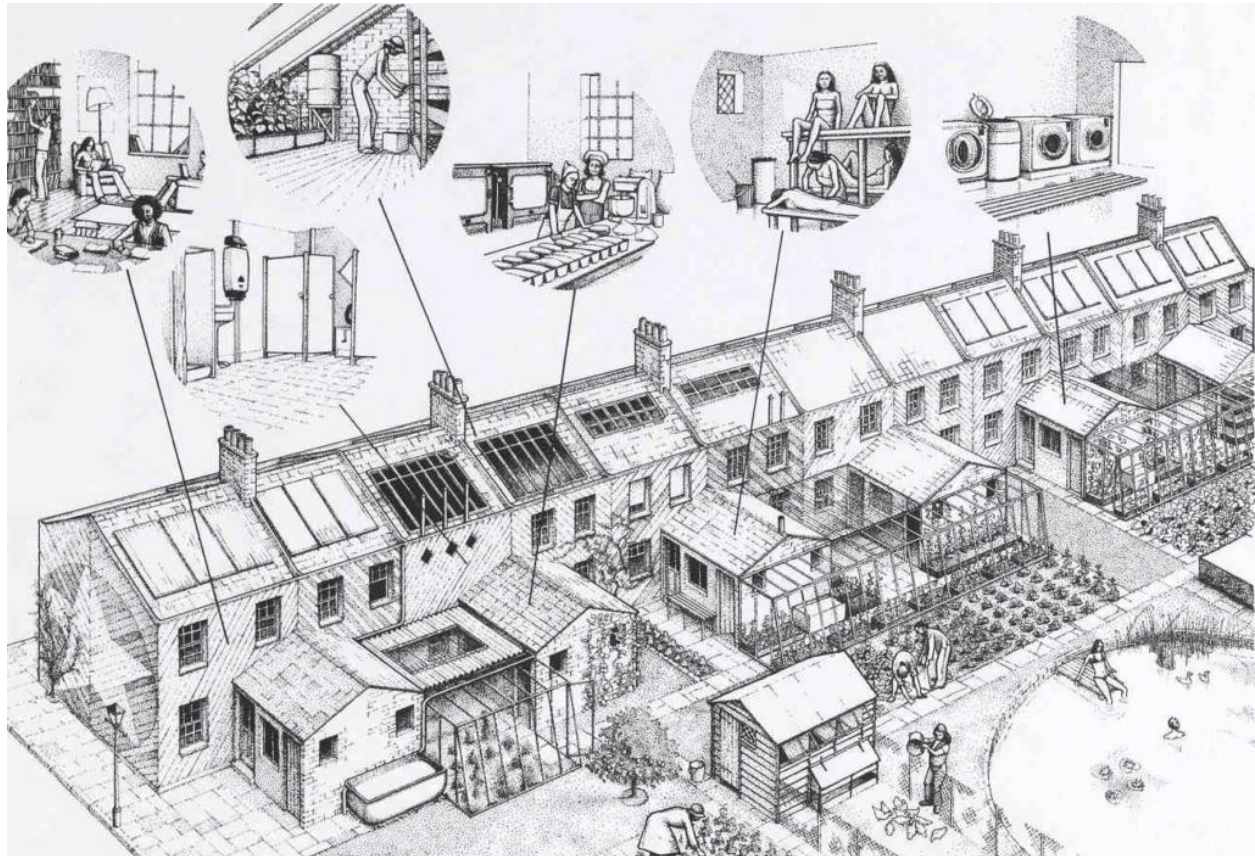
Still, social experimentation continues, for instance in the form of co-housing and “ecovillages” (Gilman 1991), and these have engendered new patterns of physical layout to accommodate multi-generational communities while maintaining the “nuclear” unit to a large extent. These remain rational solutions to many modern problems.

The famous “autonomous terrace” (drawn by anarchist illustrator Clifford Harper, no relation) shown in *Radical Technology* (1976) suggested thoroughgoing collectivisation, but had a nuclearised

⁸ Peter Harper introduced the phrase “industrial vitamins” to describe common practice at CAT, but the term was never published or carefully defined.

equivalent in the re-purposed double terrace at Spencer Street in the British city of Milton Keynes (Figure 5).

Figure 5. “Autonomous Terrace” illustration by Clifford Harper, *Radical Technology* (Boyle/Harper 1976). Based on indicative sketches by Peter Harper.



- Construction materials using industrial waste

Well of course, who wouldn't want this? If source materials are cheap and can be made into something useful, what's not to like? Unfortunately, waste materials are often in the wrong form, in the wrong place, arising erratically and perhaps contaminated. And material inputs are usually only a small fraction of the total cost of a product, so the industries concerned usually prefer to get clean raw materials whenever they can.

Although the notion of “industrial ecology” became very fashionable, with the Danish city of Kalundborg as its poster-child, in practice it proved much more difficult and never became common practice.

From today's perspective, we relate this question to recycling of household waste, the "zero waste" movement and the so-called "circular economy". Great improvements have been made, but they are not driven by plain market forces: they require "ideological" intervention. As, perhaps, they did in 1972.

- Autonomous servicing

This was astonishingly fashionable in the early 1970s. It fitted our decentralised, self-sufficiency vision. Most of the technical ideas, however, came from a group at the University of Cambridge around the architect Alexander Pike, who looked down on us as mere "enthusiasts".⁹ This academic group carefully analysed the relative costs of "autonomous" and "reticulated" (i.e. public) servicing and generally found that public provision was much cheaper, used less stuff and was generally better all round. Subsequent analysis at the Centre for Alternative Technology (somewhat with gritted teeth) confirmed this.

"Rolling your own" can be very expensive. Robert and Brenda Vale were part of the Cambridge group and carried out a three-year joint PhD programme exploring self-sufficiency at a smallholding level. Subsequently asked whether self-sufficiency was actually possible, Robert replied, "Well, yes, almost – but you need to have a bloody good job to be able to afford all the equipment" (personal communication).

- Inflatables

These were not part of the original plan but turned up anyway in response to our call for "alternative structures". They were mainly play objects (as many have become in subsequent years) and visitors were invited to step inside zippered inflatables and "walk on water" just a few metres from the exhibition door (Figure 6).

⁹ This tension between academic experts and activists is hard to avoid. These days, the boot is on the other foot, with a new generation of "enthusiasts" coming up with all manner of good-sounding ideas, only to be met with scornful criticism from previous generations who had "been there, done that" and been painfully disillusioned.

*Figure 6. Giant inflatable at the Exhibition of People's Technology.
Photographer unknown.*

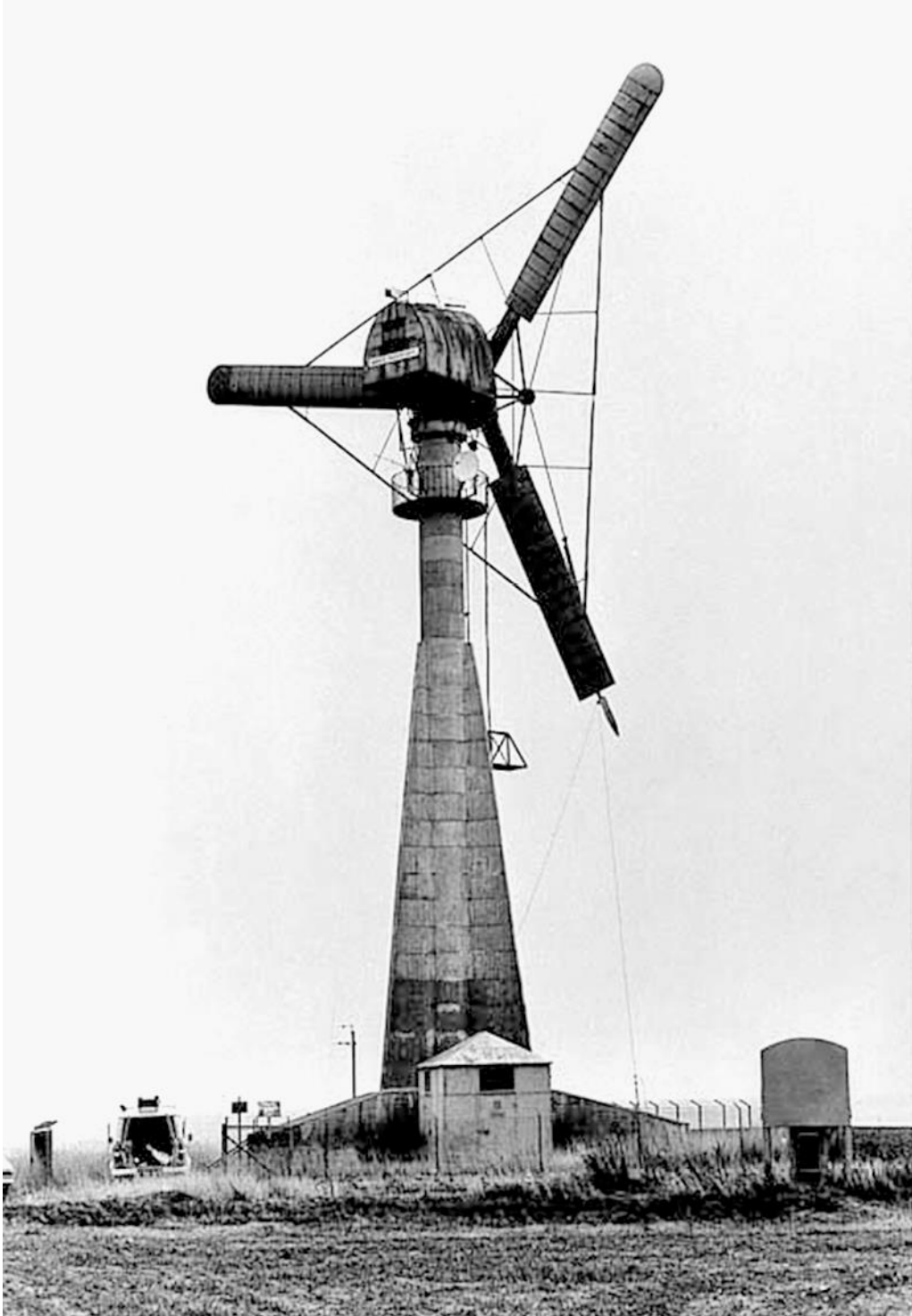


POWER

- Wind power
- Basic principles of wind energy
- Fixed windmills

I have grouped these together because they were intended to introduce the general idea to exhibition visitors. Of course, everyone was aware that windmills were used in the past, but it was assumed wind was an old and rather feeble, erratic source of energy and not suitable for a modern economy.

Figure 7. A Gedser wind turbine.



As so often, we got the scales wrong. We really loved the old-style windmills and thought they could be repurposed to produce electricity. Of course they can, but at a ridiculous cost and to little effect, but we hated the idea of large commercially run industrial-scale turbines. However, at the exhibition we had a

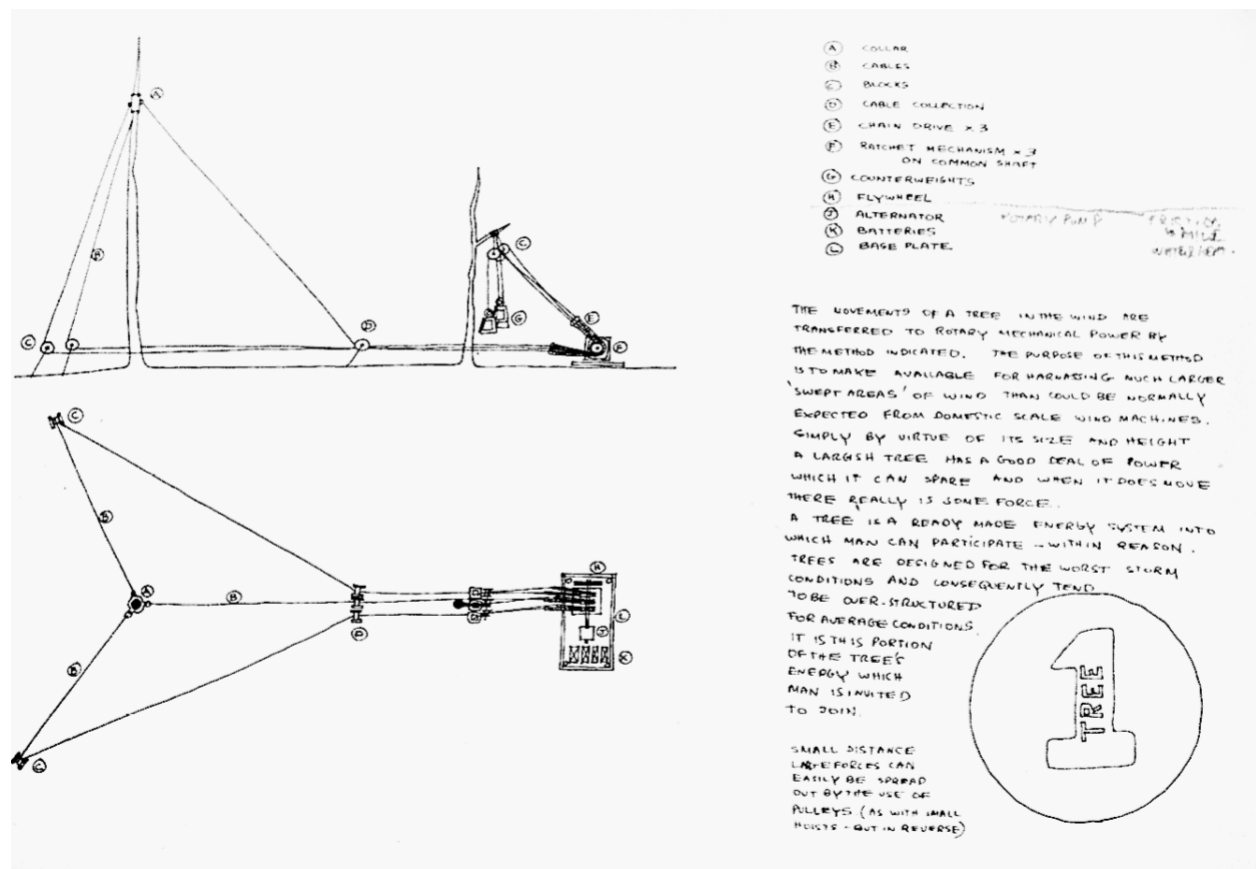
lovely foot-high model of the Danish Gedser-type wind turbine, that eventually led to the modern Danish (and thence, world) wind industry (see Figure 7). We thought this model was pretty cool, but we didn't sit down and work out the implications if wind were to be a serious contributor to grid electricity supply.

Now we understand. They cannot look traditional. They've got to be aerodynamically designed. They've got to be big. And there have to be thousands and thousands of them. But it is happening.

- Unorthodox wind-powered devices
 - Tree pump
 - Flying windmill

These illustrate very well the kind of approach we preferred and show how they might work, or not as the case may be. They were developed by the wind enthusiast David Stabb at the Architecture Association (Figure 8).

Figure 8. Wind device, designed by David Stabb. This was later redrawn by Derek Taylor and reprinted as "Natural, Endless, Free" in *Radical Technology*. Photograph: Björn Gustafsson.



The tree pump is based on the idea that a tree has a large surface area and can sway substantially in a gusty wind. You just tie ropes to pulleys and run them to some kind of pumping mechanism that can fill a header tank or small reservoir when the wind blows. It could all be pretty low-tech and made by the local blacksmith.

I don't know anybody who's tried this seriously, but it could work. We did test it on trees outside the exhibition, using a 10-kg spring balance to measure the effect, and this impressed visitors on windy days. We too were impressed when we turned up one morning to find the spring balance ripped to pieces after a storm!

The Flying Windmill is based on the idea of kites, which clearly do fly and demonstrate that the wind is stronger the higher you go. This is quite impractical on a small scale, but has been seriously proposed for multi-megawatt machines a kilometre up, tethered by giant cables. It might yet happen.

- Direct sun power

The rationale for sun power was the same as wind. Carbon emissions were not an issue then, but we believed fossil fuels were limited and would run out, hence the fondness for renewables, which were in principle “free”, and therefore (we thought) cheap. We did not grasp the extreme difference in energy density between sun/wind and fossil fuels and hence the need for very large machines to harvest renewable flows on an industrial scale.

We delighted in the simple thermosiphon solar collector. No moving parts. It could be made from readily available materials in an afternoon, set out in the sun, and behold! Hot water! Well, warm water. It always did *something*.

We thought the same principle – passive harvesting of high-energy radiation – could be used to operate an Electrolux-style vapour-absorption heat pump in order to harvest low-temperature heat. And so it can, in principle, but experience shows that the efficiency is low, and although there are no “moving parts” it is still a highly sophisticated assemblage of industrial components. It cannot be made by the village blacksmith. Might as well have a compressor and all the best kit. Today? Heat pumps can perform the alchemy of turning low-carbon electricity efficiently into heat and are destined for mass take-up.

Perhaps a better idea would have been “external combustion” heat engines such as the Stirling Engine, operating on solar heat. This does have moving parts, but can operate on just heat rather than a concentrated chemical fuel. Somebody brought along a model Stirling engine for the exhibition, and it was regarded as a kind of pet. It operated in complete silence. We thought it was bound to be the Engine of the Future, but we are still waiting.

Such passive solar heat engines were a lemon. But of course solar water heating became much more sophisticated, industrialised, relatively cheap, and ubiquitous in sunny places. Even more important were solar photovoltaics, still ridiculously expensive in 1972 and somewhat off our radar. But nearly 50 years later, they are now cheaper than coal, deployed on a colossal scale, still improving, and competing with wind to power the world.

- Small-scale water-power

This has not changed as much as most other things. The rationale is still the same, and enthusiasts are finding all sorts of little local sources that could power a community. Still, they are marginal in the wider picture.

We thought you could have direct mechanical functions as well as electricity, as water mills did, but although agreeably low-tech, that turns out to be much less efficient. Better to generate electricity and use that flexibly for all other functions. Electricity is bound to be the energy lingua franca for the next hundred years.

- Methane from animal wastes

Well, we tried it at the exhibition. We had no idea what to do, but we had the notion that AT had to be simple, so we just got on with it. We'd seen the reports from India and China with quite small digestors, using animal dung, so we filled a cylindrical tank with cow manure and waited to see what would happen. Nothing. Well, a small increase in pressure that could be released as a smelly gas.

Nowadays, much more is known about how to digest animal and plant wastes efficiently, and the gas is mainly used to generate electricity for the grid. It is a sophisticated mainstream technology and part of the suite of systems for backing up the electricity system if supplies from the variable renewables are low. Once again, it's got to be big to be worthwhile.

- Storage of energy

As just remarked, electricity from sun and wind is variable and needs storable back-up. Biomass like animal manure and plant wastes can make methane or can be thermally converted like fossil fuels. Almost certainly it will be supplemented by hydrogen, which can be generated in times of electricity surplus – which you often get with wind. The exhibition plan mentions this, but I cannot remember that we actually demonstrated electrolysis of water, or that we mentioned anything more about energy storage.

- Flower power

I think this was just a joke.

TRANSPORT

- Methane-powered bus

Naturally we were against private cars and envisaged a world dominated by public transport. We knew that you could run vehicles on “CNG” or compressed natural gas, which is pure methane, but of course that was a fossil fuel, and we wanted to use biogenic methane.

It never happened in the exhibition, but sustainable transport has moved on and there are now electric-, hydrogen-, methanol- and bio-propanol-powered vehicles. We probably hate cars less but favour shared systems like car clubs, which we didn’t think of at the time.

- Canals

Here we found the sheer retro-chic irresistible. Canals had been displaced by railways, then roads, and had not moved on. They were beautifully stuck in the early 19th century and operated with pre-industrial technology. They were consistent with the slower, steady-state world we envisaged. We thought they could be redeveloped to take much more tonnage of freight, and this is probably true, but could never compete with the vast tonnages currently charging around the planet on roads.

A nice try.

- Airships and balloons

Perhaps these are the aerial equivalent of canals. They recall a bygone age of the slow and steady. Steerable lighter-than-air craft emerge fairly regularly as useful adjuncts to the aviation industry, but never seem to, as it were, take off.

My sense of the process is that they await certain technical developments and a much higher fuel price, perhaps as a result of carbon taxes. If (as seems likely) it will no longer be possible to live on a rapid turnover, “just in time” basis, then they will greatly suit a slower pace of life. They will be back.

MEDICINE

- Malaria control

This might seem an odd item for an exhibition such as this. It is partly based on the understanding that pesticides could be terminally harmful. In one of the preparatory meetings, we had met the Iranian environmentalist M. Taghi Farvar,¹⁰ who had worked with Barry Commoner on DDT in mother's milk in Guatemala (dichlorodiphenyltrichloroethane, an insecticide). He had produced a massive tome of cautionary tales entitled *The Careless Technology* (Taghi Farvar/Milton 1972), which convinced us that Nature was easily disturbed by artificial chemicals and other interventions. Which it is. But of course, we were searching for technologies that were *not* careless.

We were also seeing the beginnings of a “systems approach” to sustainability, understanding that there could be no simple “silver bullet” solutions, but much more subtle measures based on analysis of the relations between components. You cannot simply change one thing and imagine the rest of the system will not also change, often in unpredictable ways – as Commoner himself insisted.

The topic also draws on the obsession with China, where it was thought that, free from the shackles of capitalism and consumerism, they were more able to think, and act, outside the box. We were much taken with the idea of “barefoot doctors” dealing with a wide range of common medical problems, leaving highly trained specialists to take difficult cases. There seemed to be something romantic about it, like Médecins Sans Frontières. But of course this is simple market forces at work: we now have exactly the equivalent in the form of “paramedics”.

- Acupuncture

This also relates to China, and we were confident that the Chinese would not embrace anything that was simply a superstition. It seemed an excellent system because it involved whole-body understanding, without drugs, persuading the body to heal itself by redressing imbalances. Another attraction was that, because the so-called acupuncture meridians could not be found anatomically, it suggested a radical incompleteness in received western medicine, and indeed western science altogether. It hinted at the possibility of a subtle “other world” beyond materiality that could possibly be the basis of radically alternative way of proceeding.¹¹

TEXTILES AND CLOTHING

- Handloom

¹⁰ Peter Harper subsequently worked with Taghi Farvar in Iran, continuing the spirit of the exhibition in the Faculty of Ecodevelopment of Avicenna University. The research and teaching programmes were summarily terminated after the Iranian revolution of 1979.

¹¹ See, for example, “Inner Technologies” in *Radical Technology* (Boyle/Harper 1976).

This was a straightforward ancient technology, entirely transparent in terms of its structure and operation, and we had one on display. For native English speakers, the Swedish name *vävstol* (“weaving-chair”) was charmingly literal. Of course you can produce real cloth on such a device, and you can make up clothes and wear them, but the time taken is far more than most people would tolerate and it is not surprising that we now rely on mechanised looms that produce cloth at a hundred times the rate.

This of course is true throughout the economy, and productivity is perhaps the principal difference between traditional and modern societies. It was a critical misunderstanding of ours, that we tended to think mechanised industrial production was only *somewhat* more productive than the “old ways”, perhaps 50 percent better, perhaps even 100 percent, but not enough to justify all the downsides. The reality of course is that it is 1000 percent, even 10,000 percent more productive: that makes a big difference and allows us the leisure to play with hand looms if we wish.

It is striking that the celebrated Arts and Crafts movement promoted by William Morris and others praised the production and use of handmade useful objects, in contrast to the tawdry industrial products of their day. In the exhibition, we applauded too, without realising that only the wealthy could afford this kind of thing. Today perhaps we have come to appreciate the contribution of the Bauhaus and even IKEA in providing well-functioning, stylish products at reasonable cost.

WASTE DISPOSAL

- Clivus Multrum composting toilet

This is famous in Sweden as a common item in country houses without sewerage connections, invented by the engineer Rikard Lindström. It is very large and an impressive item in the exhibition (but was not in actual use!). Its attraction for us was that it does not require or pollute water, but turns a potentially pathogenic waste into valuable fertiliser. It has no moving parts and operates passively by gravity and small differences in temperature. This was just the kind of self-acting non-industrial alchemy we were looking for.

Composting toilets seemed such a simple no-brainer that we assumed they would soon take over everywhere (Harper/Halestrap 1999). This was not be, and they remain on the fringes, although a significant presence in remote fishing clubs, allotments and country parks. People everywhere seem to prefer the “porcelain standard” and are prepared to pay for the network of sewers and treatment plants then required. (See also Figure 9.)

Rikard Lindström’s son Carl came to visit during the course of the exhibition. As his father had become a bit of a hero, we were very pleased to meet him.

Figure 9. An exhibit about the accumulation of non-degradable waste around the world. This continued to be a problem and is now considered a very serious concern. Photograph: Björn Gustafsson.



COMMUNITIES

- Biotechnic housing estate

This was not much more than a student exercise, but it was based on all the latest AT lore and had lovely illustrations. It was more or less a large greenhouse with livestock, hydroponics, solar heating and water-power. It was entirely fantastical but pressed all our buttons and looked gorgeous. Sadly, the drawings are lost, except for a much-reduced sample in *Radical Technology* (Figure 10).

- Chinese village technology

We knew nothing about China but we were suckers for the propaganda and the travellers' tales. They seemed to have all the right ideas, relying on local resources in a spirit of mutual self-help. They also had inspiring slogans, many of which we adopted, such as "The Taming Power of the Small".

It is my impression that the founders of the Chinese Communist Party, and particularly Mao Zhedong himself, shared many of our pro-rural, anti-consumerist, anti-technological tastes, and that is perhaps why we were so drawn to the stories that emerged. Later of course, China embraced the opposite of all this, and it was quite clear which path the people preferred.

Perhaps the most striking visual commentary on Chinese self-reliance was provided by Varis Bokalders, a Swedish architect and planner who contributed a great deal to the exhibition. In the early 2000s, he was invited to submit plans for a Chinese town, which would provide enough land to provide its own food and process its own waste. Having done the calculations, the allocation of areas was roughly as follows:

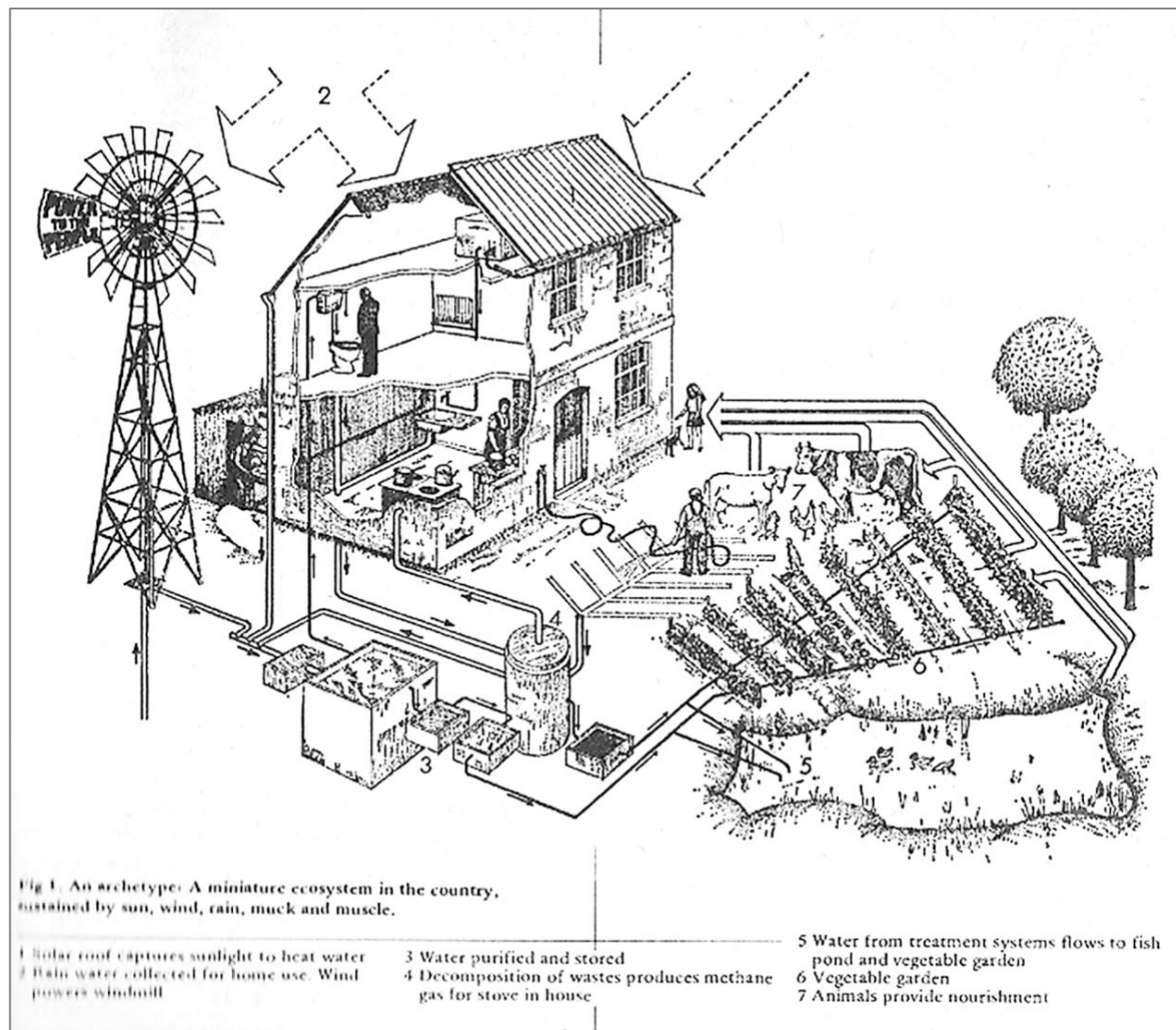
Living areas, circulation, transport	15%
Food production areas	35%
Waste treatment areas	40%

The waste treatment areas (mostly wetlands) can also contribute hugely to biodiversity and ecosystem services, but the proportions still come as a surprise.

- Alternative technology research community

This was supposed to combine the full, all-singing, all-dancing alternative dream: communal living, rural life, self-sufficiency, renewable energy, closed-loop recycling, zero waste and novel uses of traditional materials. It was supposed to record its results and make them known for others to follow – or avoid. An illustration for some of the proposals is shown below. It is worth comparing the implied areas with the results of Varis Bokalders' study above: this is the difference between naïve theory and practical experience.

Figure 10. Clifford Harper, *Alternative technology research community*. This drawing was displayed in the exhibition and subsequently reproduced in *Radical Technology*.



This project did not in the end materialise, but another did: the Centre for Alternative Technology in Wales, founded in 1974 under the influence of the same ideas, which continues to exist 45 years later.

A Conversation Between Peter Harper and Simon Sadler about The Exhibition of People's Technology

SS: The talisman of the current “Maker” might be somebody in Silicon Valley prototyping some new gizmo, which they would take to a TED talk, and then get angel investors, and the idea is that while making a profit, that gizmo will lead to a greater future, led out by somebody with a degree from MIT. And what I think this special issue of the journal *Digital Culture & Society* is trying to do is to go back into history and ask: does that really exemplify what making is about, or was about? And is there a possibility of re-writing history, in a way that makes us think more laterally about what the so-called Maker Movement is about? And I think that is where they landed on you. Because appropriate technology, Alternative Technology, radical technology, is and was about making, and it was a type of grassroots activity. It would have led to a different sort of future, in which we would think about the relationship between technology and society differently.

PH: Sometimes an idea I have now is actually the same as one I had long ago, but have forgotten. Sometimes I look back at my old notebooks – I’ve got notebooks going right back to that period – and it’s astonishing, I’d forgotten I even thought that! But one of the big things that we were interested in was whether you would use technological developments to *maintain* existing functionality, but *reduce* the impact on the environment, or other externalities of various kinds. It’s the opposite of what actually tends to happen: “let’s take an acceptable level of damage and use the advancement of technology to increase the functionality, making it faster or better or bigger”. You’ve always got that choice, what are you going to do with your new technology, your innovation? On the whole, what’s happened is that everyone has run off with the extra functionality, while the environment can just look after itself. Indeed, to some extent it can, but we’ve pressed it too far and now we are in a serious crisis. And so, our answer all the time would be, keep an adequate level of functionality, reduce your impact. But what we thought adequate by historical standards tended to generate the response: “sorry, that’s just not good enough, we want more than that”.

SS: What would you have been displaying at Stockholm that had a low level of functionality?

PH: Well, for example, the Clivus Multrum, the big composting toilet. In a way, it is an amazing thing, everyone and every house should have one. You are turning some potentially noxious and pathogenic waste into something rather valuable. And you are not using any water, you are not contaminating water, so you don’t have to clean it. But most people would say “Sorry, I’m not having one of those smelly, fly-ridden things. I want a proper toilet that I can flush. And send this stuff away to someone else to sort

out!”. What we thought was a reasonable level of functionality, for most people it wasn’t good enough. The same thing with small-scale energy systems, it just wasn’t good enough for many people. They want loads of energy, just like that. Just at the flick of a switch. Anything less than that is the Dark Ages.

SS: It reminds me of how the Bill and Melinda Gates Foundation is again studying the toilet and sanitation.

PH: Absolutely, yes! This composting toilet is one of the inspirations for Alternative Technology, and for Schumacher’s idea about intermediate technology. What he meant by that was that it was better than what people had, but it wasn’t a great leap to super modernity. Instead of just having a hole in the ground, or a pile behind a bush, you would have a proper toilet, with sanitation and a ventilation stack. But it wasn’t a *flush* toilet. And I think that Bill Gates has stumbled on the same thing Schumacher did, basically getting people from the really lowest level to the intermediate level, which, arguably, is where we need to get. It was something of a novelty to suggest that, just as the people in developing countries are at the lower level and then bringing it up, maybe we have reached too high a level and need to get ourselves down a bit. Maybe there is some way you can meet in the middle, where you can find some kind of reasonable, global, level of functionality.

SS: So you would have imagined the technology that you were showing at Stockholm to be the sort of universal technology that would equalise the Global South and the Global North, around one toilet, with an equivalent level of functionality North and South?

PH: Yes! That’s right, I think that’s what we were aiming at. I’m not saying that there is something existentially wonderfully about that standard, but we were looking for something that was sustainable. Here is the standard, can you meet it with the technology that you have and ensure sustainability? Then we are not sawing off the branch on which we’re sitting. That was the main question. So once you got some sort of a stable situation, you could say, right, now where do we go from here? Now we can increase functionality, as long as we don’t create further damage. We weren’t against high functionality, with lots of possibilities. Having said this, I must admit there was a puritanical streak that considered “high standards of living” to be in some sense “unconvivial”,¹² but paradoxically perhaps, we also embraced countercultural hedonism: we liked to have a bit of fun.

¹² The term “conviviality” was introduced by the influential theorist Ivan Illich in such works as *Tools for Conviviality* (Illich 1973). Illich considered much of modern life to be illogically damaging to a general sense of well-being that he termed “conviviality”.

SS: I would like to get back to that, because one of the things that I love about *Radical Technology* is that in the book there is a delightful wit and good humour in there. But I am going to see if I can stick for a moment with the toilet – it sounds like I might have a bit of a toilet fixation, but you could think of that as a great place to start asking about issues of design and politics and the human. One quick historical question, did you ever come across Sim Van der Ryn’s book on *The Toilet Papers*.¹³ It is a little bit later I think, but he was proposing almost something almost identical.

PH: Yes. We tried a lot of those ideas at the Centre for Alternative Technology. In fact we had a kind of zoo of alternative toilet systems, many of which were fully operational. We had the Clivus of course, and several other Swedish and Norwegian variants; we had the Sim Van der Ryn model; we had the Twin Vaults from Vietnam, all sorts of things. Eventually I wrote a book called *Lifting the Lid*, cataloguing our experiences with dry toilets and showing how to make them using very basic materials.¹⁴ You’re not the only one with a toilet fixation!

Our designs were widely used in the UK, and I should mention Japan, where dry toilets have been a core part of rural culture for centuries. I was especially charmed when, after a lecture in Japan, a person approached me and asked me to sign a copy of, blow me down, *Lifting the Lid*, which he had translated into Japanese and published himself. I still treasure the copy he gave me.

SS: So many great puns.

PH: Yes, mostly untranslatable British humour.¹⁵ Jokes and puns are almost unavoidable if you are writing about toilets.

I went all over the world looking at toilet systems, not all of the dry/composting type; some might be described as “semi-wet” but were not connected to the sewerage system. They didn’t always work. Lots of things work okay in California or Australia, just five degrees hotter, but they don’t work in the UK: there are no completely universal technologies. They fit certain climates and certain places and perhaps certain cultural habits. You can’t easily generalise.

SS: That would be something that I’d like to ask about. When I try to explain to students the principles leading to modernism and universalism, I’m describing an alien culture. They are brought up to understand difference, but to talk about sameness, to talk about the universal, for them is a mode of Eurocentric colonial arrogance. I try to explain the historical assumption that as a globalising, industrialising society, we would eventually alight upon a universal aesthetic and technology that would

¹³ Van der Ryn 1978.

¹⁴ Harper/Halestrap 1999.

¹⁵ As it happens, both interviewer and interviewee are British.

unify humanity. I contextualise this as the outcome of three or four centuries of thought going back to the Renaissance founded on capitalism, scientific revolution, enlightenment, empire, and in that framework, it would seem to make a radical sort of sense; and however problematic it looks in retrospect, it nonetheless is the undergirding of IKEA and IKEA's systems.

PH: Yes. We were very keen in 1972 on the Arts and Crafts ideal of hand production. But we failed to realise you had to be pretty rich to afford all of that Arts and Crafts stuff. And of course by historical standards we *were* rich. Even the 19th century movement was wealthy on the back of miners, mill-workers and the British Empire, but they were no doubt unaware of it. Ruskin, Morris and Co. were opposed to rubbishy mass production, but the Bauhaus said, look, we can have really cool designs that are functional and cheap and can be mass produced – brilliant! And IKEA has run with that, as far as I am concerned. It is excellent design, it works very well, it is thought up with people in mind, and it is cheap.

SS: You seem to have concluded that at a small scale, let's say at the household scale, stuff was not going to work, and you needed to find a way to scale up. Is that right, or is that wrong?

PH: Well, let's take hydroponics as an example. I've known people who have done it, and I've done a bit myself; you can grow vegetables and things in a greenhouse, without soil. And you can get good yields. What you don't get is your staples. You would hear people say, "look at me, growing my own food", but actually they are growing flavour molecules, not calories, or protein, or oil, or anything substantial. We get these things from farmers very cheaply, because farmers do it very well. I grow loads of veggies and all that sort of stuff, that's fine, but I know I am still dependent on farmers, God bless them. But look, hydroponics has now been ramped up to huge factories covering hundreds of hectares, producing salads in greenhouses heated by cogeneration from local power stations. Is that the future of food? No, but the future of *part* of our food, which keeps the costs down so we can all engage in craft-scale activities, even most of the time.

And it is the same with the maker movement, you are making one-off things. We are so rich now. We have a lot of free time because of the high productivity of society as a whole that we can then do craft stuff again. In principle, in the course of a life, you could probably make all of your own cups. You could make all of your own shoes, you could make all of your own clothes. It's interesting that you can do these things as a result of the high productivity of the industrial system that provides all the bases that we essentially need, all the warmth and the shelter and the transport. Back in the 1970s, we were thinking ... it should be *all* craft stuff. But we were wrong there: it only worked because of the incredible productivity of the industrial system just keeping us all afloat, without our noticing it really. I think what's happened now is that we are coming to accept that, okay, not only modernity, the Bauhaus, the factories,

everything, it has got to be there to keep us all going, because we can't survive without it. We are all dependent on it, but now we need to humanise it in some way. We need to find some way to stop it screwing up the planet.

SS: In 1972, at the UN conference, you were cutting against the grain of the universalist, governmental, top-down pro-development and pro-planning approach to environmentalism. It was almost like Karl Marx's vision of the future, where because the basic necessities are taken care of, you can go fishing ...

PH: You seem to be alluding to the industrial vision of socialism, exemplified in Edward Bellamy's *Looking Backward*, that – interestingly enough – provoked William Morris's *News from Nowhere* as a kind of rebuttal.¹⁶ The maker movement should go back and look at these two books again, because they paint two different conceptions of how to deliver the Good Life for all. Back in 1972, we were quite clearly Morris-ists, but as you can tell, over the years we have become Bellamytes as it were. Morrisism offers Maker creativity to an elite few; Bellamism potentially offers it to all.

Bellamy's vision does presage a wealthy welfare society, but only a few today take full advantage of it. The big “winners”, it seems to me, are those we might call Bohemians, who, while maintaining an easy-going middle-class discipline, have reduced their aspirations below the average productivity of the system, leaving them time to think, innovate, relax, and – yes – Make. It seems to me that in a post-modern society, everybody could live like this if they wished. They could live out old Marx's dream. Could I be wrong about this? A terrifying thought.

SS: In the 1970s, the emphasis was on small scale; now, we're carefully, critically accepting of the advantages of scale, of production. Nonetheless, it still leaves the question of distribution, justice and sustainability following relentless economic growth. In terms of what the maker movement might be doing now, is it some sort of recombination of handicraft and mass production? What should makers be making?

PH: We were fascinated by household, local and regional self-sufficiency, meeting our own needs from the materials at hand. But this quickly proved impossible in practice. You could “make” a simple thermosiphon solar water-heater, and we did. But you had to get the copper tubing, and the joints, and the solder, and the black paint, and the wood for the box, and the glass, and so on. Although that is not very high tech, it is still industrial. And that does presuppose that there are copper mines somewhere, and there are people making tubes. Could we have made our own tubes, panes of glass? Surely not.

¹⁶ Bellamy 1888; Morris 1890.

We did occasionally dream of a general-purpose, local-scale manufacturing process that could fabricate almost anything from given raw materials. We thought this would be the ultimate “liberatory technology”. Today we have 3D-printing which comes quite close in spirit, but you would still need the appropriate raw materials. Having said this, we would have given our eye-teeth for a 3D printer!

SS: But then, can you make a 3D printer? This is some sort of infinite regression. It is funny, it reminds me of how young designers and engineers, now, doing maker-thons and hack-a-thons and whatever, it is a little bit like you with the copper pipe in the 1970s. Sure they are reconfiguring technology, but they can't make the chip, the Raspberry Pi. They can get the chips to do good things.

PH: Yes, I see, but most of these “good things” do not need to be customised. They might as well be mass-produced in the cheapest possible way. Customisation tends to come at a higher level when you buy standard items from (say) IKEA and combine them in unique ways at home.

Some things are in our favour. Moore's law means that tiny things with marvellous capacities can be reproduced endlessly. On the other hand, miniaturisation and acceleration does not apply to meals, houses, roads, clothes, landscapes and furniture. We could “make” lots of these, but probably most people wouldn't.

There is a worry about specialised skills and supply chains: key people, industries or locations withholding supplies. I find myself unworried by this. I am more worried by the brittleness of the system, forced to rack up greater efficiency at the expense of resilience.

If you want to be more resilient, to simplify, where do you start? That is your infinite regression. This was the question often asked within the circles of people we might call “collapsists”, who held the apocalyptic view that a total collapse of modern societies was likely, perhaps inevitable. ... To some extent we were all collapsists then! You've got to remember, that was the time of the bomb and the Cold War: there was a possibility of a nuclear exchange at almost any time. And then you would have the definite collapse of central authority, and that was always at the back of our mind. But then we also thought that the industrial society might have the seeds of its own destruction, and it might just implode and fall apart, in which case, we had to ask the question, “who is going to rebuild afterwards?”. In that situation, you cannot take anything for granted, so you might absolutely have to make everything from scratch.

This was one of the notions for the New Alchemists and the CAT in Wales. We were the modern arks, and we would come out and help everyone rebuild civilisation. But you had no idea what would be

left.¹⁷ The presumption was that you should try to keep it as simple as possible, because you couldn't just walk down to the hardware shop and get yourself a metre of 19 mill copper pipe.

SS: And then adding to that potentially end times quality of the era, a year after Stockholm, you had the Energy Crisis.

PH: Yeah.

SS: And increasing industrial unrest, all through the 1970s, and at least in France, the UK and the US, increasing racial tension. And recession; and we've said about the Cold War. By 1972 as well the neo-Malthusian tenor of the Club of Rome.

PH: Of course we knew about that as well. We'd read all of their stuff. We'd met them in fact, the Club of Rome people. They were in Stockholm then, too.¹⁸

SS: And Ehrlich's *The Population Bomb*.¹⁹

PH: Yeah.

SS: And Carson's *Silent Spring*.²⁰

PH: And others of the same era, such as Barry Commoner's *Closing Circle*.²¹ Carson and Commoner both stressed the significance of applying technology in an ethically driven rather than commercially driven manner, and this had a strong bearing on the notion of alternative technologies, of having the technology but with alternative values.

SS: Politically, historically, socially, how did you and your friends find each other and come together? There seems to have been a thrilling intersection of Red and Green – a sort of socialist anarchism meets deep ecology. Not Arne Ness deep, but deep-ish. And why is that interesting again now? (It clearly is, because we are doing this interview; the journal guest editors want to know about it, and my students are curious about it.) How did you get to Red and Green?

¹⁷ This question has been given a modern treatment by Lewis Dartnell in *The Knowledge: How to Rebuild Our World after an Apocalypse* (2015).

¹⁸ The exhibition was visited by Aurelio Peccei, then head of the Club of Rome.

¹⁹ Ehrlich 1968.

²⁰ Carson 1962.

²¹ Commoner 1971.

PH: Hmm. I guess I haven't been thinking about that recently. The Green bit for me just came from the evidence. I was just paying attention to all of that Malthusian stuff throughout the 1960s, starting with the population data, because you could see the exponential pattern. If there is an exponential going on somewhere, it just can't continue, so you knew that was "unsustainable", although we didn't have that word then. And then on top of that, we started to understand more about pollution. Remember that in the immediate post-war period, there was tremendous technological optimism that the bad could be transformed into good: "swords into ploughshares". For example, chemical warfare technology went into pesticides, while munitions technology went into fertilisers. It's all the same chemistry. And the tanks turned into tractors. Of course, commercial interests promoted these things and they came to seem like technological silver bullets. DDT was the classic silver bullet. You've got all these pests, you just zap them and they go away: what's not to like? And that can keep going for about a decade before the side effects start building up. It takes a while for this to happen, and that of course was Rachel Carlson's contribution. She was showing how things were happening that we simply did not expect. We didn't expect the DDT to dissolve in body fat and work its way up the food chain and then result in raptors having no chicks because the eggs were too thin.

And one by one, we kept seeing these unexpected things. Another one that struck me was the increase of noise in the ocean. Meaning that ocean creatures like whales that depended on long distance communication with sounds couldn't manage. It was so noisy in there, they could only communicate a few hundred yards. Nobody thought of that, "ships, whales, noise". Of course you didn't. All of these things are unexpected effects. I had pages of these things and I thought, god, this is awful, everything is falling to pieces, and nobody realises because they are so intent on using their own magic bullets. An important paper, Garrett Hardin's "The Tragedy of the Commons", came out in 1968, that explained a lot of this process, with malign collective effects emerging that nobody really wanted.²² I did not necessarily buy into the author's other agendas, but the basic pattern is surely a universal one, on a par with, say, natural selection. Our answer to the 'tragedy' was essentially the kind of relocalisation that had governed local collective resources for centuries. People would say, "well alright you're a critic. Do you have an answer?" And then we said "Yeah, we do have an answer, it is a bit weird, but here it is. We think it is an answer." And that was our decentralised, low-tech concept of Alternative Technology.

Then gradually as the 1980s rolled on, the key thing that happened to me is that I realised that the different nasty technologies don't necessarily add up to a joint disaster. You can pick them off one at a time, impose regulations at a national level and get results. So you might be able to find a way to have the benefits without the nasty downsides, if we are very clever and pay attention. Not that we did always pay

²² Hardin 1968.

attention, but I began to see that you *could* have high-tech without irreversible damage, and that it is hard to run a modern society without high-tech. So then I began to switch towards what a lot of people call “eco-modernisation”: a dirty word in some circles, emphasising technical innovation rather than lifestyle change, to achieve a sustainable modern society.

But my confidence that pollution impacts did not synergise, and could be successfully tackled one at a time, was ruined by the arrival of the greenhouse gases, which behave exactly like the “limits to growth” pollution curve, much criticised for lumping them all together. Damn! I had gone through a rather optimistic phase in the 1990s, and now I had to accommodate a much more pessimistic view, which roughly parallels the great doomsday clock on the cover of the *Bulletin of the Atomic Scientists*.

SS: When you mention Garrett Hardin earlier, you said, you weren’t sure about the rest of the agenda. What do you mean by the rest of the agenda?

PH: Well, he’s infamous for being in favour of eugenics and advocating privatisation as a solution to the Tragedy. A lot of people won’t use the term “the tragedy of the commons” because it is associated with him. But you need to have some kind of terminology to talk about these malign collective action patterns, and nobody has come up with a better term that is universally recognised as referring to the same processes. I’m taking the essential “political economy” of it, without the rest of the luggage. It is striking that many subsequent “solutions” to Hardin’s tragedy share many of the limitations of our own alternative response: they are too local; they solve the problem at one level but leave it unaddressed at the greater, global level.

SS: I think the pessimism you’re referring to is one reason that we are going back into history, into the archive, to look at the 1970s and the sorts of interventions that you made, and it could be that the journal is doing this revisiting again, because if the maker movement began during one of those optimistic phases when we believed that we could innovate our way out of crisis.... I think that pessimistic swing of the pendulum is one of the things impelling the journal to say, “well okay, let’s then think about a pessimistic making”. But I still want to back up. Because a phrase that you used earlier was “alternative values”. There is right now, Peter, a hunger for alternative values. I think that an appeal of Alternative Technology is that it seems to posit an alternative set of values. One of the things that you seemed to be doing was that you seemed to be trying to pre-figure (as anarchists would say) what happens next, whether that was in those exquisite illustrations by Cliff Harper, or whether it was by trying to fabricate things, or make things, to see if it works, or whether it was through speculative texts, where in *Radical Technology* you see what socialism would be like. If the United Nations was overall in favour of what would become known by the 1980s as sustainability – that basically you can have your cake and eat it, you can have

responsible economic growth that takes care of the environment – it would seem that on the fringe of Stockholm you were “hacking the sustainability” before it is going to be sustainability, and saying “well you know, we might not get there. Things could fall apart before then, we may have to think in a much more grassroots way”. And in that, there was also something that we would today call a “hacking”, “speculation”, “decolonisation” – you were showing that there is an industrial and technological system out there that is a form of colonisation that has made us all dance to the beat of one drum, which is that of “relentless growth” and relentless production, a globalised clock. That it can be kind of hacked, and we can speculate on what comes next. We are yet again back to ruminating on what happens as capitalism stumbles, seems to become more unequal, seems to become more violent, and seems congenitally unable to deal with racial inequality, global inequality; I think one reason we are back in the archive of the 1970s is because analogously, and sometimes literally, it was asking the same questions. Can we do something exciting with crisis? That’s a big preliminary to my final question: what happened to bring socialism into the mix of thought in the early 1970s, and what happened to it?

PH: Okay, I’ve given you the Green, and I think that came from the evidence. The Red I don’t think came from the evidence. That was just sort of in the water, I think. I wasn’t particularly critical about it. It was the hip thing. Everybody around me seemed to be some kind of libertarian socialist. There were lots of radical tendencies of course at the time, and I used to meet Trotskyists a lot, and members of the Communist Party, old Stalinists, and all sorts of Marxists. It’s worth remembering that at that time you could not say that the Soviet Experiment had definitely failed. I should also remark that anarchism was a greater influence on alternative technology than Marxism, and indeed proper Marxists tended to look down on us “mere environmentalists”. History has been kinder to us than to them.

SS: Was Maoism circulating?

PH: Yes, Maoism was important too, and you can see the fetishism of China in *Radical Technology*.

PH: In a sense, there was this ... shopping mall of different ideological styles, and you could go in there, and say, “Oh I think I’m rather one of those”. It was like choosing a dress! And *these* people are cooler than *those*. Anyway, there were some things which were unquestionable, and one of these was “The Revolution”. The Revolution was a universal solvent: almost everybody seemed to agree it was both necessary and inevitable. I am astonished today looking back on it, it was assumed that from this incredible chaos would emerge a beautiful new butterfly. It would be ordered, equitable, everybody would know what to do, and everything would be good – as orderly as iron filings around a magnet.

Now we are sadder and wiser, and today I think just the opposite. The more chaos there is, the more you end up with thugs, guns, Mad Max and political opportunists. We still need a fairly rapid transformation, but it must be orderly and retain the basic civilities. To deploy a metaphor, we mustn't curdle the milk.

In the 1980s and 1990s, as I've already said, I became more sanguine about the physical prospects, but that was also the era when neoliberalism, which is intrinsically anti-ethical, was taking over the planet like a virus. We desperately needed an ideological framework to counter it, but (however unfairly) Marxism was buried in the rubble of the Soviet Union. Gradually, the old humanism exerted itself and finally Thomas Piketty and others have revived the old Marxist spirit. Good for them, we need it.

But I must still say that, in my professional life, I'm at pains to try to persuade my colleagues that if you've got to solve a physical problem – because climate change, etc. are physical problems – you have got to come up with physical solutions, which have got to be technological. And then you have to build your politics and your economics around *that*. It is very important to do it this way and not the other way round. It's very tempting and easy to say, “well let's get all the politics sorted out, and we'll just hope that the physics and the technology will play nicely”. It won't. You've got to get that physical side of it sorted out first. Only some patterns are possible.

But it seems to me that the two bits of jigsaw that fit together nicely are again Red and Green, in the sense that if you have a rational environmental perspective, it fits in with a kind of rational evidence-based, careful, social democracy I suppose. It fits together because on both the environmental and political sides everyone is trying to think things out in a reasonable and honourable way. I hope I am not sounding too naïve here. I wouldn't call it Red though; it's more pink, boring social democracy. Boring is good! And the Green is not so deep green – you referred before to “deep ecology”. The texts about deep ecology, I am sorry to say, are a kind of populist fantasy, projecting human values and human wishes onto nature. It assumes nature is a bit like us, and that you could actually have dealings with nature as if it were a person. No, Nature is its own thing, and it is not like us. You mustn't project your own values onto it. It has its rules that you have got to obey.... So in that sense, the political context is light green and pink. It is not deep Green and blood Red, as it used to be. Shame really, but there it is.

SS: Would that be a difference between now and where you were in 1972, 1976?

PH: Definitely. Definitely. In those days, I was more Green in the sense that I believed in a neo-primitive, back to nature, fundamental restriction on economic progress. On the other hand, I was Red enough to believe in The Revolution and that capitalists all wore top hats and smoked cigars! But I must admit, it was a laugh.

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