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Are Luddites Confused?

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General opposition to 'progress' is often seen as involving a personification of technology as an evil spirit. One version of 'luddism' is defended here as worthy of serious debate. ('Luddism' is an attempt to justify a general presumption that technical progress is bad for us, so technical innovations should not count as true achievement.) Our luddite says, 'If technical powers, misused, will cause more harm than good, these powers should count as bad. And such harmful misuse is likely, since the dramatic, half-blind changes resulting from technology will shortly damage world systems, swamping their adjustment-mechanisms. "Superhuman" powers go sour with merely human wisdom. "Know-how" tends inherently to pull ahead of "know-whether"'. This version of luddism is contrasted with various caricatures; luddite research priorities are outlined. Serious discussion is invited of the dangers inherent in further empowering fallible humanity.

I. Introduction

Many science-writers seem to feel that general opposition to technical progress (which we will call 'luddism' here)[1] is simply confused, deserving patient explanation or humor more than refutation. We are reminded regularly that science is neutral: equations do not explode. These writers seem to see a conceptual error in luddism: even if bad things have happened which would not have happened in a pretechnical society, it's foolish to blame these troubles on technology.

An interviewer reported Dr. Edward Teller's worry that some Americans have begun to believe that technology is bad. The reporter says that Dr. Teller sees this attitude as silly: 'There is no invention, no new development that is either peaceful or warlike. Anything can be used in a variety of ways.'[2] And John Maddox says: '[T]he present discontents cannot be laid entirely at the door of technology, and it is a non-question to ask . . . will the technology that has brought us to this pass be able to find a way out again?'[3] Maddox also says, about totalitarian regimes, 'Here again . . . it is not technology which should be blamed but the motives of those who seek to use it malevolently'.[4] Sir Peter Medawar concedes one sense in which weapons cause wars, but says that in a deeper sense it is folly to blame the weapons for military crimes: 'In the management of our

affairs, we are poor workmen who blame our tools.'[5] And Petr Beckmann compares technology-critics to those who would blame widespread obesity on farmers[6] and, more vividly, to those who would blame the Crucifixion on the existence of hammers and nails.[7] 'Like the proverbial cuckold who, on finding his wife in bed with the milkman, kicked the milkman's horse . . . they vent their frustration in the wrong place.'[8]

Philosophers become interested when it is claimed that some position is conceptually muddled. In this case I would submit that there is one version of 'luddism' which is *not* muddled, nor is it based on ridiculous claims about the world. (By 'luddism' I mean a systematic justification of a *general* dislike of technical progress. The 'technophobia' defended here is a very strong and controversial position; persons who for special reasons oppose individual projects, such as nuclear breeder-reactors, should not be called 'luddites' at all.)

I will not ask if this abstract critique of technology is correct: that would carry me further than my competence warrants into empirical inquiry. I claim only that if this luddite 'theory' is to be opposed it deserves *serious* refutation. I have only skimmed the anti-luddite literature; I hope somewhere there are better arguments for progress than the irrelevant scorn and caricatures of luddism I have encountered.

I am not concerned here with science as such, only as it leads to technical advances. (But I assume that close ties here are typical.) And we needn't agonize over the 'correct' definition of technology: I am concerned with any set of techniques that make possible dramatic new ways of changing the world suddenly, in pursuing definite goals. (If some poetical techniques could outdo engineering in changing our world – perhaps by spreading some new religion – then I'd be more concerned with these techniques; but I assume that 'hard-science' techniques produce the most dramatic changes today.)[9] I am concerned with technology as the major contemporary form of power.

II. Power as a Hypothetical Good

People want power for themselves and their children; they feel ashamed of being weak and powerless; they admire powerful people who can carry out their plans without impediment or failure. People tend to think of power as one kind of invisible fluid – like electricity, they'd say. But actually there is no one thing called 'Power', which can be assigned one value – there is only 'able to do this' or 'able to do that'.

We don't say everyone who has any power is powerful. We use words like 'powerful', 'competent', and 'able' to mark off élites. Suppose a man were able to grow the longest fingernails in the world. He'd be mentioned in the *Guinness Book of Records*; but we wouldn't call him powerful or strong. He doesn't have the kind of 'able-to-*x*' that we admire: we admire a power only as the ability to do well some '*worthwhile*' activity.[10] And what of a person who can achieve his short-run goals with daring, cleverness, and perseverance – but the very success of these short-run projects blocks his long-range goals?[11] We may admire such a person willy-nilly; but in cool moments of reflection we don't really approve of our feelings of admiration, thinking pity is more in order.

Imagine a man who gets really good at karate: growing overconfident he picks a fight with a man with a gun and gets killed. He knew how to fight with armed men in the safest way possible; but he forgot that here 'safest possible' wasn't safe enough – he didn't know enough not to start the fight at all. In such cases, we can say, 'know-how' is incompetence without 'know-whether': it makes a person less able to attain his long-range goals. Our instinctive admiration for this athlete's courage and fighting skill could be interpreted as a feeling of what a splendid fellow he would have been *if* these gifts had been matched by good sense. We might agree he was strong, but we'd hardly call him powerful in any sense that implied our cool, reflective admiration.

Should we blame his fighting skill for his sudden end? Some would object to this way of talking – and of course it would be absurd to impute any *moral* blame to an abstract quality like skill. But it is perfectly meaningful to say that the overconfidence from his karate-skill caused his death by tempting him into a fight he couldn't survive.[12] It's coherent to say that such skill was bad for this man (as pollen is bad for allergic people, through no moral fault of the pollen).

Some people hesitate to say this – they want to count power and skill as good in every context. They would admit that the compound 'foolish power' is bad, but only because the disvalue of the folly in that compound outweighs the constant plus-value of the power. Since power admittedly adds value to wisdom (the wise man is more valuable if he can carry out his plans), these people assume that power must have constant, intrinsic plus-value in itself.

But in fact values don't combine in these simple additive ways. In a sense, chlorine could be said to 'convert' poisonous sodium into salubrious salt, and therefore to 'add food-value' to sodium. Yet chlorine by itself

is poisonous. One quality or thing can increase the value of another quality or thing it is combined with, without having itself a positive value in every context.[13] Now if powers were categorically good, they should add value to every compound into which they enter; they should improve every situation where they are involved. But a complete fool is, in many situations, better off weak; strength often adds *disvalue* to his folly.

Powers act like multipliers: they increase the value of wisdom, but they also multiply the disvalue of folly. (When great powers are guided only by average discretion, I submit, they are more apt to add disvalue.) And qualities that add disvalue, which make a situation worse than before, are properly called 'bad', in such situations.

People say, 'After all, any power could be used for good'; so they feel that all powers should be valued, in any context. But what counts is not how the power might be used, but how it is *likely* to be used. If an eight-year-old boy were given some driving lessons and car-keys, he *might* take a sick person to a hospital in an emergency. But it is the *likely* outcome here that makes us disapprove of adults who make cars available to eight-year-olds.

On the other hand, not every bad actual use makes us blame the power-provider. If sensible Joe's karate-instructor had no way of knowing that a growing tumor in Joe's brain would produce murderous rages later, we would not hold the instructor morally responsible for an ensuing tragedy. Saying that powers are bad when misused would be misleading if it made us think the power-provider was automatically guilty of any harm actually done by the powers. Presumably Beckmann's hammer-maker couldn't foresee the Crucifixion. All we expect of people who provide powers for others is that they take account of those misuses which a reasonable person would foresee who had access to the same facts as they. (One shabby aspect of the martial-arts trades in the U.S.A. is the customary willingness to sell lethal skills to any chance comer. The pious hope that powers won't be misused is not enough alone to absolve people who empower others.[14] One must talk of foreseeable and unforeseeable misuses.)

The power-provider is not morally guilty if he could not foresee the misuse that would occur. The *moral* code allows faultless ignorance of actual consequences as an excuse. But unwritten norms of amoral shame and glory are not so concerned with whether agents 'couldn't know what would happen'.[15] For instance, we find no problem in glorifying Thomas Edison for contributing to a world of electronics he could never have foreseen. Conversely, while I would admit the cleverness and persever-

ence of the Wright Brothers, and would not deny their good-will, I see no reason to award them that amoral admiration we give to world-improving innovators:[16] the airplane has produced far more suffering, terror, and hatred for mankind than benefit.

(One might object that praise due to an innovator should be allocated according to the talents and dedication he manifested in his work, not according to the actual outcome of his innovations – which outcome might be a function of fortune, not of his personal traits. But Adam Smith noted that a general who plans a brilliant campaign and is then deprived of a chance to carry it out has been cheated of the glory of success, even though no one doubts his personal excellence.[17] Analogously, a successful innovator whose inventions are mainly misused by wicked or foolish policy-makers has been cheated of the glory of contributing to human welfare on a large scale.)

One inconsistency of many defenders of progress is to reject any 'blaming' of bad results on technical powers, while continuing blissfully to give such powers 'credit' for any good results.[18] A *Nature* editorial asks, for instance, 'Is it sensible to protest the A-bomb, when there's some evidence that nuclear weapons have helped to head off potential conflicts in the past, and when the real concern is that governments [have been remiss]?'[19] And a science student says, 'Science can solve almost any problem, but you have to get people to stop doing the things that cause destruction'.[20]

Indeed, this tradition of absolving powers from any of their bad results, while praising them for their good results, goes back to Gorgias's speech in Plato's dialogue: he gave glory to rhetorical power for the civic improvements it led to, but then said that it could not be blamed for its misuse. But in fact, if it is illogical to despise powers for their bad consequences, then it is equally illogical to admire them for their good uses.

Some thinkers might eschew praise *or* contempt for unused powers. Powers, they would say, have no value in themselves: only the uses people make of them have value or disvalue. Powers are valueless until they are used well or used ill.

But we don't really think this way, ordinarily. If we expect that a power will be well-used, we already value and admire that power. Surely a person who foresaw Dr. Schweitzer's lifetime of good-works would be happy already for the world on the day Schweitzer finished medical school. And if the parents of our unlucky karate-champion had fully understood his pugnacious over-confidence, they'd have lamented his karate-diploma as

his death-warrant. There is surely a legitimate sense in which something counts as good if one prudently seeks it and prudently rejoices at having it (as is the case with power that will be well used); and any quality is bad which one would be prudent to avoid and unlucky to possess (as with power when it will do mainly harm). Surely it's bad to have incurable cancer even before it starts to ravage you; so also is it bad now to have skills and abilities that will some day destroy you. Speed is a defect in a blind horse.

We 'give credit' in a perfectly straightforward sense, even before their use, to powers that will do us good. A boxer was asked once to comment on the claim that he had won his last fight with a 'lucky punch'. 'Well', he said thoughtfully, 'I think I'm lucky to have that punch.' (Presumably this fighter thought he was lucky to have that 'hitting power' even before he used it in fights – when he first noticed his blows destroying punching bags, for instance.) And a Briton who foresaw the potentialities of radar would at once admire its inventors for providing the R.A.F. with a very useful tool for downing Nazi bombers.

(Incidentally, it could be perfectly logical for the poor workman to 'blame' his tools – an inept person who could have handled a hand-saw can reasonably assert that it was the power-saw that made him lose his arm. And his wife could rightly blame the well-meaning friend who gave him the saw, as well as her husband for trying to use it. Our objectors here might see the ascription of a kind of responsibility to nonhuman tools as excusing the humans who misuse them. But 'blame' need not be lessened in being divided.)

So *if* modern technology is likely to do more harm than good, it's not incoherent to say it's bad for us, to regret mankind's acquiring these new abilities. And while we can't help feeling some admiration for the decision-maker who has all these dangerous, glamorous techniques at his command (just as we would go on feeling some admiration for the self-doomed champion), we'd do well to interpret this feeling as *hypothetical* admiration: these worthies *would* be splendid creatures if they had the superhuman wisdom to match their fantastic powers. We don't reflectively admire the sorcerer's apprentice.[21]

Precisely because a glamor automatically attaches to fighting skill (well or ill used), the late karate-champion's parents would try to see that his younger brother (even more hot-blooded and foolish) doesn't get exposed to these lethal skills at all. In other words, the automatic glamor of skills and powers may make them worse, objectively.[22] Nor would the parents

be unreasonable, believing that this sweaty way of life harms more people than it helps, to feel revulsion for the whole 'martial-arts' subculture. Analogously, it would not be unreasonable for one who thinks technology is likely to be misused (perhaps likely to end the human experiment) to feel disenchanted with the whole scientific–technical world.[23]

There is no 'personifying fallacy' involved in 'blaming' technology if one thinks that, misused, it will lead to more harm than good. But all this hinges on the big 'If' – *is* the next wave of technical progress more likely to be misused than well used? And this might seem to make the whole luddite case trivial, since most people think that past and future technology does more good than harm. Even so, there is a point worth making: perhaps the luddites are wrong in their gloomy predictions; but they are not unreasonable to dislike technology, *given* these predictions. Science advocates should not waste time chuckling over any supposed confusion – they should begin debating the prediction and evaluation of the consequences of upcoming technical innovations.

III. Blind Change Helps Entropy

Random change is the enemy of systems: in the very nature of things, there are more ways for an on-going system to change for the worse than for the better – if it changes randomly, it's more likely to change for the worse.[24] I'd like now to propose a model-description of our present situation which suggests that future technical innovations will likely do more harm than good, over-all.

To start generating the model, imagine a crude and fragile system where the parts are ordered just about as they must be for the system to function at all, with no negative feedback to repair disruptive changes. Then imagine a sudden, pervasive, totally blind intervention. For instance, imagine a blind man trying to fix his watch by plunging a screwdriver deep into its works. As Barry Commoner notes, such a plunge might conceivably improve the watch – but it's far more likely to wreck it.[25] The owner of a disorderly china shop would be ill-advised to bring in a bull to straighten things out.

This model is far from reality. The natural systems we are concerned with are often quite resilient, with strong negative-feedback mechanisms. And our interventions are not totally blind (though egoistic human actions often ignore the consequences for all if the consequences for the agent are thought beneficial). Typically we foresee some consequences; of these we

want some, and some we try to remedy. Still other consequences of our action (good and bad) we don't foresee at all – though often we can foresee that there will be some significant unforeseen consequences, even when we can't predict what these will be.

My model is concerned with the unforeseen consequences of dramatic innovations (some good consequences, but usually more bad ones, because the innovations blindly impinge on dynamic natural and human systems). Whenever these unforeseen consequences will far outweigh the foreseeable consequences, then the net over-all results of that innovation will likely be bad: it will typically do more harm than good, in the long run.

If we think of our typical actions as having two segments, the blind part and the sighted part – then what is true of totally blind actions seems true also of the blind segments of our typical actions: the consequences involved in the blind part will include more harm than good. There will be some good unforeseen consequences,[26] but usually the bad ones will predominate.

Imagine facing a large, malfunctioning clock-works: you can see only a little way into the works: some debris is interfering with a gear. But to remove this you have only a long rod with a protrusion (three feet from the end) which protrusion you need for your purpose. You can't deal with the visible problem intelligently without plunging the rod blindly three feet further into the dark works (which of course are running). If you do gamble on the intervention, it's not because you hope that the blind segment of your activity will *improve* the invisible part of the works, nor because you hope that the blind intervention will have important effects that will exactly cancel each other out.[27] You know that the unforeseeable effects of your action will likely include more harm than good – but you can hope that the extra three feet of the rod won't affect the works importantly at all. You hope that the unforeseeable consequences (likely bad in the net) will be outweighed by the foreseen consequences (practically all good).

Here is perhaps the crucial difference between modern technology and other, more traditional techniques. Again and again we find that the unforeseen consequences (good and bad) of many recent interventions far outweigh the foreseen consequences[28] – and not just in the trivial sense that moving one's finger may change the history of 1000 years from now, but in a much more immediate sense. For instance, people foresaw that the automobile would grant new and convenient mobility; no one could predict its startling effects on the family, on the cities, on the atmosphere, and on world-crises in the Middle East.

We have three reasons for hope, in such partly-blind interventions: first, we can hope that our blind interventions will in fact be puny, compared to the magnitude of the system involved – like dropping a straw into a giant clock-works. For instance, people say that each big volcano eruption puts a huge amount of particulate matter into the air, relative to our industrial pollution; yet the atmosphere seems pretty stable. And while some scientists worry that modern agriculture increases the nitrous oxide in the stratosphere (depleting the ozone and increasing harmful ultraviolet radiation),[29] other scientists hope that the ocean has all along been giving off truly gigantic amounts of nitrous oxide – so the percentage added by our agriculture might be tiny.[30]

But still it was a shock to find that our aerosols and our freon might have significant effects on stratospheric ozone. Who could foresee such odd side-effects?[31] (More unsettling, these drawbacks were discovered in a way by accident, in inquiries stemming from assessments of the effects of supersonic planes. How many similar shocks will we get in the future? Will we always find out in time?) And some scientists say we are inadvertently changing the world climates significantly, which might harm farming just by making local weather more variable.

Now it *could* turn out that the unplanned secular changes in the atmosphere will do mankind more good than harm. While most people would worry, for instance, about any sudden accelerating melt of the polar ice-caps, one Russian scientist wants us to move to speed up the process deliberately, melting most of the ice-caps permanently in four or five years.[32] But most of us would not expect such blind lunges to be beneficial.

Our interventions are getting so massive that many could affect important natural systems in unforeseen (but likely harmful) ways. As one scientific committee reported, 'Since 1945 our ability to alter the world's natural systems has accelerated far more quickly than our ability to understand the changes. . . . Unlike our primitive ancestors, we are now able to pollute whole natural systems on a global basis.'[33] (Note that it is just assumed as obvious that the blind, wholesale introduction of new chemicals into ecosystems will likely 'pollute' them, not improve them.)

Well, what of the resilience of natural and social systems? That is our second hope. For instance, some scientists have predicted that as the ozone is depleted, ozone production in the atmosphere will automatically increase – (but only enough to make up about 15 percent of the depletion).[34] And many living cells have ultraviolet-repair mechanisms to help

them somewhat in the case of a sudden increase in ultraviolet radiation.[35]

There must be repair-mechanisms in enduring, successful natural systems; else random changes would have destroyed the systems long ago. But what's crucial here is the force and speed of the damaging intervention. Rabbits can adjust to some heat-variations; but a rabbit popped into a microwave oven might as well have no adjustment-mechanisms at all. What is peculiar to modern technical interventions is their suddenness and dramatic force.[36]

But perhaps the worriers are wrong here – human intervention may still be puny compared to the adjustment-potential of the tough natural systems these actions affect. Even if this is so, there is reason to worry about the fairly near future. The destabilizing aspects of our activity seem to be increasing exponentially[37] – so if we are not yet at the danger-point, we may soon be there.

Optimists and pessimists have long argued about whether our world is a 'closed system', making exponential growth a long-run impossibility. It's difficult to show neatly that we must run out of resources or energy or food, that obvious forms of pollution can't be cleaned up as we go. But perhaps our 'blind-change-helps-entropy' model can make sense of 'closed-system' claims. At some degree of increasingly massive intervention, we must reach the point where our actions can swamp the adjustment-mechanism of important natural systems, the point where unforeseen consequences of our innovations will far outweigh the foreseen consequences – and this predomination of unforeseen consequences (in the net harmful) means that the net over-all consequences of such innovations will be harmful. So this model suggests there are real limits on the expansion of human technical progress, beyond which further progress is foolish – and exponential progress must come up against those system-limits soon, if they have not already.

Our third hope is that we can notice the first signs of damage to natural systems and repair them. But once we have damaged the invisible clockworks, further blind poking around is a poor strategy. We understand little about atmospheric systems, for instance, and we're not likely to understand them very well thirty years from now. It seems chancy to intervene half-blindly in mysterious systems to repair damage from previous mistakes. It's odd how we increase cancers by environmental blunders, then propose controversial DNA research (partly) to learn how to cure cancer. One senior scientist suggested in a casual discussion that if we find chlorine is depleting ozone, we can simply puff into the stratosphere some

chlorine-cleanup chemicals. Such breezy suggestions are chilling, especially on reading that in Grand Junction, Colorado, government officials first told the locals they could build houses on uranium tailings. Later, when this was seen as definitely inadvisable, the tailings were buried under dirt planted aesthetically with greenery. Unfortunately, the greenery now gives off radon gas three times as fast as the uncovered piles did before.[38]

Well, is this change-helps-entropy model a realistic description at all of our situation? A philosopher cannot say much usefully about an empirical question like this. But I submit that the model is not ridiculous, so it is not unreasonable to expect more harm than good from further technical progress; so it is reasonable to feel unenthusiastic about these tremendous powers, which *ex hypothesi* are likely to be misused.

IV. But Who'd Want to go Back to the Pretechnological World?

It's commonly thought that luddites must have a falsely rosy picture of the bucolic, innocent world that existed before the infestation by technical devils. Thus we have innumerable anti-luddite sermons reminding us of 'the bad old days'. But the luddite could see clearly that the world was awful back then – noting however that it is pretty awful now also.

Someone has suggested that there are more people living now without electricity than before the invention of electrical devices, because of increased population. We could develop this wild thought further. Suppose we assume that there were about 500 million people on earth before the scientific revolution, and we assume that almost all of these early people were at or below a miserable level of bare subsistence. Now assume that of the four billion people alive today, 75 percent are *above* the subsistence level.[39] Great progress? That depends on how one values the absence of misery as against the presence of prosperity. Notice that on this assumption, we now have over 1000 million people near subsistence level, instead of the 500 million who were miserable in the 'bad old days'. Human misery may well have *increased* since the scientific revolution, though not so fast as prosperity. Would we think a family is better off because, while formerly two children were miserable, now three out of ten children are miserable? Suppose a family included two deformed, miserable children and one normal child; the parents should hesitate to go on having children if they are assured that the final count would be four deformed children and eight normal ones.

And suppose a great famine should happen around the year 2010, when world population might be around six billion. This is not an impossible scenario. Suppose half of that population were reduced to misery – that would mean that six times as many people are miserable as before the advent of modern science.

'Are we better off since science?' Often this means, 'Are we middle-class Westerners better off?' And in terms of consumption-goods, even an underpaid assistant professor of philosophy today enjoys luxuries denied to ancient emperors. But I doubt if anyone has seriously thought much on how to settle the question of whether the 1700-situation was better or worse – *for humanity as a whole* – than the 1978-situation, or than possible situations in 2100. That would be a terrific question to settle: we'd need to decide how to weigh misery against prosperity, and then how to measure these indices carefully for all the peoples of the world.

What's more, there is one big difference between the world of 1700 and the world of 1978. Back then, humanity was not under the nuclear Sword of Damocles as it is now. Worrying about nuclear war has gone out of fashion, what with ecological and energy crises – but the danger may well have increased.[40] The luddite need not predict that a nuclear war *will* happen. He could simply note that in a game of chess, a player is *ceteris paribus* worse off than before if he stumbles into a predicament making checkmate a real possibility – even if he escapes the predicament. So also, even if humanity escapes nuclear war in the end, it will still always be true that in 1978 the human race was in a predicament endangering civilization, if not the whole biosphere.[41] And it will also be true that we got into this predicament because of (the misuse of) some brilliant technical discoveries.

I'm not sure this new predicament by itself means that humanity is worse off now than in 1700; but when we join this consideration with the foregoing puzzles about evaluating absolute increases in misery which count as relative improvements (for larger populations), I submit that it would not be ridiculous to say that mankind is worse off collectively in the scientific age.[42] So the self-evident superiority of life today cannot be used to dismiss luddism lightly.

V. Know-How without Know-Whether is Incompetence

Know-how is the skill for achieving narrow, well-defined objectives. As such, it advances quickly and easily. 'Keep your eyes on the ball', we

admonish young people: and we advise students not to write papers on 'Beauty-in-general' but to divide each topic up and take one sliver at a time. A kind of specialized tunnel-vision, we find, typically hastens the advancement of knowledge.

Know-how can give us quite efficiently what, at any given moment, we think we want. But an ancient wisdom, embodied in fairy-tales about fatal sets of three wishes, warns us of the dangers of getting too easily what we now think we want. We must be able to state our objectives clearly, to attain them efficiently. Norbert Wiener retells the story of *The Monkey's Paw*: a peasant asked a magic talisman for money, forgetting to specify the means to be used; he ended up collecting a large sum of insurance money from his son's horrible death.[43] Using a specialized, methodical way to solve problems, we can often get what we say now we want. This may not be what we really want – or perhaps what we want in the short run conflicts with what we want in the long run.[44]

Know-whether, on the other hand, is by nature a broader and more difficult kind of knowledge, predicting and evaluating all the relevant consequences of each proposed action. Our unlucky karate-champ had superb know-how about each karate-move in combat – but he didn't know when *not* to use his skills. And the colonel in *The Bridge Over the River Kwai* had superb know-how for organizing the technical information, labor, and resources for building a serviceable bridge under almost impossible conditions. He was a great example of 'British Can-Do'; but he was weak on know-whether: he didn't reflect sufficiently that he was building this admirable bridge for the enemy![45]

Know-how which is not correctly guided by a broader perspective turns out to be a weakness, not a strength – in attaining short-run goals magnificently, we will likely become less able to attain our basic, long-run goals. Whence the slogan headline above: 'Know-how without know-whether is incompetence.'

All this seems a mere platitude. Schumacher phrases the point neatly: 'Mankind has become far too clever to survive without wisdom.' People who quote such epigrams go on piously to wish that value-thinking could catch up with technical thinking. We need a crash program in values – perhaps we should divert some grants from engineering to philosophy, theology, and astrology (to cover all bets).

But in the first place, most of 'know-whether' (by weight) is simply empirical knowledge about 'what would happen if. . .'. The evaluation of proximate consequences of a given innovation turns mainly on predictions

about the ultimate results from those immediate consequences.[46] And the empirical knowledge involved in knowing whether to do something will always tend to lag behind the knowledge of how to do that thing. Learning how to '*x*' is often a narrow, efficient kind of inquiry; learning how to predict all the relevant, unobvious consequences of 'doing *x*' is by necessity a clumsy, slow process. Lester Brown has claimed that one chemist can invent so many new chemicals in a year that a scientist would require a whole lifetime to assess their safety.[47] And it is commonly said that if chemical manufacturers were required to shoulder a real burden of proof to show that each new chemical is really safe, the burden of research would be intolerable.

Another component of wisdom ('know-whether') is a set of character-traits: valuing strangers' interests roughly on a par with your own; valuing future interests roughly on a par with present ones; intellectual honesty, resisting wishful thinking; refusing immoral obedience, etc. Mankind has made no noticeable progress in these virtues during recorded history: Nietzsche is supposed to have said that bourgeois man has become more queasy, not more moral than his predecessors – and recent programs of antiseptic mass-killing from high-altitude bombers are not an obvious moral advance over the methods of Genghis Khan.

We have no reason then to expect that know-whether will catch up in our time with know-how. If we took Schumacher's epigram seriously ('Man has become too clever to survive without wisdom') and then added our unhappy premise about the small likelihood of any successful Manhattan Project to acquire wisdom overnight and disperse it immediately among decision-makers – it seems to follow (a) that we will not in fact survive, and (b) *that it's too bad we got so clever*. (The second conclusion, oddly, may seem more shocking than the first.)

Now the platitude has some bite, and ceases to command automatic, nodding agreement – now it supports luddite suspicions of technical progress. If we are not yet too clever to survive without wisdom, we should, perhaps, be in no hurry to increase our cleverness further.

VI. More Know-How Goes Sour without More Know-Whether

We would usually trust a nine-year-old boy with a bicycle; but to entrust a car to him would be to unleash a menace. The luddite need draw no hard, abstract line between modern technology and other techniques – he needs

only to point to a crucial difference of degree. Mankind has become able 'overnight' (in terms of evolutionary time) to brew alcohol, make guns, fix nitrogen artificially, fly faster than sound, destroy a dozen cities with rockets from a single submarine; we can visit the moon, affect stratospheric ozone and ocean fisheries and world climate; we can control various brain-centers electrically or chemically, determine the gender of foetuses, regulate conception, control disease, and manipulate genetic codes. IN USERS OF SUCH STAGGERING POWERS, ONLY VERY SMALL DEFECTS ARE NEEDED (IN KNOWLEDGE, PRUDENCE, OR BENEVOLENCE) TO PRODUCE CATASTROPHE.

No one can prove decisively that mankind lacks collectively the degree of wisdom necessary to use well the powers accruing from the next waves of technical innovations. This is a non-scientific issue requiring a broad (and vague) historical perspective. We can, though, cite certain facts that suggest the plausibility of luddite worries about our having the requisite degree of virtuous wisdom.

Item 1: The U.S.A. recently expended hundreds of billions of dollars and suffered about 1/3 million casualties (and caused incalculable native sufferings) in a silly attempt to prop up (with preposterous fire-power) a nonviable client-government in Saigon. This quixotic attempt to fight guerrillas with B-52s might best be described in a fable: 'There was once a maternal but near-sighted elephant who volunteered to stamp a weasel out of a hen-yard. After she had worked energetically for a while, a committee of surviving hens said: "Madam, we thank you for your gigantic good intentions; but the more your project proceeds, the fonder we get of that weasel!" '[48]

Item 2: Japanese scientists apparently used Chinese prisoners during World War II in large-scale, murderous germ-warfare experiments. American occupation authorities later helped these scientists conceal their deeds and let them rise into policy-positions in the new Japan. These scientists held *reunions* for years after the war ended![49]

Item 3: A prestigious American laboratory has proposed that we should generate electricity cheaply by mass-producing 100,000 small H-bombs per year and setting them off in caverns to make steam. This proposal received seed-money funding from the federal government.[50]

Item 4: 'Some 400,000 highly qualified scientists and engineers are devoting themselves to defense research and development, a pool of manpower perhaps equal to 40 percent of the world's most qualified scientists and engineers.'[51]

Item 5: A scientist imported twenty-six queen bees of a ferocious African strain into Brazil for experimental purposes, taking considerable precautions to isolate them. But a worker released them by accident; their descendants have killed livestock and people over large areas. Since then, the scientist who imported the queens has been promoted.[52] And we can understand why: people note that he took extraordinary care, and ascribe the mishap to fortune. We can generalize this case: if decision-makers take fifty times more care than ever before with material that requires 100 times more care, they know they will not be blamed for any disaster that ensues. (Defenders of nuclear-energy plants are fond of pointing out the extreme safety measures found in such plants, far surpassing the precautions required of other industries.) Human standards of 'due care' rise slowly – if new materials suddenly require a whole new order of caution, it is unlikely that enough caution will be required.

We have all heard of the failed rescuer who protested that he threw the drowning man a rope longer than any thrown before, though it was not actually long enough to help. The moral might be that swimmers should not go out beyond the point where a rope can be expected to be thrown; analogously, we should not deal with materials requiring a quantum-jump in the degree of caution required to handle them safely,[53] because such new heights of caution cannot be expected (and will not even be required by 'enlightened' public opinion).

Item 6: We have already noted the proposal by the Russian scientist to melt the polar ice-caps within five years. Zany ideas are not an American monopoly.

Philosophers since Plato have noted the 'prisoners'-dilemma' type of paradox: in certain situations it can be rational for each party to act in a way that will hurt everyone. This type of paradox was lately popularized in Garrett Hardin's paper 'The Tragedy of the Commons'[54] – his point is neatly illustrated by the recent history of ocean fishing: each nation correctly perceives that it gains much directly by over-fishing, while the

costs of its over-fishing are distributed over the whole world. So the nations over-fish the oceans.

The staggering expenditure on arms in the present world doesn't show that rulers are mad – perhaps each ruler sees himself in a situation where to be rational he must act in a 'mad' way.[55]

The luddite can note that effective world-government is not at all likely within the next thirty years. So the next wave of technical innovations will fall into the hands of national rulers tempted to behave like madmen even if they are sane.[56] (In 'prisoners'-dilemma' situations, paradoxically, *all the participants are better off if all are weak*; a Hobbesian island where all are armed with clubs is less unsafe than one with artillery.[57] One could say that a threat to ocean fishing was inevitable, in a world of nation-states, once 'fishing-factories' were invented.) All in all, our cleverness keeps pulling further ahead of our wisdom.

VII. Caricatures of Luddism

A luddite as sketched above need not believe any of the following ideas commonly ascribed to luddism:

- that abstract technology is capable of sin.
- that the average decision-maker is wicked or crazy. (The tragedy of superhuman powers is that they require *superhuman* wisdom to keep from going sour.)
- that technology is different in kind from other techniques. (Sending in a cat to chase a mouse out of a china-shop differs only in degree, but importantly, from sending in a bull.)
- that technology is an alien, inhuman force, using mankind for malign ends. (The luddite can see a kind of dystrophy involved, an unbalanced growth of natural human faculties.)
- that doomsday is at hand. (We might be lucky – but a lucky win at the race-track doesn't prove the bets were prudent.)
- that we can never learn to manage present crises: we might do this very well, only to face new crises from new technical innovations.
- that we should ban all technical advances by law. (It wouldn't work.)
- that a country shouldn't invest in research and development. (This might only put that country behind its competitors, while ecosystems go on being threatened by other nations' innovations.)
- that technologists are wicked or anti-humanistic.

All the luddite needs to hold is that technical advances in the future are likely to produce more harm than good over-all, so these discoveries will be bad for us – so he won't view these discoveries as real achievement, demanding admiration. He can't stop progress, but he doesn't have to like it.

VIII. A Luddite Program

Under our entropy-model, it is blind change that threatens, not just *humanly-caused* blind change. If a new ice-age threatened suddenly, we'd gain nothing by waiting for it passively; we'd have to move to adjust to it, risking the unforeseen drawbacks of our drastic adjustments. And given unavoidable human innovations, we must adjust also to these – we must keep running if we hope to stand still. The luddite maxim would be: 'Minimize blind, dramatic change: so act as to prevent more blind change than you cause – either by minimizing the blindness of inevitable change, or by minimizing change that must inevitably be blind.'

This maxim is not tritely inoffensive, as would be the injunction not to cause harm unless one thereby causes a surplus of good. We have never actually implemented a 'technology-assessment' policy that puts a strong burden of proof on each innovation to show its foreseeable benefits as outweighing its foreseeable costs. But even this strong policy would fall short of luddite restrictions: it counts the foreseeable costs, while the luddite foresees that there will be serious drawbacks not now foreseeable.

A luddite policy would give strong priority to research for monitoring change, and for understanding ecosystems; it would emphasize research for restabilizing changes (such as birth-control and solar energy) rather than for destabilizing changes (such as fusion power, solar energy from satellites, or advances in death control from medical or agricultural breakthroughs). In fact such a policy would be more 'reactionary' than most of us could swallow; but it is not a confused or ridiculous policy, only a 'far-out' policy. (And of course, not everyone advocating some of these research priorities is a luddite.)

There are many difficulties with the version of luddism presented here. For instance, it may be pointless to ask if we should approve of our prereflective admiration for dramatic, harmful powers and their providers – perhaps admiration is just a human 'given'.[58] And the 'blind-change-helps-entropy' model may not be useful in assessing new technology. My

only claim is that one version of luddism is not on-its-face ridiculous; my only desire is to encourage defenders of progress to face these issues seriously.[59]

NOTES

1 No reference is intended here to the historical followers of Ned Ludd. 'Luddism' as used here is sometimes called 'technophobia'. Further explanation of 'luddism' will be found in the last two sections of this paper.
2 Quoted in *Science News*, Vol. 109 (1976), p. 253.
3 John Maddox, *The Doomsday Syndrome*, McGraw-Hill, New York 1972, pp. 258–9.
4 Ibid., p. 243.
5 Quoted in *Nature*, Vol. 223 (1969), p. 987.
6 Petr Beckmann, *Ecohysterics and the Technophobes*, The Golem Press, Boulder, Colorado 1973, p. 20. Beckmann credits the 'obesity' analogy to J. G. Truxal.
7 Ibid., p. 21.
8 Ibid., p. 30.
9 Psychological techniques could be quite disruptive, in theory. But I know of no dramatic and workable techniques in the human sciences yet which are comparable to the great technical advances in the physical sciences.
10 The action need not be *morally* admirable, nor even socially useful: we feel at least some fleeting admiration for a man who can break a board (or a neck) with one hand, or a man who can snake pointlessly down a field, magically eluding tacklers. This may be because we can imagine (unlikely) situations where such skills could be useful. (On 'true achievement' in general, see my 'Action, Excellence, and Achievement', in *Inquiry*, Vol. 19 [1976].)
11 Socrates in *Gorgias* reminds Callicles of the legendary Thessalian witches who succeeded at their project of pulling the moon down from the sky, to their own destruction (513a). (Readers of *Gorgias* will recognize my paper as a meditation on themes from that dialogue, in a modern context.)
12 In a quite straightforward sense, guns *do* kill people.
13 A point like this was made by G. E. Moore in *Principia Ethica*, Cambridge University Press, Cambridge (paperback) 1965, pp. 27–39.
14 Gorgias just assumes that the presumed good intentions of the teacher of combative skills are all that count (456–7). But surely if a teacher of any kind could foresee the likely misuse of a skill he imparts, he would share moral responsibility to some extent for that misuse.
15 Contemporary Anglo-Saxon philosophers (except for Herbert Morris) have devoted little attention to shame/glory norms of conduct. I have analyzed the logic of such norms in papers as yet unpublished.
16 The admiration is amoral because we can imagine calling such a beneficial innovator 'a great man, but not a good one'.
17 In *A Theory of the Moral Sentiments*, Liberty Classics, Indianapolis 1976; Pt. II, Sect. III, Ch. 2, pp. 185–6.
18 A *New Yorker* cartoon shows a breakfast table with a new coffee-making gadget – an irate wife is snapping at her sullen husband, 'Oh, I get it! When the coffee's good, it's Mr. Coffee. When it's bad, it's me!'
19 *Nature*, Vol. 233 (1969), p. 987.
20 *Bulletin of the Atomic Scientists*, Vol. 27, May 1971, pp. 34–35.
21 Some have thought Lyndon Johnson unlucky to succeed to an office whose mighty powers dramatized his personal limitations.

22 Adam Smith noted the interesting human quirk that people actually put a quasi-aesthetic value on certain complex means for attaining welfare, a value quite independent of the welfare attained by them (op.cit., Pt. IV, Ch. 1). Smith may have felt that such a 'natural' sentiment must be somehow correct; but we have no reason to approve of all our impulsive, pre-reflective admirations.

23 Of course, there are sweaty sports that are safe and noncombative; and perhaps there are separable parts of science that directly cause little harm – but if one 'blames' technology and 'absolves' basic science, one must have a theory separating their causal influences.

24 Gregory Bateson was asked by his daughter why her things always tended to get out of place. He responded that for each thing, far more places count as 'out of place' than as 'in place' ('Metalogue: Why Do Things Get in a Muddle?', in *Steps to an Ecology of Mind*, Chandler Publishing Co., San Francisco 1972, pp. 3–8). Aristotle noted that without reason, the energetic 'natural virtues' of bravery and temperance are in fact hurtful, just as the strength of a blind animal may make it stumble worse (*Nic. Ethics*, 1144b10–12). And he noted that it's possible to fail in many ways, but to succeed in only one way (ibid., 1106b30). In *Physics* he says that time should be considered mainly a destroyer, not an improver (221b1, 222b15). He may have been thinking of random changes in time as being mainly harmful to natural systems.

25 Barry Commoner, *The Closing Circle*, Bantam paperback ed., New York 1972, p. 38.

26 E.g., the invention of supersonic planes occasioned the inquiries that revealed the influence of halocarbons on stratospheric ozone.

27 John P. Holdren, reviewing the findings of a study group on energy problems, made this point: 'I . . . believe the Study Group [erred] in concluding . . . "Whether the impacts of carbon dioxide will combine with natural changes in climate to the net disadvantage or advantage of mankind . . . cannot be judged at this time".' Holdren says, 'The first-order effects of both natural climatic change and change induced by carbon-dioxide build-up would not be the alteration of mean global surface temperature, but, rather, more complicated associated changes in patterns of circulation and precipitation. *Expecting these to cancel . . . would be a bit like expecting two random malfunctions in . . . a watch to counteract each other* [*without harm*]. The short-term effect on mankind of any non-cancelling perturbations . . . is overwhelmingly likely to be negative, owing to the adaptation of existing agricultural systems to existing climatic conditions' (*The Bulletin of the Atomic Scientists*, Vol. 33, June 1977, p. 62. Italics mine).

On the other hand, effects of *some* blind changes could tend to cancel out the effects of other changes. Some scientists calculate that the increased CO_2 which man will be pumping into the atmosphere will *increase* the amount of stratospheric ozone enough to compensate for the ozone destroyed by the halocarbons man is pumping into the atmosphere (*Nature*, Vol. 273 [1978], pp. 711–15). But we have no reason to think that *most* blind changes will cancel each other's harmful effects.

28 A scientific committee reports: 'Whatever the intentions of technological innovators, the results of innovation are always more complex than the innovators intended, and usually more complex than they could even imagine. . . . The so-called "side-effects" of innovation are often deleterious and not infrequently are so pronounced that they dominate the primary effect that was intended' (Report of the AAAS Committee on Scientific Freedom and Responsibility, excerpted by J. T. Edsall in *Science*, Vol. 188 [1975], p. 689).

29 'Reductions in ozone of the order of 20% during the first quarter of the 21st century, due to the current and future use of fertilizer, are not improbable . . .' (M. B. McElroy, J. W. Elkins, S. C. Wofsy and Y. L. Yung, in *Reviews of Geophysics and Space Physics*, Vol. 14 [1976], p. 148). A committee of prominent scientists label a 20 percent reduction of ozone as 'intolerable' (*Halocarbons: Environmental Effects of Chlorofluoromethane Release*, National Academy of Science, [1976], p. 18).

30 *Effect of Increased Nitrogen Fixation on Stratospheric Ozone* (Report #53 of the Council for Agricultural Science and Technology, Iowa State University, Ames, Iowa 1976, pp. 2 and 15–27).

31 It seems odd to call damage to the stratosphere a 'side-effect' of the use of gadgets like spray deodorants. This usage may reflect our earnest desire to absolve powers and techniques of their bad consequences, by always labelling these as 'side-effects'.

32 P. Borisov, *Can Man Change the Climate?* Progress Publishers, Moscow 1973, esp. pp. 84–85, and pp. 106–8.

33 J. M. Neuhold and L. F. Ruggerio, *Ecosystem Processes and Organic Contaminants*, Report for NSF Directorate for Research Applications, RANN Division of Advanced Environmental Research and Technology (1977), p. v.

34 W. L. Chameides and J. C. G. Walker, *Science*, Vol. 190 (1975), p. 1294.

35 *Fluorocarbons and the Environment*, Report on the Federal Task Force on Inadvertent Modification of the Stratosphere, Council on Environmental Quality, Federal Council for Science and Technology (June 1975), p. 54.

36 E.g., the oceans have absorbed much of the extra CO_2 we pumped into the atmosphere, but these 'sinks' are 'filling up' rapidly. '. . . [I]t is not so much the total fossil fuel consumption but rather the speed of the consumption that is responsible for the diminishing effectiveness of the oceans as absorbers . . . [T]he human perturbation is too sudden for the ocean to display its regulatory mechanism' (W. Bach, 'Global Air Pollution and Climatic Change', in *Reviews of Geophysics and Space Physics*, Vol. 14 [1976], p. 464).

37 'Since [the industrial revolution] about a 13% rise in atmospheric concentration of CO_2 has taken place, including a 5% rise in the last 15 years. . . .

'If present energy trends continue upward and fossil fuels continue to supply the bulk of the energy . . . by the middle of the next century CO_2 in the atmosphere will have doubled over preindustrial levels and by . . . A.D. 2200 it might be four to eight times the preindustrial level' (*Science News*, Vol. 112 [1977], p. 68). It is conceivable that future technical progress would not add to atmospheric pollution, but would rather lessen pollution. However, the net effect of previous progress has been to add to world pollution. Arguments must be given to show that future progress will have different effects – the mere logical possibility is not enough.

38 *Rocky Mountain News*, 11 May 1977, p. 14. Another example of unhelpful repair attempts was the story of the importation of mongooses to Hawaii to kill rats. Unfortunately the mongooses hunted by day, while the rats fed by night. The mongooses nearly wiped out several species of birds, while the rats flourished (*National Geographic*, Vol. 152 [1977], p. 75).

39 This assumption seems pretty optimistic. One book on population estimates that in 1967, 1500 million people were undernourished or malnourished (P. H. Ehrlich, A. H. Ehrlich, and J. P. Holdren, *Ecoscience: Population, Resources, and Environment*, W. H. Freeman & Co., San Francisco 1977, p. 290). The same book estimates world population at 500 million in 1650 (p. 182).

40 Frank Barnaby reports on various devices being developed by Russia and the United States that 'are unnecessary and even harmful for a strategy of deterrence, but . . . are highly desirable for effectively fighting a nuclear war. The fact that these weapons are being developed and deployed without significant restraint is firm evidence that each of the two great powers is striving for a first-strike capability' (in *The Bulletin of the Atomic Scientists*, Vol. 32, June 1976, p. 32). We tend to forget the dangers from synergism among the different crises we face. Someone has suggested we meditate on what might have resulted if the New York blackout had happened during a 'Cuba-Missile-Crisis', during the last nervous days of a Nixon-type administration.

41 Several scientists have claimed that a 'minimal' nuclear war between the Great Powers would wipe out the biosphere by halving the amount of ozone in the stratosphere. John Hampson says that the 5000 megatons necessary to knock out *one* major power would halve the ozone, flooding the earth's surface with ultraviolet light at an intensity equal to that of Precambrian days. This 'would presumably eliminate all surface life' (*Nature*, Vol. 250 [1974], pp. 189–91; see also *Nature*, Vol. 257 [1975], pp. 38–39). The ozone removed by a smaller exchange would be added to the ozone removed by nitrous oxides from agriculture. Nations engaging in a nuclear paroxysm would presumably not hesitate to use germ-warfare at the same time.

42 To the extra misery caused by the population explosion, the nuclear predicament, and other threats to the biosphere, we would have to add the less tangible drawbacks of the technical age: psychological alienation of various kinds (e.g. 'Future-Shock') and technological unemployment. One grim scenario would see computers replacing first the very dumb, then the mildly dumb, etc. The people at each higher level would be conditioned to despise the unemployed as 'shiftless losers', not foreseeing that they will shortly be swallowed into that feckless class themselves.

43 John G. Burke (Ed.), *The New Technology and Human Values*, Wadsworth Publishing Co., Belmont, California 1966, pp. 130–4.

44 In *Gorgias*, Socrates explained to Polus that rhetoric could give a man the power to get what seems now good to him, but not, perhaps, power to get what he really wants (i.e. what is really good) (466d–468e).

45 Interestingly, the colonel was not just carried away by a primitive urge to create a perfect bridge. He rejected suggestions to use perfectly seasoned timber, and also to paint the bridge. He was perfectly able to adjust the means to a subtle, complex goal: the best bridge that could be built quickly and concealed from 'enemy' reconnaissance. Paradoxically, if the colonel had lacked those first stages of 'know-whether', his behavior as a whole would have been objectively less irrational, since he would have produced a bridge less ideal for his enemies' purposes (Pierre Boulle, trans. by Xan Fielding, *The Bridge Over the River Kwai*, Bantam Books [paperback ed.], 1954, pp. 58–59, and p. 93).

46 Yet there is an axiological component in 'know-whether', not reducible to empirical facts. We noted earlier the problem of deciding whether a world with 500 million people miserable and 100 million people comfortable was worse or better than one with 1000 million people miserable and 3 billion prosperous. Or we might recall the *Brave New World* type of problem: if the pleasures from 'noble' activities (e.g. physical, intellectual or religious adventures) could be closely duplicated by electrical stimulation of the appropriate brain centers, would people do well to dispense with these inconvenient and dangerous activities? How heavily should we weigh now the interests of humanity in the twenty-fifth century? And so on. Properly 'philosophical' problems like these have been debated for millennia without being solved. They will not likely be settled in our lifetime.

47 In *World Without Borders*, Random House, New York 1972, p. 28. Note that chemists may not be the only kind of scientists necessary to assess the consequences of chemical innovation. And physical scientists in general may not be the main experts on the effects of scientific innovation.

48 I do not claim that the 'other side' in that war was in fact weaselly, nor that the main U.S. motivation was benevolence toward the Vietnamese people. The fable illustrates how foolish the American strategy would have appeared to one who *did* credit U.S. benevolence. Jonathan Schell (in *The Time of Illusion*, Alfred A. Knopf, New York 1976) has proposed an explanation of U.S. strategy that suggests Washington was not so much foolish as ruthless. Schell suggests that the main American goal was not to win in Vietnam, but to demonstrate America's 'tough credibility' to the Russians, to persuade them we would risk Armageddon rather than yield, say, Europe to their presumed aggressive designs (pp. 9–14 and 341–87).

49 *The Denver Post*, 19 Nov. 1976, p. 1.

50 *Science*, Vol. 188 (1975), pp. 136–7.

51 Report of the Stockholm International Peace Research Institute, excerpted by Frank Barnaby, in *The Bulletin of the Atomic Scientists*, Vol. 32, June 1976, p. 26.

52 *National Geographic*, Vol. 149 (1976), pp. 491–501.

53 In the debates over recombinant DNA experiments, one source of danger has not been emphasized. Suppose American and European scientists work safely and successfully to produce new organisms that are very beneficial and profitable. What is to stop other scientists, in countries without careful safety traditions, from working on DNA more recklessly, once such work is known to be promising?

The safety of the whole collective enterprise is limited by the chance of a few pathogenic chain-reactions starting somewhere.

54 In *Science*, Vol. 162 (1968), pp. 1243–8.

55 The pressure to project a 'tough' image has been enormously increased by the advent of nuclear weapons (see J. Schell, op. cit. [Note 48], pp. 345–55). But the 'prisoners'-dilemma' situations give participants reason not just to pretend to be reckless, but to do things that are actually 'mad' (i.e. harmful to all). An Israeli scientist once said, 'Israel would never be the first to use atomic weapons; but we won't be second, either . . .'.

56 Schell suggests that, in fact, working year after year under the pressure of 'the Balance of Terror' may actually unhinge top decision-makers (op. cit., pp. 381 and 386).

57 However, one kind of technical innovation would tend to make the island safer: if all the parties had a 'second-strike capacity', i.e. if they could destroy 'from their graves' any aggressor who struck first – then all parties would be safer. In fact, if I discovered such a 'second-strike' weapon, I would be safer on this island if I shared my discovery with the others.

58 Adam Smith seems to count amoral prudence, self-control, courage, reputation, and the trappings of wealth – all these powerful means to welfare – as categorically good, even when misused, and their absence as always inglorious. He seems to see Platonic hesitations about their value as merely feigned, philosophical doubts. In the bustle of the real world of healthy, public men, these assets are always admirable, simply because they are always admired. How could nature implant such universal admiration wrongly? Besides, he thinks such admiration is in the long run useful for society. Why resist it? (op. cit. [Note 17], pp. 88, 127–8, 298, 302–3, 354–6, 394–6).

59 I've learned much in arguments about luddism, especially with J. Benson, K. Boulding, B. Caughey, K. Doxtader, D. Freeman, K. Freeman, R. Kelman, R. Kitchener, B. Rollin, H. Rolston, D. Seckler and R. Williams.