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Disasters, A/symmetries and Interferences¹

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Introduction

How should we explain technological disasters? And how might we think about intervening in the hope of making a difference, of reducing the likelihood of future disasters?

The problem is something like this. Disasters call out for explanation. The literatures on disasters, lay, political and professional, are huge. At the same time disasters, and disaster-analyses, are high-tension zones. People care. They are hurt or bereaved. They are shocked. Often they are outraged, and almost always they want to know what went wrong. So if we study disasters academic curiosity intersects with other agendas, many of them highly charged, and most of them having to do with making a difference. 'What are you contributing?' 'What is the point of your study?' 'Why are you looking at all this suffering?' These are the kinds of questions that immediately arise when we look at technical catastrophes.

My own version of this high-energy discomfort has been in the context of railway accidents. Between 1997 and 2002 there were five major fatal accidents on the British railway system² which raised serious public questions about railway safety and management in the UK. They were investigated in a variety of official and unofficial contexts, and these investigations have



been my focus: how have these accidents been explained? What are the kinds of lessons that have been learned? And what has the process of investigation sidelined?

As the last of these questions suggests, my interest is less than innocent. Discourses and the practices in which they are implicated work in a process of selective attention and construction. Some explanatory realities are brought into being and strengthened. Others are weakened and pressed to the margins. In some cases they disappear entirely from view and become unthinkable and impossible. My concern has been with this Othering, with what it is that the inquiries in a high tension zone make impossible or unknowable. This is because I am interested in the character of explanation, and also (and this is how I respond to the charge that my interest is academically voyeuristic) because I believe that parts of what is Othered are crucial to safety. If I were to put the point in a combative way, I would say that the major explanatory discourses and practices, though they have many virtues (and I will indeed try to show this below) also set disabling limits to the conditions of explanatory, technical, managerial, and political possibility. They help, in short, to undermine safety as well as support it.

There are various idioms that might be used to make this argument. However since I come from STS one that comes naturally to me is the notion of symmetry. This can be understood as a device for destabilising high energy explanatory distinctions. In its first version (to which I will return shortly) it was a tool for destabilising what was taken to be a distinction of fundamental explanatory importance for the history of science between true and false knowledge. But this is just one version of a high-energy explanatory distinction³. Another is the division between the human and the non human. Should our explanations of human action be fundamentally different in kind to those of non-human action? Yes, says the high-energy agenda. No says the actor-network approach: if you want to understand how agency is generated then you should not start out assuming what it is that you want to explain⁴.

I will not pursue the actor-network argument here. My interest is in the operation of high-energy explanatory discursive binaries in the world of safety and railway accidents. In what follows I will argue that there are at least four of these at work: content versus context; the discursive versus the non-discursive; success versus failure; and implicit versus explicit political commitments. I will also argue that each sets questionable and arguably unhelpful limits to the conditions of explanation and intervention. Finally, I will suggest that each deserves to be levelled out and treated symmetrically.

I explore this by considering parts of the Cullen Inquiry into the Ladbroke Grove collision. I start with the original SSK version of symmetry – truth and error – and suggest that here the Cullen Inquiry is symmetrical. Arguably this is also the case for the second, context/content, divide. I then argue that the Inquiry is at least sometimes asymmetrical with respect to the other binaries on this list. Of course there are reasons for this, and they may be good. Symmetry is not necessarily desirable. But my argument is that in practice these particular asymmetries, high energy as they are, also make it difficult or impossible to raise important safety-relevant questions.

A further preliminary word on symmetry itself. As STS readers will know, there is nothing straightforward about this notion which has been aired in what is by now an extensive literature on the politics of symmetry⁵. Though my focus of attention differs from that of Dick Pels my argument nevertheless relates to his 'third epistemological position'⁶. This, to put it briefly, is that to tell social science stories about oppositions (whether symmetrically or otherwise) is to take a (third) position in relation to those oppositions. It is to make, as Donna Haraway puts it, a difference. I will briefly return to these STS debates on symmetry in the conclusion, but since my interest is primarily practical I work the major part of my argument out empirically.

The Collision at Ladbroke Grove

On October 5th, 1999, there was a serious railway accident at Ladbroke Grove in West London on the main line into London's Paddington station. An inter-city Great Western express coming from the west of England and nearing the end of its journey collided head-on with a regional Thames Trains service travelling out from Paddington. The two trains met at a closing speed of 145 miles an hour. Thirty-one people died in the crash and the fire that



followed and 414 were injured. In all of the 575 people on the two trains only 6 emerged with no injuries at all⁷.

The collision, serious and tragic in its own right, was perceived in the UK as particularly worrying because of its eerie similarities with an accident that had happened on the same line two years earlier and only a few miles away. At Southall on 19th September 1997 seven people had been killed and about 150 injured in a similar collision. The proximate cause of the two accidents was identical. The driver of one of the trains had passed a red signal instead of stopping, a 'signal passed at danger' (or 'SPAD'). As a result (but also as a consequence of the controversial privatisation of the British rail system) a strong sense started to grow in UK politics, the media and the general public that something was seriously wrong with the overall organisation and management of the railways.

The Southall accident had been followed by a public inquiry. At the time of the Ladbroke Grove collision, this had not yet reported. The Ladbroke Grove disaster led to a further public inquiry. This was chaired by Lord Cullen, a senior judge with considerable experience of inquiries into civil disasters⁸. Most of it was held in public in Central Hall in Westminster, and took a quasi-judicial form with addresses by barristers, the testimony of witnesses, and their cross-examination. The first part of Cullen's report was published in 2000 with 89 recommendations. These ranged from issues about signal and track layout in the approaches to Paddington, through driver management and training, signal sighting, instructions to signallers, to the crashworthiness of railway rolling stock.

Symmetry (1): Truth and Error

The notion of symmetry entered STS with the writing of David Bloor:

'[The sociologists'] ideas ... will be in the same causal idiom as any other scientist. His concern will be to locate the regularities and general principles or processes which appear to be at work within the field of his data. His aim will be to build theories to explain these regularities. If these theories are to satisfy the requirement of maximum generality they will have to apply to both true and false beliefs, and as far as possible the same type of explanation will have to apply in both cases.' (Bloor, 1976, 5)

Bloor's argument was that if we want to understand why scientists believe what they do, then starting out by assuming that false ideas are caused by factors different to those that are true is a mistake. The 'same type of explanation' should apply to both.

What to make of this? My response is that it should be seen as an intervention, an interference, or an attempt to make a difference⁹. David Bloor was trying to make a difference at a time when it was widely assumed that scientific error could be explained by the psychological or social distortion of otherwise reliable scientific methods for discovering truth. His SSK counter-argument was that factors such as group social location, technical, economic and industrial developments, general political and social commitments, training and socialisation, and overall cultural and social world-views always work alongside and help to constitute scientific practice (Bloor, 1976, 3-4). Symmetry, then, was a particular intervention located at a particular time. It was a tool for undoing the idea that error is produced by psychological and social factors while truth is generated by scientific method.¹⁰

Though the 'science wars' suggest that this particular battle is far from won, Bloor's argument is much less contentious than it was a generation ago. Applied to a sociotechnical system such as the railways it is scarcely controversial at all. Indeed, perhaps it never was. For instance, autonomy, the idea that true knowledge or good practice is a product of logic and rationality (i.e. it is autonomous), whereas false knowledge or bad practice derives from irrationality (Bloor, 1976, 6) is certainly not one of the framing assumptions of the Cullen Inquiry. Instead it is assumed, for instance, that driving trains well is as much in need of explanation as driving trains badly. Though what counts as adequate training may be in dispute (see below), no-one thinks that competent knowledge and driving arise autonomously.

Again, the Cullen Inquiry avoids the Whig-like assumption that socially caused beliefs are bad, while individually or psychologically caused beliefs are good¹¹. Instead it assumes, for



instance, that a competent driver has been taught to distinguish certain features of his or her environment (for example the relevant signal) and ignore others. The social and the cultural doesn't stand in the way of the psychological: each depends upon the other. And if the driver gets it wrong this requires a similarly symmetrical explanation. Indeed this is how the Inquiry worked when it considered why the driver of the Thames train got it wrong. It asked whether he was inadequately trained and insufficiently experienced¹². It also considered whether he saw a green light because of the angle of the sun (it was low): a psychological (or natural) explanation, but not one in tension with possible social explanations.

It is clear that SSK has little to teach the Cullen Inquiry here. A serious inquiry into a failing sociotechnical system is typically symmetrical about truth and error. But this commitment to symmetry is less obvious in high-energy (often media-driven) discourses that rush to judgement by claiming that individuals (drivers, managers) who make mistakes are responsible because they are greedy or incompetent. This is a theme to which I shall return.

Symmetry (2): Content and Context

The Cullen Inquiry often made use of an explanatory distinction between content and context. For instance, there is the contextual matter of the training and experience of the driver. Was this adequate for the driving that he did on the day of the accident? As I have already noted, for some the answer was 'no'. One reason given for this was that Mr Hodder, the driver, had been recruited as a result of an advertisement only two years before. With no previous experience of railway working, he had been put through an (approved) programme of training, but he was certainly not a highly experienced driver: there was a strong suspicion that his training wasn't broad or deep enough, and that he hadn't been sufficiently briefed about the possible hazards on the complex route that he had to take on the morning of the accident, or of previous SPAD incidents at the signal in question.

As I have noted, some of the recommendations of the Cullen report indeed reflect such contextual worries about training and briefing¹³. But there is a more general argument lurking in the discursive wings. Many thought that the old system of long-term apprenticeship was better than the new alternative. In addition there were many who believed that the new commercially-oriented environment following privatisation had eroded the skill base of drivers and other employees. The contextual efficiencies of cost-cutting, including cutting down on highly experienced staff, might bring short term commercial advantages, but (it was argued) were also undermining the content of skills and therefore levels of safety.

A related context/content asymmetry was mobilised in debates about the Automatic Train Protection (ATP) system. This is able to overrule the driver if s/he is going too fast and if necessary stop the train. The Thames train that passed the red light did not have ATP fitted. But it appears that if this had been installed, then the accident would have been avoided (Health and Safety Executive, 2000, section 2). So why was it not fitted? Some claimed that the answer lay in economic considerations:

'Now, with the tear-stained benefit of hindsight ... even on the basis of a cold, distasteful evaluation of £2.5 million per life lost, the benefits of fitting ATP must far outweigh the costs. [Those injured] ... wait to hear Thames Trains' commitment that costs will no longer be an obstacle.'¹⁴

This, then, is a high energy context/content asymmetry. A divide is being made between (appropriate) engineering and safety practices on the one hand, and (inappropriate) external commercial pressures on the other – a form of distinction not unfamiliar to the Edinburgh SSK school¹⁵. The implication is that the content of engineering and safety practices should be disentangled and protected from a distorting context of commercial or market logics.

So what kind of work does context/content asymmetry do if we are thinking about technical disasters?¹⁶ This is an issue carefully and critically reviewed in Diane Vaughan's (1997) magisterial study of the Challenger launch decision. Vaughan reveals how her understanding of that decision shifted as she came to learn more about it. Initially she was persuaded by a widely-circulated content/context asymmetrical version of events. This was that engineering content at Morton Thiokol had been overruled by a managerial context, that had in turn experienced pressure from NASA, that had in turn (in some versions) been subjected to



economic or political pressure to go ahead with the launch. In short, that engineering content was being distorted by a cascade of organisational and political contextual pressures.

After some time, however, Vaughan persuaded herself that this was wrong. The more she understood about NASA practices and about decision-making both in NASA and Morton Thiokol, the more she came to the view that the latter had their own integrity. Instead, she concluded that the decision was a comprehensible (if mistaken) consequence of an organisational culture that was seeking to do its best under conditions of organisational drift. Also important was a set of professional assumptions about what would count as appropriate engineering argument. She suggests that to make a good argument against the launch, the engineers (and the managers) would have needed to quantify their intuitions. However, though they indeed had the raw data on file, they had never considered representing this in what was to turn out to be the appropriate manner¹⁷. And they hadn't done this in part because their previous decisions had each, individually, been acceptable: there had been no previous catastrophic incident, no 'mistakes' had therefore been made, and there was no understood need to think about the data in any other than the received way.

In short, Vaughan's account is impeccably symmetrical with respect to context and content. It is not that political and economic context distorted the otherwise appropriate content of engineering practice. It is rather that organisations and their embedded professionals work in certain ways to produce (what may turn out to be) faulty decisions. In short it is about organisational/professional routines and learning. And, of course, about how to think about those routines in ways that might ensure that the organisation learns from near misses rather than disregarding them. This, then, is the interference that follows from breaking down the divide between 'content' and 'context' and treating these symmetrically.

It is possible to mimic Vaughan's arguments about context/content symmetry for the Ladbrooke Grove disaster. For instance most SPADs (signals passed at danger) do not lead to serious accidents: the signals are over-run by a few metres because the driver does not pull up in time. Or, worse, but still not catastrophic, the driver realises as s/he passes the signal that s/he had made a mistake, but brings the train to a halt within a few hundred metres. The number of 'runaway' SPADs where the driver does not know what has happened is minimal. Perhaps, then, this means that Railtrack (the company responsible for signalling at the time) 'learned' that SPADs, though undesirable, are not catastrophic. Perhaps it means that the company did not try to eliminate them altogether¹⁸.

The Driver Reminder Appliance (DRA) is another example of mistaken organisational learning that fits with the context/content symmetry of Vaughan's argument. The DRA is a piece of equipment in the driver's cab that s/he is supposed to activate when the train comes to a halt. When the DRA button is pressed power to the motors is disconnected and there is a visual signal in the cab. Power cannot be re-applied until the DRA is (positively) inactivated. The device is a safety feature intended to prevent drivers from absent-mindedly moving off from a halt.

At the Cullen Inquiry it emerged that Thames Trains drivers, including Mr Hodder, were using the DRA not only after their trains stopped, but also when they passed a single amber signal. (A single amber tells the driver that the next signal will be red, and the train will shortly need to halt.) They were doing this as a backup reminder that they had just passed a single amber and the next signal would be red. This seemingly extended safety: it reduced the likelihood that a driver would pass a red light because s/he would be 'reminded' to stop both by the red light itself, and the DRA display.

But there is a snag. If the driver fails to set the DRA at the single amber signal, and also fails to see the subsequent red signal, the DRA will falsely confirm that the signal wasn't red. And it is possible (perhaps likely) that this is what happened on the day of the collision. Certainly Mr Hodder's conduct on the morning – an otherwise exemplary record of defensive driving – is consistent with this suggestion. This, then, is an example that precisely mimics Vaughan's symmetrical account of inappropriate organisational learning.¹⁹

So what have we learned? How do symmetries and asymmetries between content and context play out as modes of interfering? How do they play out in different contexts? And how does the Cullen Inquiry work on these a/symmetries?



The answer to these questions is interestingly complex. In the cases discussed above the Inquiry undoes the distinction between content and context. Going into the detail of operating and engineering work implies a Vaughan-like concern with the internal rationale of the practices in question. The latter may lead to errors or catastrophe, but it is treated as a mode of normal practice. Interference takes the form of attending to and seeking to improve the character of that practice and the nature of organisational learning, rather than discovering the operation of undermining external forces. But this is only part of the story because what looks like normal practice from inside may look like unwarranted contextual interference from outside. Or, to put it differently, the more one knows the more reasonable it seems. Or, to put it differently yet again, it is a matter of where one chooses to focus. The fourth example mentioned above – that of the ATP – is instructive here. Context in the form of economic pressures is said to have exercised inappropriate influence over the decision not to adopt the system. But, at least on the data given above, we don't know how the Thames Trains directors actually made their decision. We don't have the knowledge of their context that would allow us to see it as part of an appropriate (or inappropriate) form of normal practice. Were they resisting the advice of their engineers? The answer is: we don't know. We don't have the necessary data. The bottom line, then, is that context/content symmetry and asymmetry produce very different modes of intervening. Symmetry produces difference by operating on the possible failings of organisational routines, whereas asymmetry interferes in a mode more like that of classical political critique.²⁰ And the Cullen Inquiry does both, needing, so far as one can see, few lessons from SSK.

Symmetry (3): Discursive and Non-Discursive

Once the regional Thames train passed the signal set at red, was there anything that could have been done to prevent the collision? The answer is yes: perhaps the signallers could have intervened. The Cullen Inquiry looked carefully at what happened in the signal box in the period immediately before the collision. The signallers didn't have much time to intervene: at most twenty-five seconds. But could they have done something in that brief period to prevent the accident? Under cross-examination they didn't stand up very well, seeming vague and imprecise, unclear about crucial actions or their sequence. But why?

The transcripts suggest several possibilities. The first is that they knew that they had failed to do the one thing that might actually have made a difference: to call the Thames train driver on the radio and warn him that he was driving straight into danger. If they had done this very, very, quickly, then the collision might have been avoided or the speed of impact reduced.

This, then, is the first possibility, and it is apparent from Lord Cullen's final report that he thinks that the signallers' vagueness in part reflects their desire to present unsatisfactory delaying actions in a favourable light²¹. But there are other possibilities as well. One, entertained by Lord Cullen, is that the signallers were horribly stressed. And then another, though not one explored in the Inquiry, is that the signallers were like fish out of water in the context of a formal Inquiry.

As I have noted, the Inquiry took a quasi-judicial form. All the major parties were represented by barristers. The witnesses were all cross-examined by those barristers – and frequently, given the quasi-adversarial character of the proceedings, in a sharp or even hostile manner. Finally, all the proceedings were in public, and at significant moments were reported in the press. To put it no higher, the context of the Inquiry was quite unlike the daily work circumstances of the signallers. It was intimidating for many. Furthermore, it was a context, with verbal and linguistic skills at a premium, which put many at a disadvantage. But there is a more precise point here. The Inquiry also worked on the assumption that what is important can be rendered into language. And, correspondingly, that whatever cannot be rendered into language is at best vague and imprecise, and at worst sloppy and flawed.

Here is a small example. Mr Allen the signaller, is being addressed by one of the barristers:

'You have been describing a process that involves identifying the problem, analysing a situation, taking a decision and acting on it. Now, in one of your statements you have talked about monitoring and determining the overview. Did you mean anything different from what you have been telling the inquiry by that?

[Mr Allen] No, sir²²



The barrister is making discursive distinctions that it didn't occur to Mr Allen to make in his original account. For the barrister decisions are broken down into discrete steps, units, that follow one another in a particular sequence. Decisions for Mr Allen, even when he has to write about them, seem to be more fluid, more distributed and, I suggest, more embodied and contextual. Indeed, the term 'decision' may not be appropriate at all. 'Decisions' exist in the kind of explicit space inhabited by the barrister, which is also, however, a normatively prescribed space. If actions can be glossed as reasonable decisions then they are likely to be defensible in that space. Otherwise, as Charles Goodwin has shown in the quite different context of the Rodney King trial, they are not²³. On the other hand, 'decisions' don't necessarily exist or relate to conduct in other locations – including those of a signal box.

The same bias in favour of the explicit and the centred turns up in Part 1 of the Report:

'The instructions for signallers as to their response to a SPAD should be:

(a) clarified; and

(b) set out in a single set of instructions ...' (Cullen, 2001, 231-2)

The assumption is that good decision making is explicit, that it can be centred and made explicit by means of protocols, and that those protocols can and should be carefully communicated to those who have to make the decisions.

This, then, is a further form of asymmetry, or perhaps even two. The rational and the appropriate – that which leads to good decisions – is discursive. The irrational and the inappropriate – that which leads to bad decisions – is tacit or only partially discursive. First, then, there is a bias towards the discursive. The Inquiry re-discovers what it assumes from the beginning – that good decision making is explicit and discursive. Second, there is a related bias toward a version of action that can be treated as 'decision making'. There is, as is obvious, a series of high-energy and (asymmetrical) assumptions about the (proper) nature of agency and subjectivity at work here. Good actions are not just those that happen as a matter of practice. They are deliberated as well.

There is much that might be said about agency and subjectivity here²⁴, and some of it relates to STS writing about tacit knowledge, and the importance of local and material configurations in so-called 'decision making'²⁵. These literatures are symmetrical in this third sense: the recommendation is that we treat the discursive and the non-discursive in the same terms. Both are forms of conduct and action. Both are capable of producing successful outcomes – and failures. The implication is that it is not helpful to assume that the non-discursive is inferior and flawed. And the practical interference that follows from this is that failures or catastrophes are not necessarily best averted by transforming the tacit into the explicit (for instance in the shape of norms or protocols), or converting embodied forms of action into normatively approved and accountable decisions. The conclusion, then, is that this is one place where commitment to a form of STS symmetry might start to make a difference. Here, arguably, the Cullen inquiry has been led astray by high-energy asymmetries between explicit and tacit. By, one might add, another version of the failure to understand context.

Symmetry (4): Success and Failure

So why did the signallers not act? The straightforward answer is that, as we have seen, most SPADs are not very serious: they are 'technical' but no dire consequences follow. None of the signallers had ever seen a runaway SPAD and they weren't expecting one. Perhaps they were hoping for the best because experience had taught them that it was safe to hold off for a few seconds.

So far this is like Vaughan's account of the Challenger launch decision: those involved know that things aren't as they should be, but experience tells them that they will turn out alright at the end. It is possible, however, to strengthen the case for inactivity on the part of the signallers. Some of the actions they might have taken would also have been extremely disruptive. In particular, pressing a software reset 'panic button' would have set all the signals in the sector to red while the system rebooted itself. But this would have had other consequences. It would have led to significant delays on the whole line. It would have led to many, perhaps dozens, of 'technical' SPADs as trains running at up to 180 km per hour overshoot red lights. Finally, it would have led to chaos and possibly severe injury for



passengers as emergency brakes were applied. In short, it would have had a whole series of fairly serious disadvantages, though it might have reduced the impact speed.

Of course, in the real circumstances hindsight says that the signallers should have tried to radio the Thames Train driver rather than pressing the software reset button. But my argument is different. It is that all actions have consequences that will turn out to be either desirable, undesirable, or, more probably, some mix of the two. Unless (improbably) the system routinely generates catastrophe, most of the time the actions in question will have consequences that are more or less desirable. The trains run more or less smoothly in part because no-one presses the panic button each time there is a technical SPAD. The shuttle is launched safely because the worries about O-ring erosion are set to one side. But the point is not so much about the way in which invisible routines keep systems working even if conditions are less than propitious and things might go wrong (though this is an important point). It is not even that rule-breaking (let's agree that the signallers broke the rules) helps to keep the wheels turning (though I assume that this is also the case)²⁶. Rather it is that disaster inquiries are constitutively asymmetrical because they seize on catastrophe, and explore the failure of routines that are normally successful – and indeed contribute to success.

This, then, is the moment when disaster studies are forced into asymmetry. Success and failure, this is a high-energy division. It is so high-energy that it is difficult to see how to avoid re-enacting it. The Cullen Inquiry, but also Vaughan's analysis of the Challenger launch decision are asymmetrical. As too is this paper. All are about disasters, and about how to avoid disasters. The further implication is that they are constitutively asymmetrical. They distinguish between the good and the bad in a particular way and at a particular moment. And they try to tease out explanatory distinctions that will help to produce good rather than bad outcomes. All are shaped by and in some measure carry the high-energy divisions that I discussed in the introduction.

What should we make of this? My response is that in the end it is a matter of tactics. If asymmetry cannot and should not always be avoided, then the issue is how and where to accept asymmetry, and how and where to make the effort to be symmetrical. Or, to put it differently, how and where to interfere in ways that do not line up with the high energy discourses. The answers to these questions will be ethical, political, and empirical, rather than theoretical. But in the present context I have a particular suggestion. It would often be helpful to be more symmetrical in thinking about success and failure. Here the asymmetries of both the Cullen Inquiry and Vaughan's account of the Challenger launch decision mean that in one particular important respect it is hard for them to treat the practices implicated in failure well. They find it difficult to deal seriously with the fact that the practices implicated in catastrophe are also, and far more often, implicated in successes. It becomes difficult for them to shrug their shoulders and say that a continued series of successes may necessarily imply occasional failures. It becomes more or less impossible to say that any activity entails an element of risk, and that is how it is, irreducibly. That all practices bring both good and bad.

Symmetry (5): Implicit and Explicit Political Commitments

All of which is not to criticise either Vaughan's account or the Cullen report. Doubtless if we wish a safer railway system, or a more reliable space shuttle, these carefully researched analyses have much to tell us. But what they aren't so good at doing is telling us about the ambivalent complexities of practices, and the ways in which these mix up goods or bads: the practices of a working railway system which, at the same time, leads to occasional catastrophe or other less dramatic problems such as overcrowding or delay. And neither are they any good for raising questions about the commitments we make (for instance) to modes of transport or the desirability of this as opposed to that way of moving around. Thus their asymmetries frame their questions in a way that leaves untouched the desirability or otherwise of a high-speed railway system, or a reusable space-launch capability. The implication is that other sets of symmetrical tools are needed to explore the framing and of the desirability of such commitments.



In fact we are not short of possible candidates. To talk of 'risk' as I did above is to point to the actuarial. This, to be sure has its own framing assumptions and political agendas²⁸.

Nevertheless, if we are careful it may be used to undo particular forms of asymmetry about, for instance, what counts as success, failure, or indeed disaster. Putting aside the caveats that have to be entered for any statistics, Table 1 suggests that in the 1990s it was nearly five times more dangerous to travel by car per passenger kilometre than by train in Great Britain. And cycling and walking (not to mention motorcycling) were between fifteen and thirty times more dangerous than travelling by car.

Motorcycle	104
Walking	62
Pedal cycle	44
Car	3.3
Rail	0.5
Bus and coach	0.4

Table 1: Fatalities per billion passenger kilometres, GB, average per annum 1990–1999²⁷

So why is a train accident treated as a 'disaster' while the fact that ten times more people are killed on the roads in Britain is not? This question takes us beyond the scope of the present paper – though it is interesting to note that following another of the railway accidents in the UK (at Hatfield on October 17th, 2000)

drastic speed restrictions and line closures were ordered while the track was inspected for flaws. The result – an increase in road traffic – shifted a substantial number of travellers from a safer to a less safe transport system. The important point is that such issues can only be explored if we start to question the assumptions that frame discussions of disasters – and in particular what is to count as a disaster. But to elaborate tools that efface the asymmetries between such foundational commitments is, as is obvious, to stray into the 'political'. Which is, to introduce the last of the theoretical tools for making symmetry between commitments, precisely what Charles Perrow does in his normal accident theory.

The elements of Perrow's account are well known. Errors, says Perrow, will ramify uncontrollably and unpredictably in systems that are tightly coupled and complex. A tightly-coupled system is one that moves fast: the relations that make it up are rapid. A complex system is one in which the relations that make it up are not simple or linear: there are multiple links and many connections. The result is that changes in state in particular locations are unpredictably transmitted in many directions.

Perrow is saying, then, that as day follows night, complex and tightly coupled systems will suffer unexpected breakdowns. And he adds that if the consequences of those breakdowns are catastrophic then this is a reason for political intervention: such systems should not be created in the first place. Thus unlike Vaughan, Perrow is sceptical about the capacity to improve organisational learning and so avoid catastrophe. Even the best-run systems will produce breakdowns. His ruthless configurational symmetry works to dissolve the commitment to any particular technological system. We may need electricity, Perrow is saying, but if we want to live safely we cannot live with nuclear power.

The conclusions to be drawn from Perrow's configurational symmetry for the railway system are less dramatic since few railway accidents lead to anything analogous to widespread nuclear contamination. Nevertheless, his analysis tells us that anything that will reduce the level of either the complexity or the coupling of the railway system is likely to help safety. This in turn suggests a couple of straightforward but controversial suggestions. First, quite simply, safety would be enhanced if trains were to travel more slowly. And second, safety would be enhanced if the number of possible interactions between trains were reduced.

The significance of the first of these suggestions is self-evident. Journeys would take longer. Speed would no longer be the good that it has usually been taken to be²⁹. The significance of the second is less obvious and more technical. Ladbroke Grove, on the approaches to London's Paddington station, is on a section of track where trains travel along individual lines in both directions. At any terminus some bi-directional working is essential as trains enter and leave the station. But in the early 1990s, in order to increase the capacity of the approaches to Paddington station, the line was re-engineered to allow high speed bi-directional running over a number of kilometres. And this somewhat unusual arrangement was, indeed, one of the contributory factors to the Ladbroke Grove collision which happened at a location where the trains were still sorting themselves out into single directional running.



This, then, is a final intervention which arises out (a version of) symmetry. Still framed, as it is, by a set of high energy concerns to avoid disaster, it nevertheless moves the debate on, rearranging the pieces in ways that are not entertained in the Cullen Inquiry. It represents a form of interference in another set of high energy assumptions, especially about speed, that may, as I have noted, be glossed as 'political'. Obviously politics is a movable feast, as the earlier reference to the mortality statistics for different modes of transport suggest. If it is good to reduce mortality rates then it might be good to persuade people out of their cars and onto the trains. It might be better to run those trains more slowly. Or it might simply be good to persuade people to travel less.

Symmetries, Asymmetries and Interferences

Academic writing may not make much of a difference, but at the same time it is never neutral. As it describes its topics it makes and remakes them. It interferes. The issue, then, is how to interfere well?

In the STS toolkit one of the tools for interfering is symmetry. As Pels has argued, symmetries can be created endlessly and they work in different ways in different contexts. So a simple story about a/symmetries and politics is not possible. However I have tried to show that often they are devices for interfering with high-energy assumptions. They are a way of raising questions about the assumptions – technical, managerial and political – that frame discourses and explanations. They undo what seem to be self-evidences. This means that they often generate complexity. That which appeared simple before, for instance as a foundational division between good and bad practice, is rendered complicated and questionable.

I have tried to work this argument out in five different versions for debates about UK railway safety:

- Truth and error are widely treated symmetrically in serious engineering inquiries though not perhaps in the more denunciatory regimes sometimes favoured by the mass media. Certainly the Cullen Inquiry works symmetrically here. As I have tried to show, it assumes that error is in much need of explanation as accuracy – and it explains the two in similar terms. To insist on the importance of symmetry at this point is probably to ask the media to slow up: to resist the rush to judgement.
- Content and context. Is good practice being undermined by the malign and distorting influences of context? Are context and content different in kind? Or are they, so to speak, melded together? This is what is at stake here. Vaughan-like arguments about normal practice and organisational drift imply different and more complicated interventionary strategies than asymmetrical denunciations of distortion by outside forces. And by and large the Cullen Inquiry adopts a Vaughan-like symmetry. How did practices drift in the way that they did? That is a typical Cullen question. The concern is with the complexities of the logic of railway practices, and how to tinker with these. In general he is less impressed by the idea that all would be well if it were not for (say) the distorting effects of external market forces. But others differ. Like Vaughan before she got into the engineering practice of Morton Thiokol, many participants discerned the operation of malign and distorting external influences on engineering or operational practice. This, then, is also something of a political fault-line.
- The discursive and the non-discursive. This is enacted at crucial moments in a high-energy and asymmetrical manner in the Cullen Inquiry: the assumption that good actions follow from explicitly formulated decision-making protocols, whereas bad actions follow from discursively unreflexive practice. This matters because it means that the Inquiry is working in terms of an unhelpful – and over-rationalised – version of human subjectivity. STS is not the only discipline that suggests that most of the time people aren't explicit decision makers but act in complex social and material circumstances in ways that are relatively decentred and relatively non-discursive. My argument, then, is that this is a form of asymmetry that is disabling. STS has something important to teach disaster studies here. The lesson is that people – and indeed good judgements – are more complex than those assumed in the high energy normativities.
- (What counts as) success and failure. Here the Cullen Inquiry – like every other investigation that attends to disaster and its causes including this paper – is caught in a



high-energy asymmetry. Something went wrong and the question becomes: why did it go wrong? No doubt this is enabling – it provides for useful interferences – but it is also disabling because it means that it is difficult to see that practices that lead to catastrophe also lead to successes. Or, more subtly, it is difficult to hold back from the high-energy assumption that there is an imperative to interfere in practices that lead to failure, despite the fact that they also produce success almost all the time.

One way of thinking about this is 'actuarial'. This doesn't necessarily mean the calculation of probabilities. Rather it is a trope for appreciating that any system – a railway network is no exception – produces many versions of 'the good' and many versions of 'the bad'. Fatal accidents are a bad, this is a high-energy assumption that I have no interest in dislodging. But the extent to which an accident implies the need for corrective interference is a matter that demands judgement informed by a sense of the complex ecology of goods and bads.

- To talk of 'goods' and 'bads' is to move to the political, and this is the last a/symmetry explored above: the division between the implicit and the explicit in politics. If it implies increased fatalities why is there need for a faster railway system? Or one that carries more passengers faster? Or, to shift the framing, why do we make such a fuss about railway accidents when many more people are being killed on the roads? Why do we continue to invest in roads rather than in railways? There are answers to all these questions, and perhaps they are good (though the extent to which there is discussion and debate, at least about the question of speed, is limited). Unsurprisingly, the Cullen report is asymmetrical about these matters. It doesn't question the high-energy political assumptions that underpin UK transport policy. Instead it allows them to frame its investigation, to set its limits, and to reproduce those assumptions as forms of self-evidence – which is its own form of interference, its own form of politics. By contrast, if we start to make the framing of political assumptions explicit ('start' because there is no end to the process), then it becomes possible to think symmetrically about current transport policies and some of their alternatives – and recast debates about railways, railway accidents, and railway safety.

Pels suggests that symmetries and asymmetries are devices for rearranging relations that come in many forms and do endless different kinds of work in endless different contexts. He also notes that as we write we are entangled in our topics of analysis: that there is no view from nowhere. Finally, he insists that symmetry is not an end in itself, and that the desirability of being committed to this or that version of a/symmetry is a practical or a political matter. All of this sounds right. Let me conclude, however, by making the argument in a somewhat different way.

One way of thinking about the asymmetry/symmetry divide is to say that it is about where to stop. Here is the reasoning. Every chain of inquiry stops somewhere, in one way or another. It cannot go on complexifying itself indefinitely. We have seen, or can easily imagine, a number of versions of stopping: in allocations of responsibility ('it was his responsibility, he was the one who drove past the red signal'); in system thinking ('it was an emergent system effect, a combination of factors'); in naturally-occurring events ('it was the angle of the sun'); in trust ('we can no longer trust management'); in tacit or taken-for-granted assumptions (the practices of the signallers); or indeed, in exhaustion or lack of time ('the SPAD committee was not convened because people were too busy').

What does this tell us about asymmetries? The answer is that they may be seen as a class of devices for stopping, for putting an end to explanation. For cutting off indefinite complexification. For tidying things up. The implication is that we live – we have no choice – within an ecology of stops. This is what makes it possible to live without drowning in complication. Some of these, probably many of them, take the form of embedded explanatory asymmetries. The issue, then, is not the fact that we live within asymmetry. That is our fate. Rather it is about where we want our stops to be. And the forms we want them to take. Viewed in this way the question, then, is whether the current ecology of stopping is satisfactory. Will it do?

The answer I have given in this paper is 'no'. I have argued that when we think about disasters the relevant high-energy discourses are caught up in a number of more or less



unproductive asymmetries. These are not all bad. They do some work. But at the same time I have tried to argue that they also simplify and stop in the wrong ways.

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Endnotes

¹ I am grateful to Steve Brown, Michel Callon, Mike Lynch, Annemarie Mol, Ingunn Moser, Peter Peters and Vicky Singleton for discussion about safety, symmetry, explanation, and interference in high-energy zones in STS.

² Let me record that other people have also been killed on the railways in other accidents, including railway workers, trespassers, and suicides. The framing of the issue of 'railway safety', at any rate in the press, tends to efface these other forms of railway-related death.

³ Some explanations carry a lot of social, political, and/or economic weight. They are difficult to resist. This is what I mean when I refer to 'high energy explanatory distinctions'.

⁴ The first of these appears in Bloor's (1976) programme for a strong sociology of scientific knowledge. The second comes from Callon's (1986) actor network study of scallops and fishermen in Saint Briec Bay.

⁵ Recent widely cited references include Collins and Yearley (1992), Callon and Latour (1992), and Woolgar (1992) in the so-called 'chicken debate'; Pels' (1996) and Ashmore's (1996) papers along with the other contributions to a special issue of *Social Studies of Science* on the politics of SSK; and the so-called 'capturing debate' which appeared in



Science, Technology, & Human Values, with contributions from Scott, Richards and Martin (1990) and a number of their critics.

⁶ See Pels (1996).

⁷ The details are taken from the opening statement at the public inquiry chaired by Lord Cullen. The full transcripts, formerly available at <http://www.lgri.org.uk/>, are now archived at www.archive.org. The relevant page is <http://www.lgri.org.uk/10mayam.htm>, page 5.

⁸ Lord Cullen had chaired the inquiry into the Piper Alpha Oil Rig Disaster, and also the Dunblane school shooting.

⁹ I draw the notion of interference from Donna Haraway's feminist technoscience studies (1991), and her diffraction metaphor that is drawn from optics. The argument is that interfering waveforms produce new patterns of intensity. Interferences do not simply reproduce what was there before (which is in any case impossible). Instead they make a difference.

¹⁰ Whig histories of science had come under pressure with the writing of such scholars as Hanson (1958), and most notoriously Kuhn (1970). However, the distinction between truth and error underpins Merton's (1973) sociology of scientific institutions, and also frames a range of Marxist understandings of science, which tended to separate this out from ideology, and treat the two in different terms.

¹¹ Bloor calls this distinction empiricism Bloor (1976, 10).

¹² It was suggested, for example, that he looked at the wrong signal on a complex and potentially confusing gantry where there were four or five other signals.

¹³ See Cullen (2001, 229).

¹⁴ www.lgri.org.uk/transcript/11mayam.htm (4:11 pages 9-13 (290:392)).

¹⁵ See, for instance, the discussion in Barnes (1977).

¹⁶ This position is implied in the ANT refusal to use contextual arguments about 'social shaping' to explain the unfolding of socio-technical networks. ANT authors tend to argue that social, political, economic 'contexts' are mobilised and enacted together with technical or scientific 'content'. The former do not shape the latter. For versions of this argument see Callon and Latour (1981), and Latour (1983; 1987).

¹⁷ This would have required a plot of the temperature of all launches against the presence or otherwise of an 'O-ring' blow-by. This would have highlighted the salience of the relevant figures and provided a professionally appropriate context for accounting their significance.

¹⁸ There was considerable and contested discussion about Railtrack's attitude to SPADs, their investigation, and their remedy. The Vaughan-like explanation that I have just suggested was advanced by some, but robustly rejected by Railtrack.

¹⁹ It also relates, in addition, to Charles Perrow's (1999) (differently symmetrical) analysis of high-risk technological systems to which I return below.

²⁰ This is another fault line that runs through the literatures on symmetry in STS. Does it undermine the political? Or does it, rather, extend what counts as the political? See Scott, Richards and Martin (1990) and the commentaries on this including Pels (1996).

²¹ Cullen (2001, 91).

²² www.lgri.org.uk/transcript/30maypm.htm - page 105, lines 16-22

²³ See Goodwin (1996) with its stunning account of the glossing of police violence against a suspect as a reasonably motivated set of decisions driven exclusively by the threatening actions of that suspect.

²⁴ There is much more to be said about the subjectivities implied in these different discourses. In the present context see Law (2002). In the context of disability see Moser (2000). In the context of health care see Singleton (1998) and Mol (1997).



²⁵ The importance of embodied skills and tacit knowledge is emphasised by Kuhn (1970) and Polanyi (1958), as well as such SSK writers as Collins (1975). For discussion of the heterogeneity of materials that enact and contribute to scientific and technical puzzle-solving see Latour (1990; 1986), Law (1994) and Lynch (1990).

²⁶ For this argument developed more extensively see Law (2000).

²⁷ <http://www.cpt-uk.org/cpt/cptsite/IndInfo/Facts%202001/Page19.htm>

²⁸ See, for instance, the entertaining attack on risk analysis and cost-benefit analysis offered in Adams (1995).

²⁹ This is a point that has been developed by Peter Peters in his remarkable work on slow transport, and I am grateful to him for discussion.