

"The distribution and resolution of the ambiguities of technology, or why bobby can't spray."

Brian Rappert. 2001. *Social Studies of Science* August: 557-592.

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ABSTRACT - Much debate has taken place in science and technology studies regarding how to speak about the capacities of technology. Alternative approaches are bound up with questions over the merits of realist and relativist accounts of technology and their potential for analytical insight and practical engagement. This paper advances a basis for examining the link between politics and artefacts, one that draws on but reconfigures the work of post-essentialist authors. This is done by moving away from attempts to detail the social basis of technology to consider instead where the ambiguities associated with technology are resolved. These issues are examined through the case of a (re-)emerging class of devices called 'non-lethal' weapons and in particular the chemical incapacitant spray used by British police forces. In doing so, this article reframes debates in technology studies over how far it is possible and desirable to pursue relativist lines of inquiry.

Introduction

In recent years, those in the field of science and technology studies (STS) have demonstrated a diversity of inter-connections between technology and politics. Although the interplay between the two might be conceived in multiple ways, it cannot be ignored. The view that a technology is merely a neutral instrument for achieving some end has given way to much more sophisticated approaches for understanding how technologies help constitute and are constituted by social relations. As conventional assumptions about technology have been overturned and the relation between 'the technical' and 'the social' has been explicated, the meanings of the terms have become contested. In this situation, accounts of technology are often scrutinised for their underlying assumptions about the link between a device's characteristics and the conduct of social life.

This article contributes to this discussion by considering how we should conceive of the capacities of technology. As with so many topics in the social sciences, the debate here fractures along basic lines between realist and relativistic positions and according to the role given to determinacy and indeterminacy in producing social order. In this regard, Steve Woolgar, Keith Grint and others have offered a highly provocative approach for analysing technology called 'post-essentialism'. This is a 'thoroughgoing interpretivist' position that strives to eschew any essentialist attributions to technology. Rather than seeking to determine the actual constraints or enabling characteristics of technology, they instead examine how claims are made about these and why particular stories about win out.

This article seeks to illustrate both the utility and the limitations of the post-essentialist position. It substantiates the approach by highlighting the value of taking the ambiguities

surrounding the nature of technology as the topic of analysis, rather than trying to offer a definitive or resolved account of a device's capacities. For Woolgar, Grint and others, the 'facts of the matter' regarding the implications of technology are issues for negotiation. Their approach is one of treating technologies as ambivalent entities immersed in often competing discourses. So far, the main focus of these post-essentialists has been in deconstructing arguments about the resistance of objective technical attributes to social analysis. As Grint and Woolgar ask, however, '[can] an exploration of alternative forms of post-essentialism [...] define an alternative form of politically relevant enquiry...Should we not be exploring the possibility of defining a critical space which moves us beyond merely political radicalism?' The answer given in this article to both points is yes. The position advocated here is one of moving away from detailing the social basis of technology to asking where the ambiguities associated with technology rest. Following the work of Lee and Bauman, a basis for analysis is advanced by asking who bears the burden for resolving indeterminacies. Doing so, however, requires revising post-essentialist preoccupations and acknowledging certain concerns expressed by critics. Such a focus tells us much about why specific readings of technology win out or are so prevalent.

These issues will be explored through an examination of weapons technology, specifically so-called non-lethal weapons. Within the spectrum of weapons technology, non-lethals have received much attention in recent years as devices for satisfactorily resolving a wide range of contemporary security challenges. These weapons are supposed to minimize the severity of injury and other harmful effects caused. As such they are at the intersection of various tensions about the acceptability of the use of force. Despite attempts to foster a positive image of this class of technology by proponents, the merits of such weapons are hotly disputed. Alternative prescriptions about their appropriate control depend on assessments made of their effects and to what extent there are inherent properties of technology.

The argument presented here is divided into six sections. The next one recounts recent discussions in STS regarding the capacities of technology. Specific attention is given to debates about the possibility of linking intent, design and effects as well as how researchers ought to attribute characteristics to technology. In light of the previous sections, the third examines non-lethals, a class of technology where pressing questions come to bear about causality. The ambiguities surrounding this technology and the implications of this for their legitimacy and the legitimacy of those organisations deploying them are considered. Following on from this discussion, a line of enquiry based on a consideration of the distribution of ambiguities is outlined. It is argued that a fruitful line of analysis regarding the relation between technology and politics is to examine the way in which the ambiguities associated with technologies are managed and the manner in which the distribution of ambiguity helps constitute technology. In contrast to other approaches in STS that rely on notions of closure or obduracy, this article takes the ambiguities associated with characteristics of technology as a topic of analysis. In considering the contingencies surrounding how ambiguities are distributed and made to bear on certain individuals, the argument acknowledges and explicates the relation of ambiguities to issues of authority and responsibility. In doing so the article seeks to offer a type of post-essentialism that outlines alternative form of politically relevant enquiry. Section five utilises this line of analysis for the non-lethal chemical incapacitant sprays used by the British police. The final discussion section elaborates what the approach advanced in this article means for the study of technology.

In Search of Capacities

Researchers in the field of STS have long sought to articulate the relation between the technical, the political and the social. There are competing accounts of whether and how technologies reinforce or challenge beliefs and the allocation of power, wealth and status. In asking about the relation between the social and the technical there are a number of key questions: Can material artefacts embody power relationships? What methodological approaches are most appropriate to consider such issues? What is the proper analytical and normative orientation for those concerned with the implications of technology?

Various ‘-isms’ and theories have emerged to clarify what technologies are and what they do: social determinism, technological determinism, “soft” determinism, social constructivism, and actor network theory to name but a few. A variety of attempts have been made to characterize this now considerable literature. Joerges has categorized alternative positions within STS according to whether they portray social order as a product of deliberate intent or predictable outcome (a realist discourse of control) or take a more conditional view of the process of social ordering (a relativist discourse of contingency). One of those typically placed under the control heading is Langdon Winner. He is interested in the specific features in the design or configuration of a technology that might provide ways of establishing patterns of power and authority. Those patterns may arise from deliberate intent that becomes concealed in physical form, such as the now infamous discriminatory capacities accorded to Moses’ low overpasses in New York, or from more ‘structural’ causes, such as the constraints posed by the built environment on the physically handicapped. While a level of flexibility and indeterminacy is acknowledged, technology here has discernible political and moral implications that need to be identified and sometimes remedied.

In recent years though, authoritative statements about the implications of the technology for patterns of power and authority have been much contested. Reflecting wider currents in social theory, contingency (particularly constructivist) approaches to technology have become prominent. Constructivist accounts take many forms, from treating social and political factors as built into objects to much more constitutive approaches. Contingency inspired authors of various persuasions though have argued that technologies do not have particular political values embedded within them. For Pfaffenberger, political intentions and technological effects are constructed in a reciprocal and discursive process. Rather than technologies possessing specific or inherent political qualities, they have certain affordances that suggest how they might be used. These properties derive from the symbolic discourses that regulate the sorts of interpretations made. The politics of technology thus needs to be actively created and sustained. Joerges as well problematises specifying effects from material conditions. Major difficulties are portrayed in establishing credible narratives about the role of technology as a significant determining force of social change. Joerges suggests establishing a middle position between treating social order as a result of intended action and contingent views of social order as up for grabs. Technologies instead can be thought of as boundary objects that continuously mediate expectations. The proper focus thus becomes one of examining the interplay of practices and representations of technology. A variety of authors from a ‘social shaping’ and social construction of technology (SCOT) position could likewise be said to occupy some middle ground.

Woolgar and colleagues represent what is often regarded as an extreme sceptical and interpretivist perspective. These post-essentialists are concerned with debunking the notion that there are essential capacities of technology. Instead, the capacities of technologies, the practices of using them, and their consequences are treated as contingent. Herein, the process

by which we know technology is irredeemably social. Moreover, stories of what devices can and cannot do are part of the process of constituting their effects. This is an important point as claims about the inherent or definite effects can be used to justify practices that should be considered contingent. Woolgar and Grint have been a vocal critique of many constructivist approaches such as SCOT for harboring vestiges of essentialism by claiming technologies can have political biases 'built in' to them.

The aim of this radical form of constructivism is not to establish particular truth claims about technology; rather it is to consider why some claims are considered more true than others. So along with Joerges, Woolgar and Cooper agree that Winner's description of the bridges in New York has become a persuasive icon in STS because it is a highly performative account that fits into configurations and identities of researchers. After one acknowledges the performative qualities of analysis, the question arises of where to go from there; whether one should try and offer modified and in some way more qualified accounts or whether to turn one's efforts towards scrutinizing argumentative forms.

Discussions about the merits of different approaches in STS often hinge on alternative assessments of the ability of such frameworks to speaking to practical issues of the day. For instance, Kling seeks an intermediate position between naive realism and radical interpretivism. While agreeing that effects are socially produced and mediated through complex networks, he also advises only taking an interpretivist position 'so far'. Kling's major criticism centres on the limitations of 'thoroughgoing interpretivism' in providing a platform for engaging in debates. Instead of deferring authority to those who claim expertise, social scientists need to find ways of constructing responsible narratives. One way of doing this is by treating certain parts of technology and related social practices as temporarily fixed and stable. Kling forwards an interpretivism that acknowledges the conceptual effort that takes place in making any characterizations of technology, but looks for certain facts that can be taken for granted. In that way it is possible to (re-)construct narratives in a fashion that speaks to the world of practice. This basis for engagement is seen as missing in the case of Grint and Woolgar who 'could go further and link the kinds of fictions about technologies different social actors advance to their interests and social worlds. But this requires a willingness to work on larger macrolandscape and ways to contrast fictions with some less factitious reference points'.

Winner too has criticized constructivist approaches for failing to take into account wider institutional and structural factors. In particular he has said that constructivist accounts in general mirror a pluralist analysis of politics by failing to consider those marginalized from the decision-making process and the debates that never surface. If certain workers, for instance, are no longer able to have a voice over technological directions because of the automation of particular tasks, what role can be accorded to their views in the constructivist to and fro of innovation? No matter how many 'users' and designers are interviewed, an important reference point for examining a technology's development will be missing. The exercise of power through the exclusion of certain groups from decisions or the disinclination of particular groups to become active tells us much about the wider social structure. Similar again to Kling's remarks, Winner has questioned the purpose of constructivist exercises. While it is possible to undermine narratives about technology, ultimately some claim must be put forward. Coming from an alternative theoretical starting but reaching much the same conclusion, Hutchby as well seeks to find a firm basis for a middle ground that enables a more concrete engagement with technology than that offered by the post-essentialists.

As expressed by authors such as Woolgar, the utility of post-essentialism is in providing an

alternative basis for analysis and critique. A realist or an essentialist account ‘unnecessarily compromises our ability to challenge the more foundationally ingrained sources of power’. Taking certain ‘facts for granted’ begs questions about how this done and by whom. The position advocated by post-essentialism is said to resist refutation by those who are able to marshal resources to one side of a debate. Striving for ‘a systematic understanding of which kinds of versions [of technology] win the day, in what circumstances, and why’ avoids closing off interpretations because it cannot be negated by particular claims to the truth.

There are then competing accounts of the capacities of technology. Assessments of these at once involve considerations of the adequacy of the approaches offered and their ability to inform practical matters. The debates centre on causal logic and the role of relativism in its various forms. The issues at stake include the appropriateness of particular narrative forms as a basis for social intervention, the relation between the intent, design, and use of a technology, and the conceptualization of political motives. The framing of such discussions is often in terms of how ‘far’ one goes down the interpretative path and whether there are ‘excessive’ forms of relativism. Questions then follow whether analysts should merely highlight the contingencies of social life and the constructed nature of technology, or should (and how can) ‘we’ go further and condemn dubious practices or act to transform social relations.

Non-lethal Weapons and Ambivalence

At face value, the relation between the purpose, design and effects of technology should be nowhere as straightforward as in the case of weapons. By definition, they are designed to cause physical injury. While there are obviously disagreements in the world over the merits of employing force in particular situations, as far as the capacities of technology are concerned, it might be supposed that certain discernible consequences exist. Furthermore, particular weapons such as guns are regarded by some as possessing inherent properties. Spitzer, for instance, probably echoes a common sentiment in arguing it is impossible to see a gun as anything other than offensive in potential, regardless of the intent of the individual possessing it. Guns are inherently dangerous compared to other objects such as knives where non-violent counterbalancing purposes exist.

And yet, the situation is not so straightforward. At a basic level, what counts as a weapon is less than clear. Theoretically anything can kill, objects normally associated with killing do not necessarily have to be used to do so, and the meanings given to such devices are not exhausted by this function. Grint and Woolgar have problematized the capacity of weapons in considering the scope for interpretation over the act and effects of being shot. So, the design and proliferation of weapons are the result of social interactions, the prevalence of guns in itself does not correlate to injury, the act of being shot is a culmination of extensive relations, the experiences and perceptions of pain vary and expertise is often required to adjudicate between different interpretations of events. While it may be difficult to press the social basis for the injury caused by being shot down to the resulting physical damage, in keeping with the post-essentialist spirit, the fundamental point made by Grint and Woolgar is that any account is always a reconstruction of previous interpretations. This is not to say there are no reasons for claiming technologies result in certain effects, but these claims must ultimately be understood as outcomes of interpretations. As such, the ‘facts of the matter’ never speak for themselves and are never beyond question, whether the topic be guns,

computers, or gig mills.

The remainder of this article considers the negotiation of interpretations over the capacity of technology for a particular class of weaponry: so called non-lethals. In recent years much emphasis has been given to non-lethals in the policies of Western security forces. As the name suggests, these are weapons that are not supposed to kill or at least not to result in death as often as 'lethal' weapons. They are intended for current and future military scenarios like the ever-growing role of peacekeeping missions and other quasi-policing activities, but also conventional warfare. For the police, non-lethals are meant to handle continuing threats in routine and public order policing.

Today there are a variety of non-lethals in the arsenal of Western police and military forces, and research and development continues apace into ones for future conflicts. Among the current options include kinetic projectile munitions such as plastic bullets, foam rounds, and beanbags; chemical irritants such as tear gas and hand held incapacitant sprays; and electroshock devices such as tasers and stun guns. To believe some, these 'old fashion' technologies are soon to give way to a far broader spectrum of possibilities: acoustic weapons which shatter windows and cause internal damage, electromagnetic pulse beams designed to knock individuals down and cause seizures, chemical agents which act as calmatives, and a myriad of 'super' chemicals including supercorrosives, superadhesives, and superlubricants. Add to these old and new weapons innovations in the delivery systems and the combination of different types of non-lethals (e.g., rubber projectiles which release chemical irritants on impact), and it possible to imagine something of the diversity of potential force options.

A common justification made about the diverse array of non-lethal weapons is that they offer an intermediate stage of response between no force and deadly or serious force. As two military analysts put it, 'The world is changing and our military role is changing. The tools [of the United States armed forces] don't seem to match the new roles we see out there. There is growing sense we need new tools.' One of the portrayed changes alluded to is the presence of a diligent media and the related public unacceptability of death and injury. The media is typically accorded a vital role in broadcasting the activities of police and military forces and thus placing restrictions on acceptable actions. Fears have been expressed that a hypersensitive public has made the forces of Western democracies quite risk adverse. The ability of the military to wage war or the police to maintain order effectively is undermined by 'squeamishness' about killing or causing damage.

Non-lethals offer a fix to such pressures. The basic philosophy said to guide these technologies is that death and injury are highly regrettable, so when it becomes necessary to employ force non-lethal weapons are supposed to minimize harmful effects. Their use should help ensure the legitimacy of coercive arms of the state. Because of these sorts of considerations, endorsement of the general category of non-lethal weapons is fairly widespread. The United Nations Basic Principles on the Use of Force and Firearms encourage law enforcement agencies to develop 'carefully evaluated and controlled' non-lethal weapons in order to decrease the risk of death or injury from more conventional force options such as firearms or batons. In the United Kingdom, the Defence Evaluation and Research Agency as well as the Police Scientific Development Branch give support for non-lethal research. The current agreement between the US National Institute of Justice and Department of Defense to develop second generation non-lethal neutralization equipment is just one instance of collaboration between law enforcement and military bodies. The memorandum of understanding signed between the UK and the US to exchange information on strategies and equipment indicates the international scope of activities. With public

financial support for research, an expanding industrial manufacturing base, various national and international conferences, and widely circulated scenarios, the networks associated with non-lethal weapons seem set for expansion.

Even in this cursory description, it is possible to see non-lethals involve various tensions and competing claims. While they are presented as enabling weapons designed for a positive purpose, they also may be regarded as being used for more repressive aims. A diverse range of technology is typically promoted under the general banner of 'non-lethal weapons', not all of which fare the same under evaluation. At the heart of the tension with this class of equipment is that the application of physical force is typically contested and there are differences in interpretations over the appropriate level and type of force. Beyond this though, there are fundamental difficulties in ascribing particular capabilities to technology. These issues can be grouped under a few headings:

Effects: Definitive accounts of the effects of non-lethal weapons have been much disputed. Alternative assessments are made of the proper scope for evaluation and the possibility for attributing particular consequences to these weapons. Much debate has taken place, for instance, on the long term effects of exposure to chemical incapacitants. The number of deaths in police custody from asphyxiation has brought claims and counterclaims about the contribution of chemical sprays to deaths. There are also contrasting accounts of particular consequences as 'primary' or 'side' effects and whether they are intended or unintended. In the Gulf War, 'non-lethal' minute carbon fibre spools were used to cause short circuits in power plants and switching stations. The resulting loss of electricity had a wide range of consequences, including likely civilian casualties. In addition, the potential effects of being heated, disorientated, disabled, dazzled, incapacitated or calmed are likely to vary significantly across a population. The possibility for unintended and even unacknowledged effects is not restricted to medical considerations. Diametrically opposed interpretations have been offered, for instance, on whether the deployment of such weapons helps escalate or minimize conflict. Proponents have responded to critics by stressing that whatever the harm caused by non-lethals it must be evaluated in relation to other force options. Here the attempt is made to limit the range of issues at stake to those associated with a comparative analysis of a weapon's direct effects. Even restricting attention in this way, non-lethals are rarely deployed on their own. Within police or military settings more traditional forms of deadly force back up such devices. The question thus arises whether particular non-lethals should be understood as substituting or complementing other coercive means.

Employment: Specifying effects in a decontextualised manner is of limited relevance in understanding the implications of weapons. In order to minimize their lethality, for instance, plastic bullets and other kinetic energy weapons are supposed to be fired from a minimum distance and targeted at particular body areas. To what extent these measures are feasible or followed through is a matter of some dispute. The reasons for unprescribed uses are sometimes portrayed as residing in the weapons themselves. Those within as well as outside of security forces have contended that the design of weapons as 'non-lethal' encourages greater usage and thus paradoxically the need for stricter controls.

Targets: What force is justified and to whom often depends on who is targeted. Whether non-lethals are used in conventional warfare, international peacekeeping, or domestic policing bears on assessments of appropriateness of force. While different standards of acceptability apply between wartime combatants and non-violent protesters, whether and what differences in treatment should pertain to, say, prisoners and other civilians would appear to be a matter of contention in practice if not in public rhetoric.

Effectiveness: Although there are generic problems in gauging the effectiveness of force options, this is particularly the case for non-lethals because they are often used to gain

compliance or other specific goals through the application of measured force. While many non-lethals are designed to incapacitate or temporarily immobilize, the possibilities for being able to adequately verify whether such goals have been achieved in conflict situations is limited. So too is the possibility for determining whether non-lethals are partially or wholly responsible for certain actions. In case of chemical pepper sprays in the US, for instance, authorities continue to use different criteria for gauging the effectiveness of the sprays and as a result have derived substantially contrasting expectations and interpretations of their appropriateness. Claims about the effectiveness of these sprays in stopping assaults range from 10% to 90%. If it is problematic to measure visible effects, it is even more so to determine the deterrence potential of particular weapons and thus to what extent they should be deployed, displayed, and applied.

Standpoint: From whose position should force be deemed acceptable -- users, recipients, medical experts, or the wider public? The point has often been made that weapons such as tear gas and plastic bullets are made to sound and appear more innocuous than they are. While the visible effects of some non-lethals might be minimal, that does not necessarily correspond to the pain experienced. An important point regarding acceptability is that the operators of non-lethals weapons rarely have extensive experience with them. Even in the highest security prisons in the US where non-lethals are given out to all correctional officers, individuals rarely use such devices. That the use of force is not a regular occurrence means the way in which actors construct accounts are central to understanding the range of meanings and attributes given to technologies.

In short, any assessment of non-lethal force begs questions about what options are being compared, by what criteria, in relation to what circumstances and by whom. There is considerable moral and technical manoeuvring taking place in the statements of proponents and critics. Moreover, how properties are discussed is part of constituting their effects and assessing them. For example, alternative portrayals about the deterrence potential and effectiveness of weapon options bear on what is determined to be acceptable and standard practice with them.

Non-lethals are contested and ambivalent technologies, situated at the centre of a host of concerns and classifications about the acceptability of force. Therefore, it is necessary to consider in some detail how their capacities are framed. In line with the general post-essentialist approach outlined earlier, the rest of this paper will strive for an ‘understanding of which kinds of versions win the day, in what circumstances, and why.’ The fifth section will do this in relation to a particular non-lethal weapon: the incapacitant spray used by the British police. Because a diverse range of technologies is being justified under the same broad banner, it is prudent to consider both specific technologies and the sort of broad promise on offer. The rest of this section asks what counts as a non-lethal weapon. The definition and range of objects fitted under this heading are crucial in understanding claims about the desirability of such instruments. As will be shown, it is not just that non-lethals are difficult to define, but that alternative definitions point to fundamentally different ways of making sense of the contribution of non-lethals to conflict resolution. The assumptions implicit in the definitions of non-lethal weapons inform notions of their legitimate deployment and thus the proper standards for their control.

What’s in a name?

What then makes a non-lethal weapon ‘non-lethal’? As the terms suggests, it seems reasonable to assume the differentiation between lethal and non-lethal technology should be done on the basis of effects. There have been some attempts to characterize effects in a

systematic manner so as to provide a basis for classification. Proponents of non-lethals such as Becker and Heal have proposed the 'probability to kill' as a basis for determining the 'lethality' of various weapons. Typically, this is done by comparing the kinetic energy imparted by devices fired in similar conditions over a given distance. Such measures are notoriously problematic even for those weapons amenable to this sort of straightforward quantification because they rely on a set of often unstated presumptions about how technologies will be used in practice. For instance, a common assumption underlying determination of the dangerousness of kinetic weapons is that these will strike the chest rather than the head. But if concocted experiments are not much help in deciding what is lethal, neither are aggregated figures based on experience. One of the most systematic studies conducted of wartime casualties by the US Office of Operations Research found that in various wars last century, 10,000-50,000 bullets were fired for every person hit. The International Committee of the Red Cross has collected causality rates for many recent major wars and found conventional fragmentation weapons and rifle hits 'only' kill roughly 20-25% of the time. Such figures suggest a very low kill probability for what would normally be considered lethal weapons. By contrast, evidence gathered on the number of deaths by plastic bullets in Northern Ireland suggests 1 in 18,000 rubber bullets fired resulted in death and one death occurred for every 4,000 plastic bullets fired. A report by the American Civil Liberties Union associated death with 1 in every 600 cases of people sprayed with pepper spray in California between 1993 and 1995 due to the incapacitant's use against those restrained in police custody. Furthermore, in alternative situations a non-lethal weapon will not be used in the same way and the possibility of death resulting will differ significantly. So, despite the fairly widespread use of kinetic weapons in the US similar to the plastic bullets deployed in Northern Ireland, there have been few claims about casualties associated with them. The counterintuitive 'lethality' implications raised by these lines of probabilistic argument and the assumptions buried within them all point to the limitations of separating a weapon from its context of use for the purposes of determining its lethality.

Even if effects are not gauged strictly on a probability basis, there are major difficulties entailed in distinguishing between weapons solely on the basis of effects. As the points made above suggest, effects and effectiveness are highly contested. This becomes most apparent in discussions about the appropriateness of placing restrictions on technology. Prokosch recounts a number of recent international negotiations on arms control. The contingency of the consequences of technology has not gone unappreciated in such discussions. Various lines of counter questions can be made against attempts to establish definitive (and condemning) accounts of weapons: Did critics really understand the technology? Was it really so "all or nothing" in its impact? Aren't the effects largely dependent on the intelligence information obtained and the precision of targeting mechanisms? Endless debates over the correct calculus for determining death and injury have stifled the negotiation of treaties. Finally, another limitation of effects based definitions is that, as a class of weaponry, non-lethals are sometimes said to differ from conventional ones because they are designed and employed to defeat the recipients will rather than ability to resist. As opposed to conventional weapons that are rated on their damage inflicting characteristics, non-lethals are meant to target the resolve of recipients. This might entail causes major physical damage, but it might not.

For a host of reasons, a strictly effects based approach has been taken as an insufficient basis for classifying weapons by prominent spokespersons. Despite some exceptions, in addition to some reference to effects, for proponents what makes non-lethals 'non-lethal' is the intent behind this technology. Non-lethals are intended to minimize injury. Military analysts Lovelace and Metz, for instance, have argued that non-lethal weapons can be distinguished

from lethal ones in some cases only in that the former were not primarily designed to cause death. In real terms, the damage may be much the same. After years of vacillating between 'pre-lethal', 'less-lethal', and 'non-lethal' designations, the US Department of Defense has settled on term non-lethal to describe 'discriminate weapons that are explicitly designed and employed so as to incapacitate personnel or material, while minimizing fatalities and undesired damage to property and environment'.

Arguably the emphasis given to intent qualifies the limits to harm while also reinforcing the legitimacy of non-lethals. To put it in an extreme form, whatever the actual effects of these weapons in practice, the focus on intent expresses the driving policy aim to minimize injury and death in the use of force. Of course, in the "wrong hands" any technology can be used inappropriately. For non-Western regimes, abuses associated with non-lethals are not surprising for some. Robert Bunker, a major spokesperson on non-lethals, has gone as far as to suggest that while Western non-lethal weapons aim to minimize injury, non-Western non-lethals are those intended to cause long-term disablement. As not everyone would subscribe to such an interpretation, portrayals of the merits of non-lethal technology must be proactively influenced. The promise of non-lethal weapon requires forwarding a particular reading of the use of force. How such a reading can be secured is a matter of great concern.

If the way in which non-lethals are defined is meant to reinforce a view of the benign intentions of certain parties sponsoring their development, it is also thought by some to absolve the responsibility of manufacturers. Here the status of a weapon as 'non-lethal' ensures a certain moral credibility is built into it. For instance, in the mid-1990s, the UK based company Pains Wessex exported plastic bullets and tear gas to Kenya where allegation have been made that they were used as a form of crowd punishment. Responding to criticisms from human rights groups over the possible implications of such exports and the need for stricter accountability in export controls, a company official is reported as having said, 'What do they want us to be transparent about? We don't make things that kill people.'

In discussions about the merits of non-lethals, intent is not something often questioned at the level of manufactures or governments, rather it is framed in terms of the motives and actions of operators and recipients. Non-lethals are good or bad depending on the way they are used. Explicitly throughout discussions of this technology, the point is made that these weapons are just tools. Like any tools they can be abused, but like any tools they can be used in a humane and ethical way. The emphasis on intent is shared across a wide range of commentators, though from which end of a weapon intent is considered depends on who is cast as victim or villain. John Alexander, the former director of non-lethals research at Los Alamos Laboratory, has argued that area acoustic weapons capable of shattering windows and damaging internal organs allow recipients the opportunity to stay or flee a scene of their own violation. Peace researcher Nick Lewer has portrayed the key issue in evaluating non-lethals one of how controls can be placed on weapons whose effects depend on the intent of their users.

For those attempting to construct narratives about the acceptability of weapons, if decisions about where to lay blame when things go wrong are important, so too are determinations of the possibility of specifying the definitive capacities of technology. Consider the case of non-lethal electroshock technology. Amnesty International and a number of other human rights organisations are increasingly concerned about the widespread availability of such equipment in US jails and prisons. While electroshock shields, tasers, stun guns are all claimed to be safe if used 'properly', such claims are said to be based on questionable research. Furthermore, the effects of such technology are seen to vary considerably depending on the

context and the preparedness and physiology of those shocked. Included within the range of electroshock weapons are stun belts. These are devices worn by prisoners or defendants in a court that deliver an incapacitating electroshock by remote control. Amnesty International sees as substantial and without justification the stress and fear caused by merely wearing the belts. It has called on US federal, state and local authorities to take a number of steps:

- * ban the use of remote control electroshock stun belts by law enforcement and correctional agencies;
- * prohibit the manufacture, promotion and distribution (both within and from the USA) of such stun belts;
- * suspend the manufacture, use, promotion and transfer (both within and from the USA) of all other electroshock weapons, such as stun guns, stun shields and tasers, pending the outcome of a rigorous, independent and impartial inquiry into the use and effects of the equipment. This inquiry should assess their medical and other effects in terms of international human rights standards regulating the treatment of prisoners and use of force; the inquiry should examine all known cases of deaths and injury resulting from the use of such weapons. The results of such an inquiry should be made public without delay.

Amnesty International and other groups are trying to find and promote an authoritative basis for evaluation. Stun belts are said to be inherently cruel, inhumane, and degrading, while the acceptability of other electroshock weapons should be determined through definitive research. Correctional officers and others have responded that the controlled use of such weapons is indispensable in modern, overcrowded prisons and their merits should be assessed on a case-by-case basis. A recurring dynamic in discussions about the merits of non-lethal technology is the meeting of general and specific claims. In simplified terms, critics of the technology struggle with the tension of making generalizable and authoritative claims that can effectively justify limiting the deployment of non-lethals while trying to be responsive to the specificity and particularity of individual instances of use. Proponents highlight the importance and situated utility of specific instance of use but also wish to promote the generic merits of non-lethal force options for a wide range of circumstances.

Overall then, discussions about the merits of this technology can be understood as attempts to construct persuasive narratives of past or potential events. Opposed representations are often mobilized in debates. This is the case because it is not just technological options that are on offer but wide ranging issues about the intention of actors, the merits of intervention by force, and the appropriateness of forms of state coercion. At the heart of the promise and the definition of non-lethals is the enhanced legitimacy of those organisations employing them. Securing that legitimacy though is not unproblematic.

The Performance of Ambiguity

Even in this short description of non-lethals, it is clear there are fundamental ambiguities associated with them. Their definition, function and effects are multiply conceived and contested. Key issues hinge on the claims made about the capacities of this arguably ambivalent class of technology. As Wynne has noted though, '[i]t is not particularly interesting merely to point out that there are multiple, and apparently contradictory, discourses "describing" technology. The important point is to analyze how these discourses work in relation to one another and to the wider politics of technology'.

At the heart of the problem in any sort of evaluation is that actors are trying to find an appropriate meeting point between making generalizable claims that give some policy or

other practical guidance and wanting to be responsive to the context-specific justifications for particular deployments. Any attempts to establish a definitive assessment of non-lethals is thus open to alternative criticisms that crucial but contingent variables have been suppressed (as in the case of general claims) or that nothing of much of applicability or generalizability is being offered (as in the case of specific claims). In other words, the legitimacy of the claims depends on the adequation between the general and the specific. There are related tensions such as not wanting to treat lethal and non-lethal weapons as sharply divided and thereby play on false divides, but still being able to provide a basis for differentiating between weapons as well. The question thus arises of how to move forward, and in terms of the focus of this article, how to move forward given debates in STS about the capacities of technology.

Typically the terms of the debate about the merits and effects of non-lethal weapons centre around circumscribed considerations, for instance, whether non-lethals are actually 'non-lethal' or whether they may produce 'lethal' consequences. One strategy consistent with this general approach in relation to the analysis of technology would be to clarify the terms of the debate in the hope of shoring up a particular reading. But the possibilities for authoritatively resolving these debates are limited. As the last section argued, the material nature of weapons is not some readily identifiable ultimate constraint that can be specified in a decontextualised manner. No doubt a careful and rigorous analysis of the claims and counterclaims could suggest grounds for supporting one evaluation over the others. Particular prohibitions might be offered about when a technology should not be used. Ultimately though such determinations cannot derive from a reading of the objective properties of particular weapons. Likewise though, any account which seeks to find a middle ground between a realist and interpretivist (e.g. Kling) is susceptible to both the forms of criticism mentioned above, that is they are not responsive to specifics or not generalisable enough to be of theoretical or evaluative value.

While not denying technologies can constrain or enable action, there are key questions about how such claims are established. In contrast to those who seek to lay claim to a definite account of technology, settling effects is not the purpose of this article. While particular definitive accounts of technology are important in the practical assessment of different choices, this article seeks to ask if there is an alternative basis for practical analysis, one that is able to acknowledge the contestable status of technology. The ambiguities associated with non-lethal weapons makes it apparent that asking which weapons are really harmless or harmful is sterile. Instead it is necessary to develop an understanding of the interaction (or more forcefully the co-constitution) of 'technology' with its 'context' and what is and is not made to be seen as benign. The ambiguities and the contested status of these weapons should be acknowledged while being able to explicate the implications of this for their assessment.

How might this be done? Following the general approach adopted so far by authors such as Woolgar, one option would be to dissect the performative properties of particular narratives. Prominent icons in the field of non-lethal weapons could be analysed in terms of the functions they achieve for those in funding, development, and deployment circles or, more reflexively, those in technology studies. This would offer one way of explicating the 'socialness' of technology. While this would no doubt raise valuable points, as previously noted, such an approach potentially hazards a number of problems: losing sight of technology, becoming preoccupied with ways of story-telling, and failing to connect to the institutional landscapes.

A strategy aligned with a post-essentialist approach would be to take a step back from

debates about effects and shift the focus. The ambiguity regarding this technology can be a topic of analysis rather than a matter to be resolved. Whilst ambiguity is a problem for manufacturers or human rights groups wishing to make authoritative statements because it calls into question the legitimacy of their claims, it also can be a source of insight. One way of usefully working with ambiguities without trying to settle them is to consider their distribution and where responsibility for their resolution is located. The previous section noted the importance accorded to intent in legitimating this technology as well as reasons for noting the contingency of this action. The suggestion here is thus not one of asking how 'far' to take an interpretivist or relativist line (as characterizes so much of the discussion in STS), but of examining the distribution of ambiguities in the constitution of technology.

In this vein, Nick Lee has examined how the distribution of ambiguity surrounding the ability of children to speak for themselves relates to questions of institutional legitimacy. Within adult institutions children are ambiguous creatures. It is rarely clear who is supposed to speak for a given child, whether that is the child herself or himself, parents or authority figures. In practice, the moment in which these ambiguities should be resolved is frequently deferred. For instance, the status of children as competent actors in legal proceedings is often disputed. There are understandable and persistent difficulties in making generalized policies about the status of children as competent speakers (e.g., by establishing a certain minimum age). Yet, for institutional actors' decisions to be more than merely ad hoc, some degree of generality must be entailed. The ambiguous status of children means that legal institutions often defer the time to decide on whether a particular child is competent to give evidence till the courtroom, a process that often brings significant stress for the child. In such conditions, Lee argues the key task in the social study of childhood 'is not to answer the question of children's status, but to examine how that question accompanies children in their passage through various social orders.' How ambiguities relate to the status of children are distributed, where they must be resolved and by whom are key questions.

A similar approach can be taken in examining the ambivalent qualities of technology. Evaluations of non-lethals are at once adjudications about the status of technology made in relation to concerns about the legitimacy of those pronouncing them. Following Lee, the focus can become one of asking how the treatment of ambiguity helps accompanies non-lethals and secures their legitimacy or illegitimacy. A consideration of these sort of institutional concerns then provides a basis for asking Grint and Woolgar's question of 'which kinds of versions win the day, in what circumstances, and why.' This differs from SCOT and similar approaches by not utilising largely unexplicated assumptions about closure or obduracy, but instead by attending to the activities that distribute ambiguities. In practical terms, such an approach cannot replace arduous attempts to advance particular accounts of, say, the medical effects of weapons or the competencies of children. The discussion in the next section about effects of non-lethal chemical sprays relies on claims about the sprays as resource for charting ambiguities. The ultimate status of the claims is not something to be resolved here. Whether 'real' or 'perceived' claims in some absolute sense, there is some justification for the statements made, they are treated as real issues in that must be responded to by many of the actors involved, and, therefore, whatever their ultimate merits they shape the interpretation of events by participants and the manner in which notions of responsibility are negotiated. In trying to find some way of being sceptical about knowledge claims while discussing the controversies at stake, this article takes the rather pragmatic position of saying that these claims appear to have some justification, though their status needs to be questioned as well. The to and fro of the claims-counterclaims dynamic is the basis for establishing ambiguities and thus a necessary precondition for analysing their performative characteristics. The line of analysis, however, can provide a viable basis for making explicit

the legitimacy demands on proponents, critics and commentators.

Chemical Incapacitant Sprays

To illustrate the utility of examining the distribution and resolution of ambiguities, let us now turn to the case of CS (o-chlorobenzylidene malononitrile) sprays. These are hand held devices which when triggered send forth a cocktail of chemicals intended to incapacitate those hit. The immediate effects of the chemical irritant CS include the production of tears, a burning sensation, coughing, sneezing, and vomiting. Chemical irritant gases have figured in public order policing and riot control throughout the twentieth century. The incorporation of irritants into hand held sprays for the police is a more recent phenomena, not beginning in a substantial fashion till the 1970s. Chemical sprays typically consist of three components, the primary chemical agent (such as CS), a liquid solvent and a propellant gas. Although in some countries such sprays are available to civilians, by and large the main users are law enforcement agencies. Incapacitant sprays provide officers with an additional force option that can be used in lieu of or in combination with verbal, physical and other technological measures. While various policing bodies in the UK were pressing for the adoption of some form of incapacitant since the early 1990s, just what chemical-based spray and what governing procedures should be adopted was long a source of disagreement. CS sprays were trialed and later approved for use in English and Welsh forces in 1996. Even before the trial commenced, the possibility that they might be deployed proved quite contentious both within and outside of the police. Part of this derived from the diversity of sprays deployed and procedures set up in other countries.

US police and correctional officers make some of the most extensive use of chemical sprays. OC-based sprays (oleoresin capsicum - or 'pepper spray') are the most widely used in the States. They are said to act as an effective option in handling unruly individuals from a distance, a deterrent in assaults against officers, and a factor in the reduction of excessive force complaints against the police. As such, pepper sprays are said to represent a humane alternative to firearms or nightsticks and are just one among a number of non-lethal force options that are available to police forces. Despite their wide scale adoption, there has been fairly persistent concerns regarding the lack of knowledge about health effects, the possibility for overexposure, the variability of effects due to pre-existing medical conditions, the likelihood that the spray's effectiveness has been overstated, and the extent of unnecessary and inappropriate deployments. A chemical spray called Mace, a device whose effectiveness has been said by US officials to be based on 'widely exaggerated' claims, predated pepper spray itself.

One of the most controversial aspects of pepper sprays has been their contribution to deaths due to asphyxia. Although the sprays are supposed to be safe when applied 'properly', when things go wrong there are questions about where blame lies. The variations in pepper spray suppliers, in rules of engagement and treatment, and in police practices brings ample scope for disagreement over the attribution of blame. One of the most famous instances of this took place in 1993. A pathologist recorded a man in North Carolina died from asphyxia due to bronchospasm precipitated by pepper spray. For a time, news of the event led to the withdrawal of pepper sprays from a number of forces. According to Doubet, the spray manufacturer in question laid the cause of death with the failure of the affected individual to receive the necessary medical treatment. In other words, the fault was with the conduct of officers and not the sprays 'themselves'. Noting the scope for distributing responsibility and

liability due to various uncertainties and ambiguities, Doubet concluded:

"These comments by a manufacturer blaming the police for the death and clearing their product of any responsibility should be more than alarming to agencies and officers alike. With no medical or scientific proof, they make a public statement laying blame on the officers based on what their investigators concluded. With a lack of research on their products and less than unbiased investigators looking into cases for manufactures, [police] agencies should begin to realize how much support they will be given in court by the manufacturers should a lawsuit arise."

Based on such concerns about safety, in 1994 the UK Police Scientific Development Branch determined that pepper spray posed too great a risk to be taken up in the UK. The Association of Chief Police Officers (ACPO), acting in an advisory fashion to the police in liaison with the Police Scientific Development Branch, instead approved CS sprays similar to those used by the French Gendarmerie.

Safety concerns though were not the only major factors bearing on the uptake of incapacitant sprays. While the sprays might be only one option in the arsenal of US and other police forces, in the British context their deployment threatened to compromise the distinctive basis of legitimacy for the police. Whether in substance or in myth only, the view is often put forward that a special reverence exists for the police in mainland UK. Particularly due to a lack of routinely armed officers, the British 'bobby' is supposed to be non-threatening. The relatively vulnerable position of bobbies requires a relation to the public based on mutual respect. This sort of policing is supposed to impart a level of legitimacy to the British police that means the recourse to coercive measures is less called for than in the United States or continental Europe. Waddington and Hamilton argue that the emphasis placed on the 'special relationship' with the public both underpins and yet poses a constant threat to the basis of public support for the police. Changes in the operation of the police are scrutinized as to whether they are consistent with 'traditional' forms of policing, not the least by the police themselves. In the case of the sprays, critics argued the uptake of the sprays represented a further and unproductive 'tooling up' of the British police that would ultimately prove counterproductive.

Given these sort of considerations, the introduction of chemical sprays proved problematic not only because of controversies over effects but because the implications of the sprays for British 'policing by consent'. To allay fears of their widespread use, the sprays were only supposed to be employed in specific ways for the defence of members of the police and the public or in handling highly dangerous situations. Explicitly, the sprays were justified as a tool in providing officers with a tactical advantage in violent situations. Despite these caveats and justifications, the sprays have proven quite controversial. The debate over the sprays in many ways mirrors the debate over alternative incapacitants in other countries, such as the case of pepper sprays in the US. Although originally justified as a last step measure for self-defence, a variety of studies have alleged they have been used in a wide range of circumstances and conditions. Repeated, albeit anecdotal, reports have been made of the sprays being targeted against non-threatening individuals for 'offensive' subduing purposes rather than for officer or public protection. In the most comprehensive study to date, the Police Complaints Authority noted several serious problems after investigating complaints made by the public: in 30% of cases the spray were said to be used under the one meter minimum squirting distance; in 40% of cases they were used in enclosed spaces where CS concentration levels can build up; and in 40% of cases it was determined the sprays were not

being used for self-defence. The general thrust of such criticisms is that the sprays have become an easy option for officers, where recourse to force is not the most appropriate means of handling a situation. Adamant counter responses have been made by senior officers to suggestions of the injudicious or ad hoc use of the sprays. Much uncertainty stems from the relation of the sprays to other force options, whether, for instance, they are to be used before, after or as a substitute for batons.

There are also discrepancies in statements about safety considerations. Throughout the trials and since then, constant assertions have been made that the sprays were tested to a level similar to that required by a pharmaceutical drug. What little public elaboration has been made regarding what this meant in practice offer reasons for doubting the robustness of the process. The benign qualities of CS have long been contested by those who argue the effects are often long-term, variable, and not well understood. Possible effects alleged include permanent lung damage at comparatively low doses, shortness of breath, second-degree burns, skin blistering and severe dermatitis, and the triggering of heart failure. On the basis of such concerns the medical journal *Lancet* called for a moratorium on the use of CS sprays till more safety information was made publicly available.

Additionally, concerns has been raised regarding the possibility for unknown effects from the solvent, methyl isobutyl ketone (MIBK), both on its own and when mixed with CS. Scientists at the UK national defence laboratory Porton Down conducted a literature review in 1997 (the year after the trials) with access to various classified experiments. The leaked review ruled out the current solvent due to its 'serious' toxicological risk. Although the Home Office commissioned this study, it has not led to the withdrawal of the sprays. For a time, ACPO claimed not to have seen this study since its dissemination was quite restricted. The situation is now one where the police are both making reassurances of the spray's safety and searching for alternative incapacitants and solvents. A 1999 UK Department of Health study meant to provide a definitive and independent safety assessment both failed to comment on the Porton Down claims and noted the 'sparsity' of data on the effects of CS and MIBK mixed together. The Department noted that even if officers adhered to the operational guidelines the possibility existed of adverse effects for persons with asthma, hypertension, cardiovascular disease, and those under the influence of psychiatric medication or other drugs.

These points are in addition to a variety of acknowledged ambiguities related to the effects of the sprays that complicate making evaluations of the force they entail. In general, the inability of police officers to gauge the pain they are inflicting makes determining the appropriate application of the sprays somewhat problematic. Alternative characterizations of their effectiveness have been put forward. Officers have reported significant time delays (i.e. more than 5 seconds) in the sprays working in nearly a quarter of instances. Partially due to the inadequacies of existing reporting procedures and partially for reasons that are unclear, in 20% of cases the sprays have been recorded as having no effect. The uncertainty over effectiveness thereby complicates making a quick and clear appraisal of their effects and what subsequent action might be required. Others have argued the sprays are so effective that officers are being tempted to use them too quickly. The stand-off, push-button response to policing situations introduces a physical and psychological distance between officers and recipients that reduces the inhibitions to using the sprays or in itself encourages a greater use of force. Moreover, significant variations have been noted in the concentration of CS in the sprays, another factor complicating any assessment of the likely effectiveness and safety of particular canisters.

There are then various uncertainties and ambiguities associated with the operational

deployment and health effects of the sprays. Important questions exist about who should and has been targeted as well as in what manner. Assessment of health effects and the proper operational condition of deployment are established in a reciprocal relation. What one believes about the adherence of the police to the rules affects the evaluation of the health dangers posed by the sprays 'themselves' as opposed to complications that might arise due to their 'misuse' or unadvised use. The reciprocity of the causes of effects is source of much disagreement about blame. In 1998/99, the number of complaints against the police made in relation to the sprays rose to its highest level of 476. While the physical effects on those targeted are not recorded as a matter of routine across the police, some cases of serious reactions have been documented. In theory there are any number of factors that could be attributed blame when complaints are made or there are serious reactions: the chemical composition of the sprays (whether that be CS, MIBK, or the combination of the two), their uncontrollable variability in effects across the population, the actions of officers (e.g., firing the sprays within one meter of the target), the behaviour of recipients, etc. Any assessment of where blame lies will have to negotiate with such factors, typically making determinations well after the event.

There are then numerous uncertainties and ambiguities associated with this technology. Following through the approach outlined in the previous section, let us examine the distribution and resolution of the ambiguities in constituting the sprays. This involves both a deferral of the moment of resolution of ambiguity and an organisational devolvement of responsibility to individual officers.

As mentioned above, the rules governing the sprays are a core component ensuring their proper deployment. In 1996, ACPO produced guidelines to advise chief constables and individual officers about the appropriate use of the sprays. Although individual police forces were able to revise the ACPO guidelines, few if any have done so. While the relation between formal rules and practices is less than straightforward in any organization, it is particularly problematic within the police. As numerous studies have noted, despite the link between policing and law enforcement, discretion in the adherence to rules is central to the actions of police officers. Because of the high number of law breaking incidents, the police must make judgements about the interpretation of rules and decide how to enforce the law in practice. To draw on Goffman's distinction, in the public 'frontstage' police are presented as quasi-militaristic and highly disciplined, but 'backstage' on the streets that image gives way to much more messy set of practices. Further compounding the situation, routine policing has a 'low visibility' in relation to police management (as represented by associations such as ACPO). Attempts to control or even accurately represent the actions of officers often founder for this reason. On the positive side, discretion enables a flexibility that resists a mechanical enforcement of the law. It also though brings grounds for criticism for decisions and the potential for conflict between rank-and-file and senior officers when blame needs to be attributed.

These general considerations combined with the controversy surrounding the sprays meant that there were acute tensions regarding the internal and external legitimatisation of the sprays through the devising of guidelines. If the rules surrounding the sprays were highly proscriptive then they would lack flexibility, act as a method for determining liability and no doubt appear quite unrealistic to many officers. However, rules without any teeth would lack public credibility and risk allegations of an ad hoc and uncontrolled deployment. The 1996 Guidelines 'resolve' this tension by deferring the moment of its resolution. The decision to use the spray is treated as an individual one for officers who will be accountable to the law. As such ACPO reinforced the legal and occupational discretion of individual officers and the

policies of police chiefs. The non-legally binding guidelines specify the incapacitants should be used against: (1) those offering a level of violence which cannot be appropriately dealt with by 'empty hands' techniques, and (2) violent offenders, other than those armed with firearms or similar remote injury weapons, where failure to induce 'immediate' incapacitation would increase the risks to all present. Several proscriptions are made. The use of the spray against those with a firearm, for instance, is deemed 'inappropriate and should not be considered.' Officers should not use the sprays within three feet of a target 'unless life is at risk'. Despite the ultimately provisional character of such stipulations, their 'inflexibility' brought a rewriting in 1999. As opposed to the 1996 Guidelines, the 1999 policy is one of guidance. The guidance is meant to 'support and inform' individual officers in determining what force to use (i.e. what constitutes reasonable and necessary force). The major point of departure is in the appropriate contexts for acceptability. The 1999 advice states the spray is a tactical option 'available to an officer who is faced with violence or the threat of violence [my emphasis]'. The provisional character of the proscriptions given to officers is reinforced by the latest advice. So, the guidance advises officers not to use the sprays below three feet, unless it cannot be avoided. Possibilities for cross-contamination means the sprays should not be used in crowd control situations unless the officer can justify their actions. The decision of whether to spray the mentally ill is one where an officer may consult others but the final decision rests with the officer. The use of the incapacitant against those armed with a firearm or those in control of a motor vehicle need to be 'carefully considered'. Cautionary issues are noted, but only noted.

To different degrees, the 1996 ACPO Guidelines and 1999 Guidance handle the ambiguities surrounding the sprays and the desire for internal and external legitimacy by devolving responsibility for appropriate use down to individual officers. The provisions in place lay out general policy directives while acknowledging the central role of discretion in policing. Where proscriptions are made, they could hardly be said to be definitive. The general policy is that it is for individual officers to decide on and justify the appropriateness of the sprays on a case-by-case basis. Officers must balance the uncertainties, the possibilities for serious effects, etc. As such conceived, the merits of the sprays depend on the intent and actions of its users.

Whether intended or not, this focus on the practices of the direct users deflects attention away from critical questions about government and corporate responsibility regarding safety concerns as well as the role of senior police management in ensuring proper deployment. While there are risks acknowledged with sprays, these are portrayed as manageable and established ones associated with the use of any such chemical incapacitant. So though there exists the possibility of severe but unforeseeable reactions, the sprays are basically safe, being tested to the level of a pharmaceutical drug. A further justification is that on balance the sprays pose much less a risk than other force options such as the baton that can cause permanent damage.

With the management of many of the health considerations, the main focus of attention becomes the instructions given to officers. Problems with the sprays become defined in terms of the inadequacies of existing training provisions. The focus on training is also shared by quasi-regulatory bodies such as the Police Complaints Authority. The Authority has conducted some of the most systematic analyses of the sprays, with an overwhelming prescriptive emphasis on training and guidance to officers. It has approved of many of the changes entailed by the shift from guidelines to guidance. With the attention training provisions, the central question for criticism becomes one of asking whether officers are using the sprays properly or improperly. Critiques of the sprays thus become critiques of the

actions of officers. This framing is no doubt part of the reason why police bodies have responded so adamantly against critiques of the sprays. Officers are said to do a difficult job in sometimes violent situations and need the best protection they can be afforded. When this justification is married with the central role of discretion, the possibilities for reprimanding officers is limited. Cases of severe reaction, for instance, might be attributed to officer holding the sprays too close to the target, rather than being an effect of the composition of the sprays. While the former is regrettable, its importance is mitigated because of the volatility of the circumstances of use. Although senior officers might defer the ambiguities surrounding the sprays down to rank-and-file ones, given the importance of officer discretion, the potential for the diffusion of responsibility at this level is more than a mere possibility.

Given the considerations above, it is probably not a surprise to many of those in STS that debates about the sprays have tended to degrade into set of oppositions: side effects vs. officer protection, safety vs. liberty, use vs. abuse, safe vs. unsafe, officers vs. criminals, etc. Proponents and critics typically take opposite sides in this debate and both mobilize or appeal to the mobilization of definitive accounts of technology to support their positions. Civil rights groups such as Liberty and anti-racist groups such as the Newham Monitoring Project have called for the deployment of the sprays to be suspended until the facts regarding their safety and operational deployment are known. Certainly while there are pragmatic reasons for seeking a clearer understanding of the 'facts of matter' there are major problems in doing so. Not least is the possibility for alternative assessments between interested parties about what constitutes reasonable force. A different critical response to some of the points noted above has been to seek to define generalizable and definite proscriptions. Concerned Parliamentary representatives have suggested that CS spray should not be used against children or those known to have mental health problems. Such suggestions have been criticized for being unrealistic in practice (e.g., how young is 'too' young?) and not allowing officers to independently deal with particular situations. Young people or the mentally ill may be extremely violent and officers are said to thus need to defend themselves. Whatever the merits of such proscriptions, the claims and counterclaims put forward for them represent attempts to occupy a pole in the general/particular spectrum. The preceding sections argued that rather than advancing a position in the claims and counterclaims debate, a different basis for analysis is to examine the performative character of the ambiguities associated with non-lethals such as the CS sprays. The desire to establish both generalizable yet practical working rules has led to the deferral of the resolution of the (narrowly conceived) ambiguities about the sprays to street level officers whom are held responsible for their actions to varying degrees. In asking what has 'gone wrong' with the sprays, the ascription of effects and assessments are bound up with legitimacy of the policies of the police.

This situation characterised by constant deferral is not evitable. Not all police forces in England and Wales have approved the deployment of sprays nor do they advise officers in the same manner regarding the appropriateness of the use of force. With regard to the former, two forces (Northamptonshire, Sussex) have declined to take up the CS sprays citing health fears for officers from cross contamination. With regard to the latter, the devolved nature of decision making about the use of force represented in the 1999 Guidance is just one approach for ensuring the acceptability of force. In addition to not deploying the sprays, the Northamptonshire police force operates a more robust regime for advising officers on what they should and should not do, where responsibility for handling the ambiguities of the use of force are distributed throughout the police ranks.

This is achieved through a wide ranging set of activities, largely initiated and championed by the force's training inspector. Part of the system is a simple use of force monitoring

procedure. Standardized forms are utilized that consists of categories on the use of force and an open-ended section that officers fill out after an encounter. These provide a basis for monitoring, evaluating, and learning procedures regarding the use of force. Officers give the reports to their area instructors who assess them and then pass them on the training inspector. The information collected includes the types of weapons and tactics involved, the time of day, the injuries sustained by all parties, the ethnicity of subjects of force, and the assessment by officers of the effectiveness of options. All existing practices and equipment are scrutinized so as evaluate them in relation to wider changing police practices and environmental factors. Information is also collected on the use of force practices which are not standard procedures but which can later become part of officers' repertoire if deemed effective. The data collected is tabulated and sent out in monthly and yearly reports to relevant middle and high ranking officers in the force. Instructors are expected to incorporate the lessons of such reviews into their training and refine the advice given to officers. In doing so, the instructors are able to provide more than mere guidance, but instead offer accounts of what types of force and equipment ought to be used in what circumstances, how potential conflict situations should be approached, and how the application of force ought to escalate. Ideally, the information obtained by the Northamptonshire police can be used both to protect police and to take action against inappropriate behaviour. Complaints against officers can be situated in relation to her or his history of the use of force and officers can be referred for more training when deemed appropriate.

Currently, the extent and nature of the recording of the use force by British police forces varies considerably. While officers are sometimes expected to file incident reports or notify their superiors regarding the use of CS sprays, such information is not made use of in a systematic way and it is not able to be situated within the overall picture of the use of force. The lack of comparative or intra-police force data means policies or training are rarely devised on the basis of systematic evidence. While a recent attempt has made by ACPO to introduce national and standardized use of force report forms, the initiative suffers from a low uptake and questions concerning confidence in the data obtained. Institutionalizing use of force reports in a matter that inform training procedures requires more than merely having forces adopt them. According to the training inspector in Northamptonshire, their system was only treated seriously by officers when they believed that filling in the forms amounted to more than a bureaucratic surveillance process but instead would actively be integrated into training procedures so as to reduce the possibility of assaults to officers. By this estimation, the standardised forms in and of themselves are of limited value.

The system for monitoring the use of force in Northamptonshire is a highly integrated trust based system relying on obviously rationalistic assumptions. Clearly it may be challenged as such and for various other reasons. The sceptical approach to knowledge claims taken in this article prevents treating the system at face value. In terms of the argument of this article though, the crucial point is that the system offers a different means for distributing and resolving the ambiguities associated with the use of force. It is not the case that in such a system the basic disagreements about the acceptability of force disappear. Rather it is a matter of where those ambiguities rest. Street level officers are still legally accountable for their actions and have a broad latitude of discretion, but policing takes place within a set of procedures designed to help senior and junior officers learn about force options as well as punish acts of impropriety. With regard to officer decision making, rank-and-file officers must be able to justify deviations from those procedures deemed to be most appropriate rather than determine the best response in specific cases. For their part, senior officers should know where the problem areas are and the measures most likely to be effective in dealing with situations. What the overall limits of the system, the tendency for evaluations of force to

degrade into simple stories of street level officer's use and abuse of a technology is generally less likely because the figure of responsibility points to senior officers as well.

Discussion

This article has adopted a sceptical approach to the capacities of technology in order to acknowledge the constitutive relation between operational rules, perceptions, and practices. Rather than trying to forward a definitive account of the properties of non-lethal weapons, it has been suggested that ambiguity as to the determination of such "properties" become the actual focus of the analysis. The manner in which ambiguities are framed and 'resolved' can be examined in relation to the legitimation processes for technologies and institutions. What force is acceptable, what justifications are made for it, and by who depends on the distribution of ambiguities. To the extent that organisations attempt to devise generalized policies that try to be responsive to particular situations, there are important questions about the management of ambiguities. While the substantive topic addressed in this paper has been non-lethal weaponry, the basic tensions outlined regarding generality, particularity, and legitimacy are part of the coping strategies of institutions in dealing with ambivalence and ambiguities. In the case of non-lethals, the tensions are especially evident given the justifications for and effects attributed to these weapons.

Technology and Responsibility

A central concern raised by this analysis is the importance of responsibility in relation to organizational processes involving authority and legitimacy. It has been argued here that in the case of the CS sprays discussions about the capacities of technology have been polarized as different but definitive accounts of technology are put forward. It has further been suggested that in the search for definitive claims, the manner in which discussions divide into opposing camps means that the merits of the sprays are framed within the fairly narrow terms of the use and abuse of technology. As such, the complexity of the debate about the sprays and the constitutive functions of the socio-technical processes at work are lost in favour of a discussion of the 'actual' health effects of the sprays and the intent of officers.

These dynamics could hardly be said to be unique to the case of CS sprays. The use/abuse model is prevalent in claims by critics and proponents alike for all sorts of non-lethal weapons and other technologies more generally. In this sort of model, technology is evaluated as good or bad, appropriate or inappropriate depending on its usage. In other words, the object in question is taken as essentially neutral, this despite the recognition of the negotiated status of technology and uncertainties associated with it. While such a framing is perhaps pervasive in accounts of technology, it ill-serves attempts to devise processes for learning from the complex experiences in conditions of disagreement and uncertainty. The poverty of discussions about technology in terms of the use or abuse of essentially neutral tools has been a topic of much commentary from those within STS in the past. The possible origins for the persistence of this framing though have been given less attention.

Wynne has commented that discussions about many technologies are often characterized by a stark divide between the rule-bound images prevalent in public discourse and the contingencies and informal routines (even rule-breaking practices) that constitute technology. The operation of technologies should be thought of as emerging out of practice rather than being determined by official rules. The case of the CS sprays certainly echoes this characterization. While police authorities have offered a public image of the sprays as rule-bounded in deployment and highly rationalistic in uptake, such claims fail to acknowledge

the complexities and uncertainties of the situation. For Wynne, experts thus face dilemmas as they try to reconcile the rule-bounded images of technology with the messy world of practice. Often this means that in public discussions, problems with technology are attributed to 'human error' or deviation from objective rules by 'downstream' actors (e.g., operators, the public) even when the experts involved recognize the limitations of a formalized discourse in speaking about the operation of technology. The analysis presented here of the CS sprays and non-lethals generally is consistent with this focus given to the intent and the competencies of users. This article, however, has sought to understand the attribution of responsibility as a product of particular organizational strategies. As argued here, the prevalence of framing can be understood, at least in part, as a product of attempts to reconcile particular and general claims. When one pays attention to the management of ambiguity and its deferral, it is possible to see the contingency of such a framing, the effort behind designations of technology as neutral and the dynamics behind attributing blame to downstream actors.

Rethinking the terms of debate in STS

Finally, when approached in this manner described in this article, the question of how far it is reasonable, practical, insightful, etc. to take sceptical accounts of technology gives way to a wider set of concerns. Once we acknowledge the contingency of how ambiguities are distributed and made to bear on certain individuals, the question of who has to deal with the ambiguities becomes an important practical consideration. Previous sections have elaborated something of the interpretative dynamics at work in the case of CS sprays and other non-lethals. Questions about who says what are the demands of the technology, under what circumstances and how, are inseparable from questions about the control of information. It is in conditions of asymmetrical knowledge that claims and counterclaims are made about the legitimacy of force options. Concerns about the severity of complaints made against officers, the extent of legal proceedings and awards to members of the public or officers, and the possibility of long term health effects are addressed in a situation where the necessary information to make an assessment does not exist, is of limited value, is not collected, or is not released to the public. Such a situation arguably fuels much speculative debate and mistrust. Assurances by the authorities of the safety and appropriate use of the CS sprays have done little to appease critics of the technology.

A limitation of many constructivist and post-essentialist accounts of technology is that they too often take as their object of analysis prominent, highly visible technologies that are in many ways quite legitimately understood in terms of their immediate consumption. It is on that basis that questions are asked about how individuals construct particular narratives. If we are to constantly question the basis of claims so as to not allow particular readings to be closed off from questioning as Woolgar and others suggest, then it is imperative to acknowledge the processes that close off readings, including the control over information. As Winner argues, if we are unable to comment on the choices of readings that emerge for actors and how some issues are excluded, our analysis cannot but attend to a limited range of concerns. Following through the logic offered by Woolgar and others makes this clear, though this is not something they have chosen to take up. A post-essentialist approach is well suited to the examination of technologies where the decision-making process is characterized by foreclosure rather than disclosure, as it is not reliant on settling controversies but instead attends to the performative aspects of perceptions and accounts involved. Once we move away from detailing the underlying social basis for the capacities of technologies to a consideration how the distribution and resolution of ambiguity helps accomplish them, questions about what ambiguities are and are not recognized (and for whom) come into the centre of analysis.

So in asking which claims attract the most support, we also must attend to those issues marginalized or left off the political agenda. Having made this point, doing so by appealing to some derivable interests of the actors involved is of limited utility. As Pfaffenberger notes, 'values and technologies are reciprocally and recursively constructed in interaction with one another, producing an outcome that ideally generates both political authority and a technological system.' In the case of the sprays, the situation in the early 1990s was arguably one where few officers felt that additional equipment such as the sprays would deter or help deal with assaults. By the beginning of the next decade the sprays have become deemed an essential police option. This despite the known injuries to officers from the sprays, the possibility of serious toxicological risk (reluctantly) acknowledged by police authorities, and the arguably scant evidence that the sprays have caused a reduction of assaults on officers. The overall embedding and legitimation practices involving the sprays is beyond the scope of this article. Suffice to point out here that examining the capacities of technology is not a matter of specifying their actual effects or merely noting the space for indeterminacy, but instead building an approach sensitive to the conditions under which interpretations are made. It is necessary to develop an account of dynamics at work between individual's action and perceptions of the technology to see how the uncertainties involved are made sense of in practice.

In its most robust, honest and demanding form, this approach would extend to a reflexive examination of the claims of the analyst. This article has wrestled throughout with the central problem faced by those of constructivist persuasion in STS of how to speak about the characteristics of technology as both 'real' matters deserving of attention and 'claimed' attributions. In focusing on the management of ambiguities, this analysis has displaced rather than superseded the thorny question about how to specify the characteristics of technology. (Alas) In many ways this displacement activity has meant this is a matter for (you) the reader to resolve. Furthermore, the conceptual propositions made can be analysed in terms of the general-particular tension utilized in this article. An attempt has been made to offer an argument that is seen as legitimate because it is at once both relevant to the case at hand, but also informs more general theoretical discussions in STS. To the extent this has taken place, the outcome is a contingent achievement.

While not attempting to address such vexing reflexive considerations, this article has offered possibilities for the analysis of technology that draws on but reconfigures post-essentialist treatments of technology. It has focussed on how to orientate analysis in relation to that ambiguity, whether it becomes a topic to be settled or examined in terms of its performed and performative characteristics. The capacities of technology have been discussed in terms of the socio-technological management of ambiguity. Instead of attempting to find some middle ground between treating technologies' capacities as open-ended or fixed, this article has sought a different grounding for analysis. Through a sceptical approach to technology attentive to the distribution of ambiguities, it is possible to provide a basis for analysis.

Notes

A version of this article was presented at the Science and Technology Studies Unit (The University of York) Discussion Group on 9 January 2001 as well as the EASST Conference on 30 September 2000. In particular, the author would like to thank Brian Martin, Nick Lee, Birgitte Munch, Paul Rosen, Andrew Webster, and three anonymous referees for their helpful comments.

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As is argued in this article, the specific interpretation given to the 'capacities of a technology' is a matter of some debate within the literature. The abstract term 'capacity' is used in a general manner to indicate the properties and characteristics of technology that account for what it is and what it enables, constrains or otherwise influences.

. See, for instance, Keith Grint and Steve Woolgar, 'Computers, Guns and Roses: What's Social about being Shot', *Science, Technology, and Human Values*, Vol. 17, No. 3, (Summer 1992), 366-80; Steve Woolgar and Geoff Cooper, 'Do Artefacts Have Ambivalence?: Moses' Bridges, Winner's Bridges and other Urban Legends in S&TS' *Social Studies of Science*, Vol. 29, No. 2 (April 1999), 433-45; and especially Keith Grint and Steve Woolgar, *The Machine at Work* (Cambridge, Polity Press, 1997).

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* suspend the use, manufacture, transfer and promotion of any type of equipment where credible evidence has shown that it may inherently lend itself to human rights abuse, pending the outcome of a rigorous, independent and impartial inquiry into the use and effects of that type of equipment.

* prohibit the transfer and use of any type of equipment where credible evidence has shown that it may inherently lend itself to human rights abuse unless the receiving party has established rules (including mechanisms which enable the effective monitoring and observance of the rules) which regulate the eventual legitimate use of it and which are based upon international human rights and humanitarian law standards.

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All three anonymous referees of this article were highly critical of a previous and slightly more extended discussion of the system in Northamptonshire. One referred to my analysis of it as relying 'a panopticon of data' and another said it was theoretically and empirically disappointing. Certainly I do not wish to take the system as unproblematic or capable of resolving disputes about the use of force in an authoritative fashion through the mobilization of data. The amount of information gathered and the potential for feedback does hold the potential for Northamptonshire to minimise (but not eliminate) uncertainties and learn from their experience. Arguably these basic measures are important considerations, whatever the lack of a radical change of organisational practices.

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sprays is a major concern for officers. An unfortunate wind change or the physically handling of recipients quite often results in officers getting contaminated. While there are not centrally maintained figures on police injury, during the trials of the sprays 78% of officers experienced cross contamination. Indeed, the original trials of the spray in 1995 were called off due to serious injuries sustained by officers in training.

My 'thanks' to an anonymous reviewer who brought up this set of issues.

For a further discussion see Lee, *op. cit.*, note 3.