11 TEXT AND ACTION

THE OPERATOR'S MANUAL

IN CONTEXT AND IN COURT

JAMES PARADIS

Modern professional knowledge, it has been widely noted, is formally embodied and disseminated in literary networks (Price; Garvey et al.). Studies by Gilbert and Mulkay, Latour, and Bazerman have shown that the socio-rhetorical strategies of publication help to formalize a specialized field, not only by defining its territory and identifying the members of the network, but also by furnishing the means for constructing and maintaining consensus—or, at least, the impression thereof. The rhetorical practices of disciplines have broader social consequences, as well, since expert knowledge is routinely exported to society in innumerable manifestations of modern instrumental control—the codes, procedures, and industrial products that shape, amplify, and direct our daily behavior. Nearly all of these products are transferred from institutional settings of expertise by means of written operational discourse, which helps frame them in terms of relevant actions carried out in social contexts. These texts, which form the basis of most informal and formal training and certification processes, are exegetical, serving to interpret for the lay public the meanings, applications, and procedures by which expert products, whether VCRs, tax codes, or angina medicines, are integrated into the behavioral flow of society itself. The rhetorical process by which this immense body of expert knowledge is transformed into the basis of subsequent human action is a question of considerable importance.[1]

The semantic complexity of everyday life, Alvin Weinberg has argued, is a social problem of Malthusian character. Any individual's "semantic apparatus" is increasingly taxed as he or she attempts to keep abreast of what Weinberg has called the "proliferation of the semantic environment" that attends unrelenting population and technological growth (2–3, 26). That is, we are physiologically fixed, despite numerous technological aids and props, in an environment of rapid population growth and technological innovation that vastly increase the amounts and complexities of available information.[4] Innovation, with its ever-evolving intellectual sophistication, is increasingly accomplished within the specialized research networks referred to above, as well as in the expert domains of professional schools and in the design clusters of engineering houses. The technological complexity that governs everyday life is thus supported in environments sequestered within their own networks of expertise, out of which products are then "released," so to speak, to the public at large. The lay person is largely isolated from the professional origins of technologies, whose procedurally sensitive behaviors are crucial to transacting the business of everyday life – for example, filing complex tax forms, negotiating computer protocols, using new tools with expanded capabilities. Procedurally sensitive processes often require that the operator adhere to specific protocols or operational sequences, which can be counterintuitive. Millions of operations manuals, protocol books, instructions sheets, guide books, and codes cycle throughout society to steer individuals and their experts through the complexity of our increasingly artificial social environments (Simon 4–5). This vast body of task-oriented literature thus helps to adjust machinery to human norms, or, human norms to machinery, depending upon one's philosophy of technics.[5]

The rhetorical export of expertise and its products has some major implications that I would like to examine in the light of two recent liability cases concerning injury by specialized construction tools. In both cases, a major issue was made of the role of operator's manuals in enabling a user to develop an adequate working knowledge of an unfamiliar power tool. The tool, a direct-acting studgun used to fire nails and other fasteners into various construction materials, was the product of a relatively old firearms technology that had recently been adapted to a new social environment – the construction workplace. Operator's manuals outlining the principles of use accompanied the studguns, and the question arose of just what role such manuals should play in the user's mental construction of the tool and how effectively the operator's manuals in question elaborated the procedurally sensitive processes of safely applying the studguns to various tasks. The formalities of courtroom discovery forced a comparison of the images and norms of the public mind with those of the expert. In effect, the inquiry sought to determine, in the context of tort law and legal liability, the rhetorical role of operator's manuals in the social construction of a technology. This question ultimately touched on the role of written discourse in constructing a world of "reasonable" actions that could resolve the polarities inherent in almost any technology between mechanical function and social purpose.

Operator's manuals, I will argue in this study, typically employ four textual elements that attempt to bind, by means of representative human actions, the worlds of external objects with those of human behavior. First, they construct a written analogue of the tool or process itself. This analogue reduces the tool or process to a series of verbal and visual terms that are, in effect, idealizations substituting for the thing itself. Second, the manual introduces a fictional operator who represents an average or suitably qualified individual. This everyman is the agent, the initiating and guiding force, capable of making a range of commonsense decisions about how to apply the tool. The third textual element of operator's manuals is environment, the material context of conditions and situations requisite for effective and safe use of the instrument. A fourth textual element of the manual is the action itself. This procedural element can be a loose narrative of representative steps the operator takes to apply the tool. Or, it can be a narrative sequence of precisely defined actions that furnish a behavioral template on which the operator must model his or her actions. Together, these elements help to construct a *teleological* view of reality, by which I mean a reality subordinated to human purpose. The operator's manual is a conceptual framework that infuses human purpose into mechanical devices or their equivalents, thus aligning the neutral products of technology with the value-laden ends of society. Not all operator's manuals are effective in constructing this mechanical world dominated by human purpose; yet, even in poorly executed operator's manuals, these textual elements of object, agent, conditions, and action are all implied. If they are either poorly treated or absent, the operator must invent his or her own version of them in order to pursue a course of action.

As a technology becomes more complex, the rhetorical effort required to sort and reduce its expertise to some course of activity comprehensible to the operator-everyman becomes greater. As the differential between expertise and common sense becomes greater, or as the audience itself becomes more diverse, the demands made upon the operator's manual increase. We have enough information in our daily environment to operate simple tools like hammers or to carry out basic procedures like mailing letters. But with processes associated with more complex technologies and social institutions—whether computers or the filing of taxes—we require additional support. Expert advisors who can personally direct us are extremely effective but costly means, because the ratio of human time expenditure to productive activity is so unfavorable. Group training and certification improve this ratio but require substantial institutional support, as well as dislocations and time commitments of the learning operators. Texts improve the ratio still further, because they can circulate the same expertise to the masses. But the inherent linearity and rigidity of written discourse, coupled with the necessary reduction of complex situations to sequential units of simple action, increase the possibility of omission, ambiguity, and misunderstanding. We now need specialists, technical writers and editors, who can anticipate these problems and who can apply rhetorical strategies to achieving operational coherence and simplicity.

In what follows, I begin with a manufactured product – a studgun – and examine the rhetorical frame two operator's manuals attempt to build around it. I explore how instructions for a publicly marketed tool serve to mediate between the expert world of technologists and manufacturers and the lay operator world where the tools are employed. I conclude with a consideration of the same manuals in light of recent legal liability proceedings in order to illustrate how these texts are socially burdened by tort law and the concept of liability, the larger object of which I argue is to impose purpose on the basically neutral world of technology. In this light, the operator's manual can be seen to play a profound role in the effort – sometimes specious – to adapt technology to human ends.

The Studgun as Mechanism

The studgun is a versatile tool that dramatically improves the effectiveness with which construction workers can drive nails and other fasteners into a multitude of construction materials. The distinctive aspect of the studgun design is its blend of hammer function and firearm technology.[4] The resulting device, euphemistically known as a "powder-actuated fastening tool," exploits the mechanisms and dynamics of a gun, with a chamber that receives a projectile and powder charge, which in turn is discharged with a trigger (see figure 11.1). Studguns fire a variety of fasteners, including pins (nails) and studs (threaded bolts), into materials as different as wood, hard concrete, and structural steel. The tools range in cost from less than a hundred to several hundred dollars and are marketed by several companies that have developed a variety of studgun models with different capacities, as well as a range of accompanying fasteners, powder charges, and accessories.

There are two types of powder-actuated studguns, the more powerful being the direct-acting or high-velocity tool, which can drive fasteners into thick structural steel or hard concrete. In the high-velocity tool, a powder charge directs expanding gases against a fastener-projectile. Fasteners in these direct-acting studguns are capable of attaining speeds of high-powered rifles. In contrast, the piston-driven studgun, a low-velocity tool, drives the fastener with a piston that absorbs much of the energy of the powder charge. Piston-driven tools are therefore less likely to force fasteners through construction materials into free flight and are generally safer than direct-acting tools. However, piston-driven studguns do not have the penetrating capabilities of the direct-acting tools and are not as effective for applications in thick steel or very hard concrete.

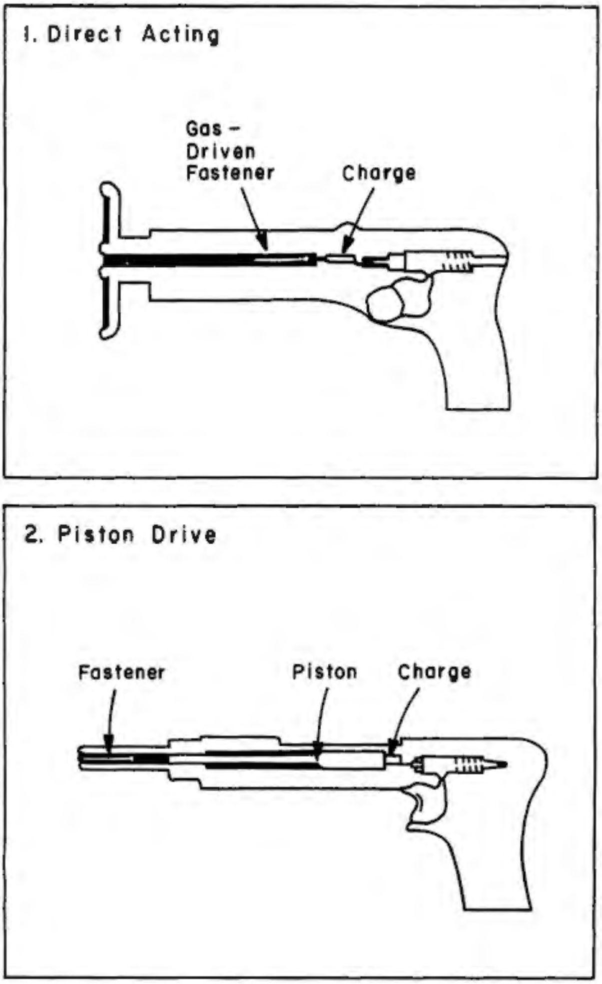

Fig. 11.1. Diagram of a studgun: 1. direct-acting, 2. piston-driven

Both the great virtue and risks of the technology inhere in the range of driving forces studguns can impart to their nail-like and bolt-like fasteners. The variations in fastener design and intensity of powder charge make it possible to apply the technology to such soft materials as construction-grade framing wood and to such dense materials as ¾″ structural steel (see figure 11.2). Fastener thrust ranges across as many as twelve strengths of powder charge. Fasteners vary in materials, length, shaft diameter, tip design, and shaft design, each variation having a different effect on the net penetrating capability of the discharged fastener. In addition, there are ramrod devices for positioning fasteners at various depths in the gun barrel to achieve still different intensities of thrust, and doughnut-like metal disks are available for collaring fasteners, so that they are not driven too far into soft materials.

This great variety of choice, however, brings an enormously complex firearm technology into the social environment of the construction workplace. The numerous options complicate the decision-making process required of the user, for there are thousands of conceivable combinations of studs, powder charges, and base materials. Compared to conventional firearms, which are used in restricted corridors, studgun technology, used in socially active construction areas, is orders of magnitude greater in complexity.[5] The tremendous force that enables the construction worker to fire nails into concrete or steel is also potentially lethal when used incorrectly or in unknown materials or circumstances. Thus, the adapted firearms technology of the studgun, effectively displacing the common hammer for many applications, has also introduced a difficult to regulate technology into largely unregulated social environments.

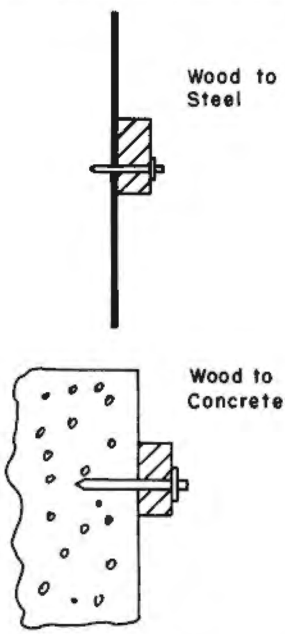

Fig. 11.2. Some generic studgun applications

This combined studgun effectiveness and danger is nowhere more dramatically illustrated than in the two accidents that formed the subject of this analysis. Both concerned direct-action studguns, in which improper operation on construction sites led to the partial paralysis of one worker and the death of another. Both operators thought they were using the tool correctly, but neither was experienced in the use of studguns. Moreover, the studguns they were using had no safety warnings attached to them, and their respective operator's manuals failed to warn of the specific mechanisms that led to the accidents. Subsequent legal proceedings questioned the adequacy of the rhetorical framework established around the studgun. Questions were raised about the kinds and levels of discourse one would reasonably expect to accompany potentially lethal devices such as the studgun.

In the first case, *Roger Gagne v. Power Anchor Corporation et al.*, a Maine construction worker was trying to frame a window opening in a concrete basement foundation. Other workers had drilled and sledgehammered a 3′×4′ opening, around which Gagne and his coworker were now using a studgun to attach a preassembled wooden window frame. A fastener fired from a direct-action studgun passed through the wood, rebounded off some object embedded in the concrete, fish-hooked back out, and struck Gagne, lodging in the back of his neck and causing him injury. Although Gagne possessed an operator's card for the studgun in use, his companion who fired the studgun did not. As the result of the injury, Gagne was unable to return to work.

In the second case, *DuCharme v. Star Expansion Corporation*, an employee of an aircraft company in Colorado, who was helping to construct some shelving on a plant wall, was killed by a stud in free flight after it had passed through three layers of materials. The employee, who had gone around a partition wall to clear the area behind, was struck with a 1⅞″ stud that had passed through a 1/32″ piece of corrugated steel, a 1/16″ steel beam, and the plywood partition wall. The fastener passed through these various layers with such force that it went directly through the body of the victim and was never recovered. In this instance, the stud was being fired with the lowest powder charge available as a test firing, in order to determine the suitability of the application. Neither the operator nor the victim had an operator's license.

These two accidents were full of ambiguity. In each accident, the operator applied the technology in questionable ways. The operator in Case 1 fired the direct-action studgun closer than three inches from the edge of the two-by-four inch *wood* frame into the concrete substrate. The operator's manual had cautioned against firing "closer than 3 in. from the edge in *concrete*." In Case 2, the operator fired a low-powder charge into very thin steel, a practice that, although not rejected in the manual as unsafe, was questionable, given the potential force of a high-velocity direct-action studgun. Moreover, neither operator had been licensed to operate his respective studgun. On the other hand, there were no danger warnings on the two studguns in question. No effort had been made by manufacturers to incorporate a semiotics of hazard on the tools, their accessories, or indeed in the manuals. Explicit warnings are one of the most widely followed conventions used in industry to establish an operating context of extreme danger. Neither operations manual mentioned that incorrect or casual use could lead to serious bodily injury or death. Nor had either manual instructed users in any systematic way on the methods of selecting the proper combination of stud and powder charge for an application. Thus, the possible arguments concerning the cause of the accidents were diverse.

In the narratives of accidents, causality is always a central issue. As the philosopher Norwood Hanson once observed, the attempt to determine the cause of an accident is a request for an explanation of the event, and a surprising variety of plausible narratives will be established in terms of each explainer's point of view.[6] An accident involving a studgun might readily be explained in terms of the operator, the environmental conditions, the tool itself, or its procedural guidelines. Were the accidents caused by operator error or by faulty tool design? Was the error a matter of the operator's negligence or of the manufacturer's negligence? Powerful social forces were at work on behalf of each theory. Defenders of the tool would be expected to base their arguments on the industrial integrity of its production and the adequacy of the expertise embedded in the tool's design. Their opponents would be expected to base their arguments on the tool's flawed design, the failure of the manufacturer to warn of operating hazards, and on the unreasonable expectations placed on the operator-everyman in the proper operation of the tool. Such opposing views, established by legal proceedings, would pit the mechanical domain of design expertise against the social domain of human purpose. The territory between these poles becomes the field of argument upon which the various theories of error play.

The Rhetoric of Action: Constructing a Working Image of the Direct-Acting Studgun

In the process of exporting a technology to society, expertise has many possible options, since users can construct working images of a technology in many ways. The casual user can be relaxed about simple consumer technologies in which there is little personal or financial stake other than a few lost hours or dollars. Despite obvious hazards, lawnmowers, familiar objects to the suburbanite or the avid television watcher, require little assistance to learn how to operate. User strategies can be built upon the stock of generic images that, as Boulding has argued, is shared by society (54–55). Everyone "operates" a screwdriver or flashlight without having to be instructed. In a thriving consumer society, this kind of intuitive operational knowhow based on socially shared imagery must be widely available. Many lawnmower purchasers can by mere inspection decode the fraction of the technology necessary to operate the instrument satisfactorily. Hence, the sport of dispensing with the manual: "When all else fails," the saying goes, "consult the manual." The highly accessible technologies common in a consumer society are thus based on a social substrate of shared generic imagery, a kind of Platonic world of idealized forms and processes that is presumably the product of elementary and secondary school education, supplemented by television culture. Commercial designs are built up on these familiar images as part of the so-called idiot-proofing process well-known in the engineering sectors of product design, where the ideal is an intuitive design that needs no manual.

Access to more complex technologies, many of which have great institutional impact, usually requires a formal framework of explanation. The public stock of imagery no longer suffices to guide the operator successfully or safely through the necessary operating procedures. These technologies cannot be exploited without a carefully constructed framework of explanation that illustrates the contexts and conditions of effective action. Many technologies of health, explosives, and computers with complex protocols would be unfathomable without the systematic learning made possible by manuals. Frequently, as in health or computer technologies, operators require formal education, training, or on-site apprenticeships. One is licensed to apply the technology, authorized to convert the knowledge of expertise to operations in the public sector.

Written discourse plays a necessary role in the exportations of expertise, whether of simple casual consumer technologies or of complex instruments of institutional proportions. Texts can break down and sort the complex phenomenological reality of events and objects. As a signifying system, language precipitates versions of experience from the complex contents of "reality." These reductions are necessary distortions. They help to establish perspective in simplified points of view that clarify the structure and purpose of artifacts, yet also hide their deeper complexities. Language, as Berger and Luckman have noted, "objectivates [our] shared experiences and makes them available to all within the linguistic community" (68); written discourse renders that experience into a true *object*, independent of time and space (Boulding, 55; Joos, 41–42). Moreover, texts have permanence. Written discourse reduces and fixes human experience so that it may be reprocessed—read, studied, and manipulated as object. "By creating a text 'out there', a material object detached from man (who created and interprets it)," Goody observes, "the written word can become the subject of a new kind of critical attention" (129). Operator's manuals thus recreate the artifact or tool itself in a context of critical analysis, giving us control—or, at least the impression of control—over the imagery for the object or process. In text, we can resolve the technological object into its parts in such a way that it remains dissected, as an organism remains dissected in an anatomy manual. We bring into the textual field and associate as equivalent elements the implement, the operator, the environment, and the operation. This reductionism, in ignoring the vast phenomenological differences in these elements, enables the user to see them as a system and to manipulate them logically. One learns how to operate on the artifact by operating on the text.[7]

If we examine the public rhetoric of studgun technology, we find a number of documents treating the various objects and processes associated with the end action of firing a stud into construction material. These documents fall roughly into two basic groups. The technology has a commercial status and is marketed in a variety of catalogs, price lists, and advertisements. It also has a functional status as outlined in the operator's manuals, treating the assembly, operation, and maintenance of the tools. Studguns, in addition, are typically labelled with a variety of safety warnings and symbols, which reinforce the conditions of operation outlined in the operator's manual. These documents, which define the tool operationally, commercially, and socially, can be at odds when the commercial object of maximum sales volume is allowed to conflict with the social object of effective and safe operation. Sales literature and operator's manuals can exaggerate function and downplay hazard.

Operating procedures for the direct-acting studgun in the Star operator's manual illustrate several rhetorical conventions of operational discourse. We find, for example, a procedural outline for selecting a power load for the studgun titled "To Determine Correct Power Load." As already noted, not every operator will use this textual formulation to learn how to select a power load, since it is possible to figure out the procedure through training, observation, or, for that matter, guessing. Still, *this textual version governs all studgun usages*, as official rules always govern practice. An operator's manual is company-formulated—an operationally explicit version of how the stewards of the expertise recommend that the public apply the technology. In reducing the power selection process to a protocol, the manual, we assume, invests us with expert behavior. Hence, willy-nilly, it has the status of authority, a status of contract. Each specified iteration must be treated by the lay user as an expert formulation of how one should apply the technology.

Three rhetorical conventions found in operational discourse rather stringently shape the user's action: taxonomies or terminological standards, conditional generalizations, and segmented action sequences. We find all three of these conventions in the prose sample taken from the operations manual of the Star Power Tool Model 100:

> To Determine Correct Power Load.
> 1. The fastener and the power load that should be used for a given installation depends on the thickness of the object being fastened and the nature of the material into which the fastening is to be made.
> 2. The harder the material the stronger the power load, and the shorter the fastener.
> 3. Caution: In making an initial test fastening always start with the Green color load, Power level 3. If fastener does not penetrate to required depth, then try the next strength power load until desired penetration is obtained.
> 4. High Velocity special .22 caliber power loads are available for driving fasteners as follows:
>
> .22 CALIBER STANDARD (WADDED—BRASS CASE)
> #6022-036 Green Power Load—Power Level 3
> #6022-056 Yellow Power Load—Power Level 4
> #6022-076 Red Power Load—Power Level 5
> #6022-096 Purple Power Load—Power Level 6
> .22 CALIBER LONG (WADDED—NICKEL CASE)
> #6022-156 Gray Power Load—Power Level 7
> #6022-176 Brown Power Load—Power Level 8
>
> 5. To vary the amount of penetration: (a) Fasteners can be positioned in the barrel by using the ramrod provided with the tool kit. (b) By using .22 caliber crimped loads Power levels 1 or 2.

These conventions reflect a rhetorical preoccupation with accuracy and clarity. Terminological standards establish a morphology of the tool or process that helps us relate form to function. Such a referential language that thousands of individuals can hold in common enables us to share common iterative behavioral priorities of operational discourse. This attempt to create a unity of action among diverse users is based on terminological standards that reduce the possibilities of ambiguity. Taxonomies, typically established within the professional design community, impose conventions that identify components and functions of the implement in question.

For the studgun, these naming conventions extend to parts, accessories, and the various fasteners and powder charges. In the sample given above, for example, we find a taxonomical table that identifies several kinds of .22 caliber power loads, or shells, organized in increasing order of strength. This schemata ranks the levels of function in powder loads. But such specialized terminology can also be misleading, since its meaning often depends on the user's prior conceptual depth or experience. These conventions usually develop first within a larger framework of expertise that uses them to summarize its own experience. The color distinctions of the green, yellow, red, purple, gray, and brown powder loads can have only limited meaning to the general user. The scheme ranks in a rudimentary sense the increasing powers of charges. But no specific kinds of application are specified for these distinctions. We are not shown a specific instance of how an operator might use the chart to select a powder charge for a given kind of application. No description predicts what will happen if we use a green powder charge with a 1" stud in ¾" structural steel. Indeed, for the outsider, the occasional user, such a hierarchy may give a false impression of precision in a selection process that, as noted in Rule 3, is conducted by trial and error.

Procedural discourse always faces this formidable problem of constraining the operator's action within set physical limits. Like the Sorcerer's Apprentice, the operator may initiate actions according to some known procedure that subsequently gets out of hand, because some terminological detail has been forgotten or some conditional detail has been neglected. This problem of control, as Wiener observed in his classic *God and Golem, Inc.*, is inherent in all human artifice, whose effects are difficult to anticipate in totality (63). The operator's manual attempts to establish barriers to undesirable forms of behavior by restricting the terms and conditions of use, but this process requires both insight and considerable rhetorical skill.

Conditional generalizations, for example, attempt to limit an operator's activity on the tool by establishing circumstantial limits within which the tool is effectively and safely operated. In Rule 2 of the prose sample above, harder materials are said to require stronger power loads and shorter fasteners. This rule of thumb, which establishes a relationship between materials, power charges, and fasteners, seeks to channel behavior in certain directions. The assertions of Rule 2, however, are based on assumptions that exist outside the text. That is, the full information upon which the generalization has been made is not available in the text. For example, the outsider can only speculate on the meaning of an unqualified distinction such as *hardness*, when no fastener dimension and no specific base material are mentioned. The generalization of Rule 2, in fact, is nearly devoid of content for an outsider, once we recall that the possible combinations of materials, fasteners, and powder charges range in the thousands:

Permutations of Studgun Applications
= *Shell Charges* (6 levels)
× *Fastener Designs* (type, length, diameter)
× *Base Materials* (type, thickness, hardness, condition, combinations)
× *Accessories* (disks, barrel types, ramrod positions)

Such mechanical complexity, which vastly exceeds that of any firearm, cannot be reduced to commonsensical proportions in textual generalizations of the kind given in the paragraph cited above. In the heading of the manual section – "To Determine Correct Power Load" – "correct" is a misleading ideal. For the designated procedure leads to no predictable result, given the myriad possible combinations.

This discrepancy between mechanical complexity and discursive reduction is a problem common to all operational discourse. The reductive text's utility is achieved through a simplification that does not admit the complexity of the phenomenological reality. This differential becomes serious when it burdens the user with guesswork that can result in serious error. In the instance I am discussing the authors fail to make explicit the variety of assumptions insider operators – whether designers or experienced users – routinely apply when selecting fasteners and charges. The language of reduction in the instance of the direct-action studgun does not encompass the detail that the expert operator must master in order to determine an appropriate power load.

Further efforts in operator's manuals to reduce ambiguity and constrain behavior are typically made by specifying action. In this distinctive rhetorical convention of operational discourse, the user is given behavioral templates on which to model his or her actions. These templates usually have a narrative, dramatic quality that unfolds a series of actions in steps through time. The operator's manual becomes a kind of script for the human-machine interface, in which human physiology is unified with machine action to achieve a utilitarian objective – for example, fastening studs to a sheet of steel. Rule 3 of the cited instructional sample directs the operator to begin with the weakest possible charge and to work upward in charge strength until the "desired" penetration is achieved. Such action statements attempt to resolve the technology into a series of discrete operations that direct the human-machine interaction so as to deliver the technology to the user's purpose. Once again in the sample we are examining, the selection process is underspecified. The shortage of action statements forces the operator to formulate his or her own actions on the extratextual basis of individual judgment. The operator must invent a procedure in the process of applying the tool.

The Legal Framework and Conflicting Interests

That every operator's manual has a legal significance should come as no surprise. Written discourse is inherently accountable. Evidence that a given technology is a reasonable solution to a problem is a matter of demonstration, in which texts – quite frequently the operator's manuals – will inevitably play a powerful testimonial and illustrative role. The document is a *testament* that the technology can be explained, which is to say made understandable and controllable for the lay user. Language plays a crucial role in this rendering of technology into human terms (Miller). Indeed, rendering public technologies into written procedures is a decisive step in the socialization of a technology. The operator's manual not only assumes a contractual importance in its capacity as written claim, but it also becomes evidence that the expert, who usually has an exclusive hold on the expertise, has sufficiently reasoned out and articulated how it is to be made fit for public use. Hence, manufacturers who neglect to frame their technology in text are open to the charge of negligence.

The legal process has an ancient preoccupation with texts. As Goody has argued, the alliance between the law and the written artifact, which has been nearly universal among cultures, serves to reaffirm the uniformity and stability of the law (153–54, 170). Texts are viewed as more stable than oral discourse; they can be collated and preserved from artibrary rewording. In modern practice, there is a steady effort to convert experience to text. Depositions are taken, documents are amassed, transcripts of testimony are made, and all these are sorted and arranged in casebooks, drawing important elements out from a background reality. This reconstructed reality can now be processed and opened to collaborative exegesis. Narratives are fashioned from these materials as a way of probing causality. This process of objectification is important in analyzing potentially conflicting accounts of experience, for the material record allows one individual to collate his or her own version of reality with that of others.

In sorting through the merits of the two studgun cases mentioned above, the legal process converged on the respective operator's manuals. One of the main strategies for reconstructing the accidents was to assess the way in which the tool, its operator, the conditions of operation, and the recommended procedures were elaborated in the operator's manuals. Each manual, issuing from an authoritative source, whether manufacturer or distributor, was treated as a reference tool with procedural authority over the studgun. Legal analysis naturally focused on these procedural elaborations as a way of assessing the intentions of the manufacturer and the nature and limits of the knowledge made available to the user.

In both the Power Anchor and Star studgun cases, an important part of the legal inquiry concentrated on aligning the material facts of each accident with a "theory" of tool use, as provided in the operator's manual. The events of each accident were compared with the written procedures concerning the relevant action and conditions, in order to determine the degree to which the text anticipated the event. For example, in the Power Anchor accident, where a stud appeared to have fish-hooked off of spalled concrete behind the 2"×4" frame, all elements of the operator's manual dealing with use of the studgun in such a situation and for such purposes were scrutinized, including the warnings related to such uses. In the Star studgun accident, where a stud had passed through three layers of construction materials, parts of the manual governing studgun charge selection and use on walls and in steel materials were examined for the degree to which they anticipated that kind of event. Hence, a sustained line of inquiry sought to reconstruct the circumstances and events of the accidents by reference to relationships worked out in the manual—the tool, action, conditions, and operator. The operator's manual was thus interpreted within a theory of verisimilitude, in which it was expected to caution against, and thus anticipate, the actual events.

In the legal domain, a variety of specialized concepts composing tort law have institutionalized the expectation that the relations between operational texts and human actions should be governed by verisimilitude. Of special significance to operator's manuals is the notion that the manual is a *warranty*—both a promise that the fact is as represented and a promise that the information in an instructional publication used for a specific purpose is suitable for that purpose (Walter and Marsteller 165). In the legal context, operational discourse takes on the social and material consequences of liability, outlined as follows in Section 311 of the Restatement (second) of Torts:

> (1) One who negligently gives false information to another is subject to liability for physical harm caused by action taken by the other in reasonable reliance upon such information, when such harm results (a) to the other, or (b) to such third persons as the actor should expect to be put in peril by the action taken. (2) Such negligence may consist of failure to exercise reasonable care (a) in ascertaining the accuracy of the information, or (b) in the manner in which it is communicated.

This formulation of Section 311 legalizes our social expectations that the reality constructed in the discourse of operations is both reasonable and expert (Walter and Marsteller). Operational discourse, tort law insists, should attempt to resolve mechanical complexity into commonsense terms that channel human action into benign and useful effects. An injury becomes a material – and operational – emblem of an incongruency between text and action.

Claims made on behalf of the plaintiffs in both the Power Anchor and Star cases were substantially based on theories of verisimilitude determined by textual analysis. The charge in each case developed a commonsense argument that the technology of the direct-action studgun was "unreasonably" dangerous, entailing risks that were unannounced to potential users. For example, the claim against Power Anchor, Inc. was as follows:

> Our action on behalf of Mr. Gagne and his wife is based on our contentions that the stud gun is unreasonably dangerous and that its warnings are inadequate for a number of reasons. Notably, we believe that there was a failure to adequately warn users of the hazards associated with the use of the tool.
>
> In particular, the content, format, and presentation of warnings set forth in the owner's manual are such that they do not call attention to the general hazards associated with the use of the gun in proximity to the edge of concrete surfaces. Further, the warnings attached to the gun itself and contained on the gun's tool box do not begin to bring home to potential users the gravity of the risks engendered by the gun's use.

In this claim, *reason* is normative, a state of conditions that is assumed to govern the individual's encounter with the mechanical complexity of material culture. Reason, taken as a self-evident human faculty, is the norm to which technical complexity must subordinate itself. *Risk* becomes a term used to identify the existence of contingencies that are not subject to operational control or foreseen by commonsense inspection. *Safety*, a matter of the human body, is the condition in which the technological and human – that is, the mechanical and the social – regimes interact without harm to the operator. Reason and safety are thus bound together in the notion of verisimilitude, the notion that things are as they seem in the manual.

In both cases the plaintiffs based their claims largely on an analysis of the studgun as it was represented in the operator's manual. The manual must, as a rational system, be accessible to common sense. Its world therefore must to some degree be *complete* or self-sufficient, understandable on its own terms. However, if the tool is presented algorithmically as a matter of operating protocol, common sense may get in the way. For the point of constructing protocol is to dispense with the complex but often inessential principles behind the procedure. If we had to comprehend fully the rationale of every technology we availed ourselves of, even electric power would be removed from common social use. On the other hand, as procedures become elaborated in detailed protocols, they increasingly leave the realm of commonsense behind. They demand strict compliance and assume a highly problematic responsibility to be accurate and exhaustive. This is a paradox of all procedural discourse as it is exported to lay social settings.

In the legal context, our rhetorical analysis of the studgun manuals assumes a new significance. For example, the failure of the Star operator's manual to reason out a stud selection procedure is a problem for the user, who has no way of knowing what the implications of his or her uses are. The erratic coverage of the power load selection process, characteristic of the manual as a whole, fails to meet the expectation that the rhetorical system is reasonably self-explanatory. Many of the statements have meaning only when supplemented with "insider" knowledge not contained in the text. Consider Item 5, for example:

> To vary the amount of penetration: (a) Fasteners can be positioned in the barrel by using the ramrod provided with the tool kit. (b) By using .22 caliber crimped loads Power Levels 1 or 2.

Nowhere in the manual is it explained how the ramrod works, what "crimped" loads are, or where Power Levels 1 and 2 fit into the scheme of ammunition used to propel the studs. It is not at all clear in what way these factors "vary the amount of penetration." The loose terminology and incoherent syntax, here as throughout the manual, underscore the inconsistency of the taxonomical, conditional, and action statements, which introduce ambiguity rather than reduce it. The result is that the operator is burdened with guesswork as he or she tries to determine a course of action.

The lack of safety warnings was a central issue in both the Star and Power Anchor studgun cases. Neither the Star manual nor the Power Anchor manual warned of the serious hazards attending the use of high-velocity studguns. This omission of prominent, explicit warnings made it easy to assume that the direct-action studgun is just another construction tool, blurring the fact that a gun-like implement, normally regulated with the strictest care, was being introduced into a social environment. Neither manual used the words *hazard, dangerous, warning, death, caution,* or *injury*. Nor did they invoke any of the conventions of hazard warnings, used in most competitors' manuals, such as red or amber colors, redundant warnings, highlighting, typography, placement, or illustration—all of which are well established techniques of safety warning (Clement). The rhetorical effect of this bland treatment of hazard was to normalize the technology in such a way as to assert its fundamentally benign character, whereas operator's manuals of many other direct-action studguns used explicit death warnings to reinforce the impression of social emergency.

In the Power Anchor operator's manual, the entire issue of safety was relegated to small print on the next-to-last page in a hodgepodge list of "Safety Rules". The "do not" mentality revealed in this language is authoritarian and nonrational, with none of the saving graces of operationalism's explicit detail and careful sequential logic:

> Observe These Safety Rules
>
> Do not load tool until you are ready to fasten.
>
> Never fasten closer than ¾" from the edge in steel.
>
> Never fasten closer than 3" from the edge in concrete.
>
> Do not attempt to fasten into brittle material or hollow material such as tile, hardened steel, solid rock, cast iron, face brick, marble or sheet rock.
>
> Always keep head and body back of the tool when firing.
>
> Operators should always wear safety goggles.
>
> When working on ladders and scaffolds, do not lean out too far thereby putting yourself out of balance. Make sure you brace yourself solidly.
>
> Clean the tool daily.
>
> Always know the material into which you are fastening. Never guess. Check constantly to avoid firing into unsuitable material. Always try the lightest charge first.
>
> Do not use the tool in explosive atmosphere.

There is no effort to provide any explanatory rationale for the rules. They are simply grouped together and dispatched at the end of the manual. This neglect to place any priority on human consequence reduces the user to a nonentity.

How can we explain these lapses in procedural specification, hazard warnings, and safety recommendations? One cannot ignore the fact that the operator's manual is a rhetorical field on which different, often inconsistent interests vie for accommodation. The tool is a different object to the various constituencies whose professional ends are in some way or other bound up with it. To the engineer or designer, the studgun is an expression of functions that have been tested within the quantitative context of such specialized fields as mechanical design, materials behavior, and ballistics. This insider invokes his or her vast mental library of images and processes to supplement any fragmentary discourse in the manual. The capitalist, on the other hand, thinks of the same tool in terms of production, marketing, and finance – questions that have far-reaching monetary consequences. The tool in the operator's manual has a commercial significance. The operator sees the studgun as a utilitarian object whose purpose is to drive studs with speed, force, and accuracy. We must expect that these different groups will conceptualize the studgun within the different frameworks of their professional interests (Hanson, 32–33). Hence, the objective that an operator's manual render a consistent, self-contained public version of a given technology may well be defeated by the larger reality that powerful institutional interests are vying for definition of the technology.

Certainly rhetorical ineptitude helps to account for the failure of safety warnings in the Star and Power Anchor manuals. In neither case had experienced manual writers overseen the manual writing process, and the engineers and marketing personnel who wrote the manuals were inept at rationalizing and operationalizing the technology for inexpert users.[8] Design and marketing interests appear to have dominated composition and production of the manuals, since there was little evidence of a systematic manual writing effort from the user's point of view. In the context of legal inquiry, the kinds of rhetorical failures seen in the samples we have examined proved to be decisive arguments that direct-action studgun technology, framed as it was in inconsistent and often incoherent language, was misrepresented. Failure to place priority on language and clarity is also a failure to give special emphasis to the social function of operator's manuals. These lapses are consistent with a rigid positivist model of knowledge, in which the written discourse is considered an unwieldly approximation of a deeper material truth that is better understood in physical or mathematical terms. The relation between text and action is treated as unreliable. Language devalued leads to such half-truths as "No one reads manuals, anyway," or "Any tool can be dangerous if improperly used," or "You can't warn of every possible improper use."

Conclusion: The Metaphysics of Operator's Manuals

The operator's manual, we can conclude from the Power Anchor and Star cases, is a critical part of the machine-human interface by which technologists may help to accommodate humans and technology. But this accommodation remains problematic. As Norbert Wiener once noted, "A goal-seeking mechanism will not necessarily seek *our* goals unless we design it for that purpose and in that designing we must foresee all steps of the process for which it is designed, instead of exercising a tentative foresight which goes up to a certain point . . ." (63). The rhetorical process of preparing the operator's manual obliges the expert to imagine the consequences of operation and to lay these out for the user. It is a crucial step in the socialization of expertise. We can only maintain that individuals are responsible for their actions if we enable the rational individual to take charge of the growing presence of technology. We can only insist that operators retain legal responsibility for their actions if we provide them the means to understand the human consequences of their behavior.

As individuals avail themselves of the specialized knowledge modern society has spawned, the "semantic environment" (Weinberg, 2–3) becomes an information marketplace in which expertise is constantly reconstructed in behavioral terms of action for the nonexpert. This procedural discourse, however, is not without its social problems. As a given technology becomes more complex, it becomes harder to understand and to manipulate according to the dictates of common sense. The exportation of complex technologies is increasingly achieved by the detailed operationalizing of human behavior in the immense body of procedural literature that accompanies industrial products. But, as we have seen, there is a conflict between obligatory procedures of operationalism and the exercise of independent human reason.

Procedures without any accompanying rationale become imperative and defeat our social (and legal) expectations that human activity be governed by reason, human judgment, and initiative. In all strictly procedural discourse, a tension will arise between the instrumental need to be algorithmic and the legal obligation to be reasonable. On the one hand, we ask the operator to relinquish his or her individual inclination so as to conform to some algorithmic activity; on the other hand, we expect these principles governing our behavior to be reasonable, not arbitrary. As higher-level experts set the conditions of instrument assembly, operation, and maintenance and serialize them in repeatable unit human actions, the lay user may increasingly be faced with a situation in which he or she no longer understands the potential consequences of specific actions. And if, as was the case in the two manuals we have considered, the procedures are incomplete, the operator may well be obliged to use guesswork and to operate unknowingly on the margins of safe use.

In many instances, this problem of complexity can only be mastered by the training of individuals who can then comprehend the reasoning behind the procedures. Training programs were pronounced as obligatory in the two manuals we have examined, but, in fact, the programs were not readily available and there was considerable doubt as to their quality.[9] Moreover, the manuals we have examined remained the central instruments of the training.

As Simon has argued, the technical object must be rescued from the control of the specialist and related to the broad social environment (176). This question is a significant one for all individuals involved in the processes of production – the designers, the producers, and the writers. In the operator's manual, we shift from the initial design and manufacturing orientation toward objects to a new orientation toward human thought and behavior. The operator's manual constructs this anthropocentric ethos in which material things are subordinated to human purpose. Simon speaks of the tool and its environment as object and mold. "An artifact," he argues, "can be thought of as a meeting point – an 'interface' in today's terms – between an 'inner" environment, the substance and organization of the artifact itself, and an 'outer' environment, the surroundings in which it operates" (9). But *environment*, as we have seen, must also be seen in terms of social circumstances and *artifact* must also be considered to include the rhetorical instruments. The neglect of these instruments can have terrible human consequences, not to mention serious legal implications, as we have seen in the Power Anchor and Star instances.

NOTES

1. A discussion of operationalism is found in Percy W. Bridgman's *The Logic of Modern Physics*, which made successful completion of specified tasks the criterion of positive knowledge. Studies in popularization such as those in Shinn and Whitley have examined the dynamic of publicizing science. See also Dobrin, who analyses instructional literature from the standpoint of speech-act theory.

2. The problem is not solely one of increasing quantities of information per population increase, for, as Boulding notes (55), technological innovations in print, broadcast, and communications media have vastly increased the potential information disseminated per unit individual. One newscaster, salesperson, or partisan can communicate with millions.

3. The literature on the engineered life is considerable. See Florman and Ellul for opposing views on the direction of the machine-human accommodation.

4. Although studguns came on the market in the United States in the late 1940s as construction tools, they were originally developed and patented in England during World War I by Robert Temple, who was attempting to adopt firearms technology to constructing devices for attaching lines with lighted floats to the hulls of submerged enemy submarines, which could theoretically then be spotted on the surface (Schillings). Temple patented a modification of the device in the United States in 1921 as an "explosively actuated penetrating means." Later, Temple proposed using his explosively actuated device as a

means of fastening sheets of steel to damaged ship hulls at sea. In the United States, after the war, Temple developed a variety of studgun applications for the construction industry. A piston-driven version of the studgun was also developed as the cattle stunner for the assembly-line slaughter of livestock. These tools have undergone a steady evolution from the late 1940s to the present.

5. This complexity can be glimpsed by simply multiplying the variations: *types of stud design* × *varieties of powder charge* × *kinds of materials of application*. This can easily come to 20×8×20=3,200.

6. Hanson recounts how an aircraft downed in a storm will find plausible causal explanations in disciplines as diverse as those of the mechanic and the psychologist.

7. Popular lore sometimes holds that no one reads manuals, but we must recall that manuals do not have to be read by everyone or even by the majority. A manual's content can be drawn into the operating community by individual readers who instruct others on how the tool should be used. Such local experts, the so-called gatekeepers (Allen), propagate the information in the operating environment.

8. The authors of the two manuals even failed to incorporate all the recommendations of the *American National Standard Safety Requirements for Powder Actuated Fastening Systems* (ANSI), a standard reference document that suggests important rhetorical and semiotical usages to be taken into account by individuals preparing manuals on studgun technology.

9. In one instance, training consisted of a brief orientation and a true-false test given by the renting agent, which no one had ever failed.

BIBLIOGRAPHY

Allen, Thomas. *Managing the Flow of Technology*. Cambridge, MIT Press, 1977.

American National Standards Institute. "Safety Requirements for Powder Actuated Fastening Systems." ANSI A10.3-1977.

Barnes, Barry. *Scientific Knowledge and Sociological Theory*. London: Routledge and Kegan Paul, 1974.

Bazerman, Charles. *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science*. Madison: University of Wisconsin Press, 1988.

Berger, Peter L., and Thomas Luckman. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. New York: Doubleday, 1986.

Boulding, Kenneth E. *The Image: Knowledge in Life and Society*. Ann Arbor: University of Michigan Press, 1956.

Bridgman, Percy W. *The Logic of Modern Physics*. New York: Macmillan, 1927.

Clement, David E. "Human Factors, Instructions and Warnings, and Products Liability." *IEEE Transactions on Professional Communication* 30 (1987): 149–56.

Cloitre, Michael, and Terry Shinn. "Expository Practice: Social, Cognitive, and Epistemological Linkage." In *Expository Science: Forms and Functions of Popularisation*, ed. T. Shinn and R. Whitley, 31–60. Dordrecht: Reidel, 1985.

Dobrin, David N. *Writing and Technique*. Urbana, Ill.: National Council of Teachers of English, 1989.

Ellul, Jacques. *The Technological Society*. New York: Alfred A. Knopf, 1964.

Florman, Samuel C. *Blaming Technology: The Irrational Search for Scapegoats*. New York: St. Martin's: 1981.

Garvey, William D., Nan Lin, and Carnot E. Nelson. "Communication in the Physical and the Social Sciences." *Science* (11 Dec. 1970): 1166–73.

Gilbert, G. Nigel, and Michael Mulkay. *Opening Pandora's Box: A Sociological Analysis of Scientist's Discourse*. Cambridge: Cambridge University Press, 1984.

Goody, Jack. *The Logic of Writing and the Organization of Society*. Cambridge: Cambridge University Press, 1986.

Hanson, Norwood. *Observation and Explanation: A Guide to the Philosophy of Science*. New York: Harper, 1971.

Joos, Martin. *The Five Clocks: A Linguistic Excursion into the Five Styles of English Usage*. New York: Harper, 1971.

Latour, Bruno. *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge: Harvard University Press, 1987.

Miller, Carolyn R. "A Humanistic Rationale for Technical Writing." *College English* 40 (1980): 610–17.

National Institute for Occupational Safety and Health. "Powder Actuated Fastening Tools: Employer's Safety Training Guide." U.S. Dept. of Health, Education and Welfare Pub. No. 78198B, 1977.

National Safety Council. "Powder-Actuated Hand Tools." Data Sheet No. 1-236-79. Chicago, 1979.

Paradis, James. "Bacon, Linnaeus, and Lavoisier: Early Language Reform in the Sciences." In *New Essays in Technical and Scientific Communication: Research, Theory, Practice*, ed. Paul Anderson, John Brockman, and Carolyn Miller, 200–204. Farmingdale, N.Y.: Baywood, 1983.

Powder Actuated Tool Manufacturer's Institute. *Powder Actuated Fastening Systems: Basic Training Manual*. Chicago, 1971.

Power Anchor Corporation. *Maintenance and Operating Instructions for Bauer Model Piccomat*. New York, n.d.

Price, Derek J. de Solla. "Networks of Scientific Papers." *Science* (30 July 1965): 510–15.

Schillings, H. J. "Mr. Temple's Submarine Locator." *Electrical Contractor* (February 1970): 30–31.

Shinn, Terry, and Richard Whitley, eds. *Expository Science: Forms and Functions of Popularisation*. Dordrecht: Reidel, 1985.

Simon, Herbert A. *The Sciences of the Artificial*. 2d ed. Cambridge: MIT Press, 1981.

Star Expansion Industries. *Manual for Star Power Tool Model 100*. New York, 1974.

Walter, Charles, and Thomas Marsteller. "Liability for the Dissemination of Defective Information." *IEEE Transactions on Professional Communication* (September 1987): 164–72.

Weinberg, Alvin M. *Reflections on Big Science*. Cambridge: MIT Press, 1967.

Wiener, Norbert. *God and Golem, Inc: A Comment on Certain Points Where Cybernetics Impinges on Religion*. Cambridge: MIT Press, 1964.