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From Work to Activity: Technology and the Narrative of Progress

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Abstract

Information technology transforms work in all its variety into uniform inscriptions that are combinable across time and space. Its digitized codings and classifications are immutable mobiles which claim to represent the true form of work to management and workers alike. Activity based costing is an accounting technology that produces such immutable mobiles. It promises to capture the essence of work and transport it unchanged from the factory floor to the manager's suite. We use this accounting technology as an exemplar to trace the rhetoric of how new worlds and new logics of work are created with the inspiration of information technology. We do so by analyzing a central story with which activity based costing justifies itself and makes its truth claims, and by identifying the kind of world, organization and work it creates. By expanding and extending the plot of the story told by the principal proponents of activity based costing, we expose some contradictions of this powerful system of representation and locate it within a larger narrative that promises progress through information technology.

1. INTRODUCTION

As managers and technicians develop ever more precise methods of gathering data at a distance, they are able to make representations of the world to themselves in ways that claim to be ever more real. Their motto could well be "the greater the accuracy, the greater the reality." Advances in information networks and representational technologies promise to transport particulars of local situations to managerial centers where they can be combined into a universalized knowledge-at-a-distance, enabling managerial knowledge to make ever stronger truth claims. The data used to construct such representations are what Latour (1990) refers to

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as immutable mobiles: inscriptions that claim to resist change and depict the same essence though communicated widely through space and time. Even the networked organization, in which strong centralized control is replaced by dispersed pockets of autonomous managers, relies upon immutable mobiles being available to each local manager, directly revealing the "form" of the world to them (Boland 1987; Latour 1987). As these digitized representations strengthen in their claims to accuracy and universalized truths, factory work is transformed. The logic of the factory shifts from one that assesses local efficiency to one that connects the micro movements of workers to global competitive consequences for the firm (Miller and O'Leary 1994).

In this paper we explore some aspects of how new systems for inscribing organizational work and representing it to ourselves are constructed and installed. As an exemplar of such a system we will consider activity based costing (Cooper and Kaplan 1988), which has come to dominate images of accounting for factory work over the last ten years. This is a computing intensive cost accounting system whose rise to prominence has been made possible by the development of microprocessor technology (Johnson 1992). Put simply, activity based costing replaces traditional methods for averaging costs across products with techniques for tracing a cost to the specific product it helped produce. Traditional cost accounting methods accumulated costs in a few overhead accounts and then spread those costs across products by various rules of thumb. Activity based systems use data processing to identify each detailed cost with a specific product. Activity based costing is a good exemplar for our purposes because its proponents make exceptionally strong claims that it is a more truthful representation than prior systems of cost accounting, and because it is a central feature in the redesign of factory work. Robert Kaplan and Robin Cooper are the most visible and vocal advocates of activity based costing, and they characterize it as:

- the first real management information system,
- the essential core of just-in-time manufacturing,
- a prerequisite for total quality management,
- and the underlying logic of any successful attempt at business process reengineering. [Kaplan 1992]

In other words, activity based costing has been put forward through the eminence of the *Harvard Business Review* as the mother of all information systems.

Activity based costing systems are an exemplar of information technologies that not only transform work but also transform the organizations, logics, ethics, aesthetics and worlds in which certain representations of work are claimed to be true. In an activity based costing system, work is replaced by the notion of activity. Work is a job to be accomplished or a function to be performed that has a local, self-contained quality. Activity, in contrast, is a more abstract notion in which mental or physical actions of a person are identified not as a job-of-work in their own terms, but as one element in the complex assemblage of a particular product or service, produced for a specific customer (Miller and O'Leary 1994). Activity based costing systems link the inscription of a person's mental and physical effort through complex paths within the organization to the product that "caused" them to happen. The immutable mobiles of an activity based costing system are a chain of digitized representations that trace from the need of a customer through the product that satisfies that need, to each of the elements that contributed to that product, and

finally to the individual person whose activity created that element. With activity based costing, the individual who formerly did a job that was well-bounded in a local space and immediate time is now a mediated and essential piece of an enterprise-wide logic that could conceivably be global in scope.

When work becomes an activity it is transformed from overhead to direct product cost. What was a job to do and part of a general overhead of the firm, allocated to products by a rule of thumb, becomes an immediate element in the extended logic of the product. Work takes place in a local space that is reflexive in its own terms (humble as they may be). Activity, in contrast, takes place in an exposed global space, extended and linked directly to products and distant outcomes in an enterprise-wide form of reflexivity. Work is localized, passive and contained. Activity is abstract, global and extended.

We will develop our study of activity based costing by drawing inspiration from Latour's analysis of how truth claims for new images of the world and new techno science practices are made. First, we will explore briefly how the qualities of immutable mobiles are manifest in activity based costing, so that we may understand better how truth claims are constructed and strengthened with information technologies. We will then analyze the rhetorical processes through which activity based costing proponents have created persuasive arguments that their system represents a progress toward truth that it is superior to that of other cost accounting systems. With these persuasive rhetorics, they have enrolled companies worldwide to change work practices and install activity based information systems.

For this rhetorical analysis we will present the central narrative used by the principal proponents of activity based costing and will show why we believe it is such a powerful and convincing story to support their claims of truth and progress. Then, we will play with their narrative in order to undermine its claims. We will do this by telling an alternative but equally compelling story, and also by extending the original story and telling it further — to see what happens next. In both cases we will show how a narrative constructs alternative possible worlds, and how a technology and its logics of action depend upon the plausibility of the world that the narrative creates. As our analysis of activity based costing will reveal, the power of a narrative to provide worlds, logics, ethics, aesthetics and motivations to restructure work with information technologies depends on controlling what is read into the story, on stopping rival counter-stories from being told, and on terminating its own tale before the story goes too far.

2. THE RHETORIC OF TRUTH MAKING WITH INFORMATION TECHNOLOGY: CAPTATION OF THE READER

Presenting a narrative of life in the factory is an important rhetorical device for making activity based costing so believable; Latour (1987) refers to this as the process of *captation* through which the reader of an activity based costing proposal is carried along to its author's desired conclusions. The reader can be expected to raise objections to the line of argument in a text. A reliable reader is a skeptical one, but the successful truth maker skillfully anticipates a reader's objections and develops a "captation" to control the reader's possible meandering. As Latour stresses, if the author is to succeed as a truth maker, the reader must freely reach the desired

conclusion, but only that one. The problem is "how to leave someone completely free and have them at the same time completely obedient" (Latour 1987, p. 57).

Captation refers to the way a truth maker can develop a persuasive line of argument that, like a river valley, allows readers to flow freely yet will succeed in "moving readers far away from what they were ready to accept at first" (p. 57). In the case of activity based costing, we see a narrative — the story of two factories (Cooper and Kaplan 1988) — playing the crucial role in its successful process of captation. Cooper and Kaplan use the story of two ballpoint pen factories as a principle vehicle in presenting a compelling case for activity based costing as opposed to traditional cost accounting. The story of the two factories will be presented, countered and extended below as we analyze how narrative enables truth making within particular kinds of worlds and their logics for the design of work.

Adopting Latour's vocabulary, we can approach activity based costing as a technology that has been made true and has been established as a widespread practice through a process of translation in which allies have been enrolled, black boxes have been constructed and stacked, and arguments have been built-up into many layered defenses against adherents of the traditional cost accounting techniques. Activity based costing is a kind of jump shift in the progress of cost accounting as a center of calculation, promising to collect data and enable managers to see and act from a distance with a dramatic increase in precision and truth in cost representations. Accounting has been inscribing business transactions into texts and providing authoritative readings of them since the time of ancient Mesopotamia (Hoskin 1993). Accounting is perhaps one of the first "immutable and combinable mobiles" with its use of clay tablets in hollow balls to transmit details of business transactions along the earliest caravan trade routes. Cost accounting has always promised managers to present the factory to them in a way that enabled them to analyze and manipulate it for purposes of control. Activity based costing promises a kind of hyper-realism in that form — a realism that offers a new, more penetratingly accurate truth, one that exposes and corrects the lies generated by cost accountings of the past.

Adherents of activity based costing are leading a revolution intent on overthrowing ideas of accounting for factory work that have been firmly in place for over a century and replacing them with an utterly new set of ideas and guiding images. Their claim is that all cost accounting theories and practices which have gone before are wrong. For over a hundred years, accountants have thought that any cost of running a factory department that did not arise from directly touching the product during its manufacture (such as the materials in a product or the labor that shaped these materials) was to be classified as an indirect cost or overhead. This overhead was to be assigned to products with various rules of allocation that had been developed through decades of cost accounting practice. Indirect costs generated by support activities such as engineering changes or parts maintenance were thus allocated to products in proportion to material or direct labor costs assigned to them, or in proportion to the square footage in the factory dedicated to their manufacture, or a myriad of other cost allocation rules.

Activity based critics of this traditional allocation practice have denounced it, claiming that it creates a false image of the product, its costs and its potential for profit (Cooper and Kaplan 1988, 1991; Johnson 1992). Traditional costing, they claim, arbitrarily assigns overhead expenses to individual units of manufactured product. Cost allocations that divide overhead by the number

of units produced naively assume that indirect costs vary with units of output. Instead, activity based costing makes visible the degree to which a particular product was "touched" by activities anywhere in the firm and traces the cost of the activity to that product. A cursory brush with an activity does not cost a product as much as a significant encounter with it, and activity based costing promises to use information technologies to characterize every activity in the firm as a touching and thereby a cost of some product.

The advocates of activity based costing thus argue that the practice of averaging costs across many product classes based on materials or labor consumed in their manufacture have created blurred pictures. These have deceived managers and have led them to think and act in foolish ways. Because product costs calculated by cost allocation systems were not correct, the managers could easily sell items at the wrong price, creating losses rather than profits by mistake. Activity based costing proponents, inspired by the capacity of computers to collect, store and process seemingly infinite amounts of information (Johnson 1992) called for redesigning accounting systems in the factory so that any activity anywhere in the organization would be traced directly to the particular product that had "caused" that activity to happen.

All costs in the factory therefore become direct costs, just like the materials in the product and the labor that shaped it. They become direct costs because information technology can monitor micro movements anywhere in the factory and can provide a trace from every product at each and every moment of its manufacture back to the activities that sustain that product, no matter how distant, complicated, or indirect that path might be. Activity based costing proponents hold that the only limit to tracing through these complex paths is the limit of computational ability in today's computer systems. As computer power increases and as computer prices decrease, the dream of completely tracing every activity, no matter where it takes place, back to a product on the factory floor that caused it, edges closer and closer to reality.

One can see even before we explore the rhetoric of captation for activity based costing that its claims of progress and truth are part of a larger myth of information technology shared by many application systems. This is the myth that managers can see the world clearly through numbers, can grab onto it, and can shape it with a logic of efficiency revealed through the numbers (Boland 1987; 1989). Computers and related information technologies are intertwined with and feed into a belief in progress toward an enlightened future state. Activity based costing has been positioned as the factory accounting system that embodies that hope. It will save the manager from error because it will make visible the true state of affairs as well as the road forward.

3. THE STORY OF TWO BALL-POINT PEN PLANTS

In setting the stage for their discussion of how traditional costing systems generate distorted product costs and how activity based costing systems, by contrast, can produce accurate ones, Cooper and Kaplan (1988, pp. 97-98) tell "The Story of Two Plants." Both plants are identical in size and equipment, and both manufacture one million ball point pens per year. Plant I makes only blue pens, while Plant II makes a wide variety of pens. As Cooper and Kaplan describe it, "In a typical year, Plant II produces up to 1,000 product variations with volumes ranging between 500 to 100,000 units" (p. 97).

Plant II, although having the same standard labor and materials costs, has a much larger production support staff than Plant I: more product variation requires more people for scheduling, designing, negotiating with vendors, and so on. There is also more idle time, overtime, inventory and scrap in Plant II. Using traditional cost allocation methods, these overheads are distributed equally to every unit of output. Hence, blue pens, which represent 10% of Plant II's production will carry about 10% of factory costs and low-volume specialty pens, like lavender ones, will have only a small fraction of factory costs apportioned to them. The accounting system will report equal costs for lavender and blue pens "even though lavender pens, which are ordered, fabricated, packaged, and shipped in much lower volumes, consume far more overhead per unit" (1988, p. 98). The moral of their story of Plant I and Plant II is told by Cooper and Kaplan as follows:

> Think of the strategic consequences. Over time, the market price for blue pens, as for most high-volume products, will be determined by focused and efficient producers like Plant I. Managers of Plant II will notice that their profit margin on blue pens is lower than on their specialty products. The price for blue pens is lower than for lavender pens, but the cost system reports that blue pens are as expensive to make as the lavender.
>
> While disappointed with the low margins on blue pens, Plant II's managers are pleased they're a full-line producer. Customers are willing to pay premiums for specialty products like lavender pens, which are apparently no more expensive to make than commodity-type blue pens. The logical strategic response? De-emphasize blue pens and offer an expanded line of differentiated products with unique features and options.
>
> In reality, of course, this strategy will be disastrous. Blue pens in Plant II are cheaper to make than lavender pens – no matter what the cost system reports. Scaling back on blue pens and replacing the lost output by adding new models will further increase overhead. Plant II's managers will simmer with frustration as total costs rise and profitability goals remain elusive. An activity-based cost system would not generate distorted information and misguided strategic signals of this sort. [Cooper and Kaplan 1988, p. 98]

The story of Plant I and Plant II is a compelling narrative. Upon hearing it we can almost see the blue pens in Plant I, flowing smoothly through a continuous production process untouched by the Plant's limited production support staff. We can imagine an equally smooth flow of blue pens in Plant II. But the Plant II picture is marred by the stops and starts caused by specialty pens, the jolts in production seen in idle time and overtime, the messiness of surplus inventory and the waste of scrap associated with these non-blue pens. ***We*** can see the difference between the two plants, but the managers of Plant II are oblivious to it. Their inability to see what we as readers can see gives a suspense to this story. It makes us wish we could intervene and stop the strategic blunders that are sure to befall Plant II.

Reading (or listening) is an important source of the power of narrative, because we don't just read a story — we also of necessity read into a story. The story as told or written is always sketchy.

More details can and will be added by the reader because a story is never a complete telling of all the motivations, histories or circumstances of the characters or the setting. Bruner (1990) refers to this as the subjunctive quality of narrative. To get the "whole story" the reader's imagination is always at work completing the whole characters, the whole situation, the whole set of possible consequences and meanings that the events and plot suggest. Readers are always "writing" a virtual text as they "appropriate" a text's meaning for themselves (Ricoeur 1981). This subjunctive quality is an important part of the captation at work in the two plant story. Because we actively read into it and complete the story, its compelling logic is in part our own.

The story of Plant I and Plant II, simple as it may be, displays the essential elements of narrative structure (Bruner 1990, p. 77). First of all, it involves events that occur in a sequence and have a beginning, middle and end. We could tell the story with flashbacks so that the events appear out of sequence in the actual telling, but the underlying chrono-logical structure would remain undisturbed. The reader would, in effect, write its proper chrono-logic for herself. Second, the story involves intentional agents whose action is directed toward goals. The plot involves the seeking of the goals and the sequence of events builds a dramatic tension toward the denouement. Third, the story draws upon, questions and ultimately speaks to what we in the management community take to be canonical behavior. The intentionality of the characters is judged in terms of this sense of canonicality. The story dramatizes how the decisions and actions of Plant II's management violate the norms of expected behavior. It does so by contrasting it to the canonical behavior of Plant I, and this contrast relies upon the fourth element of narrative, the narrator's perspective. As the teller of this story, the narrator externalizes himself from the action and can therefore see both Plant I and Plant II in a way that neither of their managers can. It is the narrator's perspective that makes us as readers privy to how the managers of Plant II are oblivious to violating our (and their) standards of canonicality.

Chatman (1978) presents an elaborate framework for diagraming narrative structure and we can use some of his techniques in a simplified form to portray the structure of Cooper and Kaplan's two plant story (see Figure 1). In diagramming the structure of events in a story plot, Chatman distinguishes between major and minor events. He calls major events kernels and shows each kernel as a square. Minor events are satellites and are shown as dots. Satellites are events which enrich the story aesthetically, but are not crucial to the plot. Satellite events "necessarily imply the existence of kernels, but not vice versa" (Chatman 1978, p. 54).

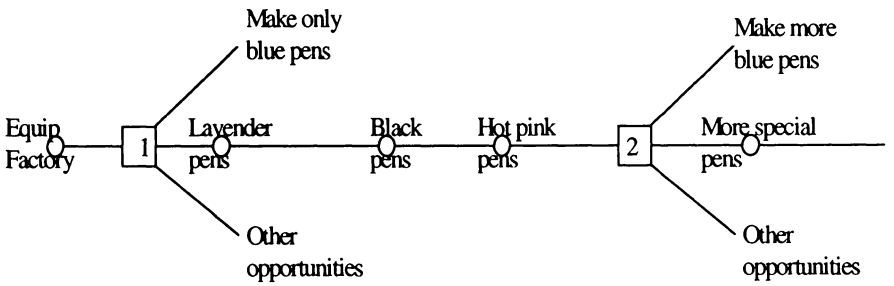

Figure 1. Diagram of the Plant II Story

Adapting Chatman's technique for depicting the narrative structure of the story of the two plants results in a diagram with a striking resemblance to the kind of river valley which Latour (1987) uses to describe the process of captation. Just as the narrator highlights some satellite events while deliberately keeping quiet about others so as to make the plot coherent and arrive at a certain moral, so the truth maker must set up a line of argument that prevents the reader from straying off the path up a tributary into a side valley. If the narrative is strong enough it can lead even the most skeptical dissenter to the desired conclusion.

In our diagram of its narrative structure, we identify two kernels in Kaplan and Cooper's story. The first is when Plant II chooses to produce other pens in addition to just blue ones. Details of how many different colors and sizes they developed (is it 1,000 or 1,500) are satellite events which elaborate upon but are not crucial to the plot. The second kernel comes when the management of Plant II bases its decision to pursue a specialty pen strategy on traditional cost accounting reports, once again failing to choose the path of pure blue pens. These two kernels as seen from the narrator's perspective are the crux of the non-canonical behavior by Plant II's managers. The story then subjunctively promises that canonicality could be restored, if an activity based costing system were used instead of a traditional one. Management would then have made a different choice at the second kernel and avoided their strategic blunders. That is how the story first disturbs, then promises to restore canonicality and how it helps the reader to construct a world in which activity based costing is needed.

But what is the moral of the story? What are the lessons to be learned from it beyond the desirability of activity based costing? In our reading of it, the moral of the story is found in the kind of world it constructs. Beyond activity based costing, the story of the two plants is presenting a world in which a certain type of plant is preferred. It is a world with a certain type of ethic and sense of value embodying ideas about the identity of a firm and its products, the nature of work, and the responsibility of a manager.

The moral of the story is that variety and small volumes breed inefficiency, which is costly and therefore bad. Treating products and customers as commodities in a mass market helps management reduce the variety it faces, which is good. Traditional cost allocations hide this true reality from us and induce us to first indulge in variety and then eventually to pursue it blindly. Activity based costing is not the moral of the story. It is a practice which promises to align us with the moral, which is to seek a world in which it is possible to be a low cost, high volume producer of commodity products to a consumer mass market. The moral is that true blue is beautiful, ordered and pure but multi-colored variety is messy, disorganized and noisy. Activity based costing is an information technology for restoring the beautiful world of order and truth. Why resist it?

4. ANTI-STORIES OF OTHER COST ACCOUNTINGS

Even though narratives are a powerful mechanism for convincing an audience of the correctness of an argument, they are also fragile. Seeing a story as an incident or an example, allows us to challenge it by a counter example, keeping in mind that for stories to be effective in the communication of morals, the narrator and the reader must share a sense of coherence and

canonicality. By appealing to the reader's common sense view of the world (Linde 1993), we can renarrate this story and guide the reader's subjunctivizing toward a differently charted course.

Below we present two different approaches to renarrating and undermining Kaplan and Cooper's two plant story. First, we will resist the "facts" or kernels as presented in their telling of the story. Instead, we will move up a tributary and chart an alternative course by adding events and creating an anti-narrative with a reverse canonicality. After that retelling, we will undermine their narrative in another way, by picking it up where they left off, and telling the *rest* of the story.

4.1 The Two Plant Story: The Anti-Narrative

Shortly after Plant II begins producing specialty pens, several events in the environment combine to create a radical shift in consumer preferences. Elements in the background include an increased use of color graphics in personal computer displays, a series of popular press reports on psychological research showing that color is an effective communication tool, and a number of popular novels and multimedia experiences published with text of various colors — each color of text denoting different qualitative elements in the story. Against this background, leading companies in the business community begin a "reengineering" of corporate communications in which colored pens are used to highlight written documents and increase their "communication power." Packets of pens with an individual's preferred set of communicating colors become the new rage. Soon, pen packets are a symbol of professionalism and creativity for workers at every level of the corporate hierarchy.

At first, Plant I does not responds to these events, treating it as a fad that will go away. They continue their strategy of producing only blue pens, but consumer fascination with using color to communicate persists. Demand for standard blue pens decreases sharply. Plant I's management responds by lowering its price to keep market share. Unfortunately, many other pen manufactures have adopted activity based costing and have followed the low variety, single color strategy chosen earlier by Plant I. They also have been cutting prices, leaving Plant I with continually declining sales.

At this same time, Plant II finds its sales booming because they are able to produce multi-color pen packets with ease. They can offer their pens in an unlimited number of color combinations, almost customized for each customer's preference. As fashions in colors and their meanings change, Plant II is able to smoothly shift its production in response.

After a while, Plant I's management is forced to produce pens in different colors. Finding new suppliers, testing their quality and establishing relations with them is an expensive and difficult process. Variations in ink of different colors requires subtle changes in pre-mixing and machine adjustment. Plant I finds that it lacks the support staff with the expertise to handle these new tasks.

Because the management of Plant I desires to avoid a large production support group, consultants are hired to redesign their pens, find new suppliers, test the new inks, reformulate their mixing procedures and recalibrate their machines. Plant I's workers perceive these changes as a threat and fear being made redundant because of the different skills that are needed to produce multi-

color pens. The few engineers that Plant I does have on its staff resent the dependence on consultants and become as demoralized and alienated as the production workers. Nonetheless, Plant I's management is eventually able to get multi-colored pen packets produced and shipped. They breathe a small sigh of relief as the plant slowly begins bringing its production volume back up.

Meanwhile, Plant II had anticipated that customers would soon go beyond wanting a pen packet with multiple colors and would demand packets in which each pen had the same feel in use and wrote with the same texture and thickness of line, no matter which color they were using. The sense of aesthetics of Plant II engineers dictated that the writing on a multi-color document should be identical in every respect except color. All the pens should have the same properties of line thickness, drying time, smudge resistance, fade resistance, bleed through, and so on.

This refinement in consumer tastes made Plant II's pen packets the most desirable on the market. Plant I tried to develop a similar feel and look in its pens by once again hiring consultants, but the skills and knowledge to achieve the needed consistency were beyond the consultants' ability and the workers and staff at Plant I had a very limited capacity for learning. After a short while, Plant I's sales of pen packets decreased sharply and management wondered what to do next.

4.2 The Moral of the Anti-Narrative of the Two Plants

In the version of the two plant story presented above, the moral is not one of purity and order, but one of networked interdependence and requisite variety. The moral goes something like this: only organizations with a sufficient capacity for complex interaction and coping with the variety presented by their environment will survive. As for the nature of the world presumed by these stories, we might say that the original two plant story presumed a world in which things will not change (except slowly and predictably), whereas our second version presumes a world in which things can and will change, and often quickly.

In the first kind of world, wisdom is something you achieve after learning about the world very well, just once. After something has been learned, the goal is to perfect it through repetition. Exact measures and comparisons against established norms are used to ensure high performance. "Pay attention only to that which is measured" is the operant logic in this world. In the second kind of world, wisdom is something you achieve when you realize that you must learn about the world over and over again, without end. "Learning is never wasted" is the motto that captures the ethic of this world. Knowledge and wisdom have blurred boundaries and are therefore hard to confine with activity/product traces. They are more like an accumulation of a resource that is available for drawing upon later. In a sense, this accumulation of experience as learning is an overhead, but a desirable one. In the first kind of world, a learning capacity beyond what is needed for perfecting the manufacture of one product is a luxury and an indication of waste and inefficiency; in the second kind of world, it is a necessity and a sign of an organization's fitness.

One implication for information technologies such as activity based costing is that the appropriateness of the logic of a given system is dependent on the type of world in which it is to operate. The way Cooper and Kaplan (1988) narrativize a manager's experience clearly makes activity based costing a compelling choice. Another implication is that the way we narrativize our

experience and the kinds of information systems we select is also in part a making of our world. In the original two plant story, the customer is seen through the eyes of product costing. The desirable customer becomes a commodity, like the desirable product. Costs attach to the customer as they do to any other element of production, and the best customer is a low variety customer that does not demand high discounts, frequent delivery of small lots or expensive sales and technical resources (Cooper and Kaplan 1991, p. 134). If customers demand too much, i.e., become too costly, "fire them" (Kaplan 1992, pp. 62-63).

It turns out that in the second version of the two plant story, the canonicality of traditional allocation based costing and activity based costing are reversed. Traditional allocation based costing would have generated signals that encouraged the development of specialty pens and positioned management well for the coming changes in consumer tastes. It is not our purpose to prove that any one cost system is ***the*** true one, but rather to unpack the narratives that construct the worlds associated with different deployments of information technology.

Still, the question of learning raised by the second version seems to pose a difficulty for activity based costing in almost any circumstance, except that of a stable world. Learning is tangled and messy, transferring with surprise from one product to another. Solving a difficulty with red pens can result in knowledge that transfers to pink or purple ones. Building relations with a vendor while negotiating for green ink may affect relations with that vendor for all other inks. The design team that learns to reconfigure one line of pens builds skills and develops knowledge that can transfer to all future design projects.

Plant II did well in version two of the story because it had developed the capacity to learn and the costs associated with learning were not attached to any one product or activity. It is in the interrelations among persons, products and departments that an apparently localized act of learning can reveal its greater organizational benefit. Activity based costing isolates the linkages between discrete actions and products. It compartmentalizes persons, products and departments and thereby ignores the interrelations where learning can create value.

Activity based costing suffers from the reductionist fallacy in an extreme form; it is like saying we can study the individual members of a group separately and understand all we need to about their functioning as a team. Activity based costing, by teasing out separately traceable cost elements, sharpens the edges and outlines of the production process but cuts out the richness of interrelations and network of interdependencies that gives value to organizational learning.

4.3 Extending the Narrative Structure of the Original Two Plant Story

Stories have a beginning, middle and end. Coherence and plausibility are dependent upon relating events to the narrative's ending. The beginning and end provide a frame within which characters and incidents can be evaluated. It is this frame that enables both the narrator and the reader to moralize about the story. Thus the story can be fundamentally changed by ending it at a different place. "Reframing" the story in this way implies that the significance of events changes, that its plausibility needs to be reassessed and that a different moral may be drawn.

We will now change the ending of the two plant story, as a reframing strategy. In the first alternative story presented above, we created a different world by traveling up a "forbidden" tributary. Now we do so by staying within the river's valley but not stopping at the vista to which Cooper and Kaplan's story has led us. Instead, we will go further along the valley and arrive at a new moral. We thus continue the story line of the original "Two Plant Story" by following the major plot beyond its current ending point to see where it leads. The plot we will follow further is the implication of tracing the mental activity in production support to the specific product being thought about.

In activity based costing, products that are the focus of attention of engineers preparing change orders, or staff handling customer queries are, identified through "drivers," and the cost of that mental work is attached to its focus of attention. Accountants have always wanted to trace costs this way, the story goes, but couldn't do so because of record keeping and computational impracticality. Now, however, computers are able to do the amount of information processing required to make activity based systems possible. In principle, as the power and ubiquity of computers grow, the scope of mental work attached to products will also grow. As Cooper and Kaplan (1988, pp. 101-102) express it, only the costs of excess capacity and new product R&D would be excluded from an ideal activity based costing system. This is the direction in which we will expand the narrative structure of activity costing. We assume that by the year 2000, computers will have become so powerful, small and inexpensive that wholly new domains of mental activity will be opened for direct tracing to product costs. The kernel event we will add to the original activity based costing story is the invention in 2001 of the "Executive Jacket."

4.4 Capturing the Cost of Management Attention: The Executive Jacket

Plant I, after being forced to recognize the change in consumer tastes described above and to manufacture multi-colored pen packets, feels it is more important than ever to expand the scope of activity based costing to include all mental work in the company, including that of top management. Low-cost microprocessors have made new data collection devices possible that were unthinkable just a few years before. Cost accountants have used them to develop novel systems for tracking the mental activity of managers and tracing the costs of management directly to the products they focus their attention on during the day. One such device, called "The Executive Jacket," has been incorporated into the activity based costing system of Plant I.

The Executive Jacket is a fine quality suit coat with microprocessors, data storage, and "wireless" infrared communications, as well as location sensors, bar code readers, sound recording and high resolution video cameras woven into the lining of the jacket. Each manager in Plant I, including the CEO, wears an Executive Jacket and in so doing allows much of his or her mental attention to be recorded and allocated as costs of production.

Through the day, each manager's spoken words are recorded, transcribed, and key word indexed. All reading and writing is recorded by the video camera or gyroscopic pens and similarly indexed. Every second of a manager's time is then allocated to the product or project being discussed or written about. Each Executive Jacket comes with a pair of executive glasses in the breast pocket. These glasses have a bar code reader, a scanner and a gyroscopic tracker built into them, and

managers wear their executive glasses whenever they read a document or report. Each page of every company document is bar coded and calibrated with grid lines readable by the glasses' scanner. As a manager turns to a new page on a cost report or budget, the glasses record which page is being looked at and where on that page the manager's attention is focused. This on-line tracking of their mental attention is transmitted to mass storage devices and entered into the cost file for the relevant product or project.

When several managers are together in a meeting, location sensors in their jackets allow the central computer to capture and allocate the costs of all managers present. As the director of cost accounting systems explains it, "When one manager in a meeting is speaking, we assign the cost of the other managers at the meeting to the product or project being discussed. It isn't perfect of course, since not everyone is really paying attention and some may even be having private thoughts, but it will take a big leap in technology to deal with those shortcomings."

The Executive Jacket system is not without problems. Managers have discovered that discussing a given product in a group meeting with ten or twelve executives can dramatically shift the cost structure for that product. "Twelve executives plus their support staffs can easily run $100,000 per hour, so discussing a product's cost per unit for more than just a few seconds can change the cost enough to invalidate their decision," explained the director of cost systems. "It seems that each refinement of the Executive Jacket enabling us to improve our cost tracing for management just makes the problem worse," he continued. "Hopefully, they will learn to think about things less and keep our products more cost competitive," he joked. Managers have now requested a real time costing system with interactive displays in their meeting rooms so they can track the changing costs of a product as it is being discussed. As one of the consultants hired by Plant I put it, "They have discovered the Heisenberg Uncertainty Principle of activity based costing — the harder they look at exactly where the cost is, the faster it moves."

4.6 The Moral of the Story of the Executive Jacket

The moral of this version of the two plant story is something like "beware of what you wish for — you just might get it" which is in some way analogous to the notion that we often mistakenly transfer the accuracy of the medium to the accuracy of the message (Latour 1990). By shrinking the distance in space and time between cost incurrance and its representation to the actors, the edges of action are sharpened leaving little room for people to talk, negotiate and maneuver. With the Executive Jacket, managers look into the computer display and see a mirror image of themselves. Action and the accounting of that action becomes instantaneous, leaving no place for the actor to be alone or even to stand.

We can imagine two main story lines that Plant I and its Executive Jacketed management team might follow from this point on. In the first story line, a question as to the value of management would be raised by workers and their unions as well as by the company's Board of Directors. The question would be: "How can we justify the cost of this management attention? Can't the workers and staff closest to the problem deal with it most effectively?" In this story line, the very information technology that gave management the power to make the mental processes of production support visible and traceable to products comes back later and is applied to them. With their mental work, they touch the product in much the same way as the shopfloor workers

do. Activity based costing turns this work into a direct, visible cost. The result is a questioning of the value and efficiency of management itself, leading for a call to "fire the manager," instead of "fire the customer" as in the original story. Through a concerted effort of the Board and the Unions, management ranks are reduced to a mere few residual area coordinators. Over time, the managerless Plant I becomes even less able to sense, interpret and respond to the environment than before. The company moves slowly but surely to bankruptcy.

The problem of advanced information systems in this story is once again a failure to account for (or allow for) learning. Hopefully, learning was taking place in those management meetings and when they discussed an issue concerning hot pink pens they were learning about similar issues related to other colors and styles of pens. Similarly, when managers talked about a consumer reaction to a new pen packet line, they were learning about consumers in ways that would improve their knowledge of the market generally, including competitors, economic conditions and broader consumer preferences.

By directly linking mental activity to the immediate object of thought, an activity based system ignores relationships among objects, ignores the capacity for abstraction, and in short ignores learning. We could imagine that the managers of Plant I would themselves come to see this, which suggests a second story line that the tale of the Executive Jacket could follow.

In this story line, management begins to install the Executive Jacket system for management activity accounting, but stops abruptly, declaring that they have just had an insight: they have come to see that when they think about something they never *just* think about that one thing — they also are always *self-reflecting*, or thinking about their thinking (Bateson 1972). Self-reflection, in contrast to the apparent product or problem focus on their surface level speaking, reading and writing, is a meta-level activity that shapes and guides their thought. Self-reflection is what gives their thinking its value, and self-reflection is fundamentally about monitoring a focused activity in light of its full context of relationships. "No wonder activity based costing gave such distorted results of our management deliberations," the President of Plant I said after achieving this insight about self-reflection.

This story line has a kind of happy ending you might enjoy hearing. The management of Plant I revised their cost accounting and created a "Learning Account." Most of the cost of their deliberations were put into this new account. The cost accumulated in this account was then allocated to products based on broad indicators, such as labor hours, machine hours or materials cost. Management's insight on reflection soon grew to include the realization that production support staff also self-reflect during their work. As a result, a majority of the cost of the production support staff was also being assigned to "Learning Accounts" and allocated to products on the same broad indicators as managements'.

5. CONCLUDING THOUGHTS

The narrative of information technology as exemplified by activity based costing is a narrative of progress toward clarity, simplicity and purity. Information technology has a kind of magical power attributed to it for sharpening edges that were dull, making clear what was blurred and purifying what was contaminated. The world of work has become messy and inefficient over the

last few decades as overheads grew and inventories proliferated. We long for the simple days when products were made directly for familiar customers in stable local communities. Information technology is intimately bound up with a kind of dream wish for restoring that simple past, and activity based costing is an exemplar of how information systems promise to fulfill that dream.

Information systems like activity based costing promise to replace free-floating and ethereal overheads of work with direct connections between activities and products, enterprise wide. They do so by cutting the edges of representations ever more exactly and precisely in the writing of globally reflexive texts. But the progress of return that they promise is just as false as the representations they replace.

The mental work of production support and management is a kind of organizational tapestry. By picking apart separate strands of thought-object linkages, activity based systems begin a process of unraveling the tapestry. Activity based systems claim to be more complex than the simplified traditional systems they are to replace. However, as a knowledge structure, activity based accounting is itself a progressive simplification — a systematic ignoring of relationships and sharpening of boundaries between activities (Star 1983).

Traditional cost allocation systems may appear simple to proponents of activity based costing, but by not pushing too far to sharpen the outlines of objects and processes, traditional systems allow a space for the complexity of interrelations in mental work. The allocations of traditional systems result in a blurring of the linkage between production support and products, but that blur allows for the possibility that learning and interrelationships can persist, safe from inscription.

Our conclusion is not to argue for yet another new kind of costing as the truly "unbiased" one, but instead to suggest that more appreciation be given to the narratives which underlie our technologies and the worlds which they create. More attention should be paid to narratives that emerge from the shop floor and the production support staffs themselves. Consideration for multiple narratives that give voice to and allow the construction of multiple worlds will not give us any one representation of work that is enduringly true, but they may give us more interesting ways to think about the organization, ethics and aesthetics of work than the search for such true systems has.

6. ACKNOWLEDGMENTS

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