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# New genres and obsolete expertise in the new textiles economy

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**ABSTRACT**

This paper examines the role of distinctions between genres in conflicts over expertise in an American textile mill. Riverway is a struggling 150-year-old New England textile mill where members of a diverse workforce focus on producing high quality fabric in a context that demands daily adaptive expertise. Based on fieldwork from 2015–19, we examine how Riverway workers interacted with documentation systems at the mill. They engaged with managers and coworkers around new forms of technology and shifting valuations about skill and expertise, and, in the process, made sense of their roles as workers in a declining industry where their skills and forms of expertise were nearly obsolete. Through analysis of conflicts in the mill, we examine how members of the mill's community of practice made sense of a changing genre ecology of tools for communicating, recording information, communicating asynchronously, and asserting expertise. We show how technologies for making fabric and communicating about fabric production became symbols of valuations tangentially linked to production. These technologies became lightning rods for debates about expertise, skill, and knowledge, and for everyday distinctions that workers and managers made about the value of their work during a time of economic change marked by mill closures.

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## A maker's mark

In a garment factory in North Carolina in 2017, Rob searched through rolls of fabric, shelved on their side like wine bottles, to find the one he needed. He located the product number on the tag for a roll from the Riverway textile mill in New England, and he ferried it to the first work center in the factory. It's a long table, with an unroller at one end and a computer numerical control (CNC) laser cutter at the other, programed to efficiently cut the needed shapes for the next workstation where garments are assembled and sewn.[1]

While the roll was being fed into the CNC, Rob stood at the table, inspecting the fabric to ensure quality; he was looking for runs of missing fiber or yarn, tears in the fabric, stripes or blotches where there were mistakes in the knitting, color blemishes from the dyeing. He had been getting this same orange fluffy pile-knit fabric from Riverway for months – always top quality – and he had already worked with several flawless rolls that same morning. But, as soon as he unfurled the new roll, he noticed a strange, coiled depression in the fabric in the first yard.

Did an insect eat the fabric during shipment? He wondered. No, the marking was too clean.

Had the shipment included a note about allowances for defects? No, there was no such notation on the standard information included on the packing list and on the tag attached to the roll.

Wondering if he was seeing stripes, or a drawing, or perhaps letters, Rob backed up to get a different angle. When he pulled over a stool and climbed up, he could see that the depression

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formed letters: 'Love U.' Rob stopped the machines and called over Sammy, his manager. 'Is that cursive?' the manager asked. 'Yes. I think it says "Love you." See the big cursive "L"? It was like that when I unrolled it.' Rob and Sammy took measurements of the flawed fabric, and Sammy snapped a photo with his phone. Even though Sammy knew that the writing would not impact the final garment's appearance or function because of where it would be placed in the final product, Sammy instructed Rob to cut that section out, record the waste measurements on the computer, and leave it on Sammy's desk. Sammy had never seen anything like this before, so he emailed the photo to Riverway's president, his sales contact.

When Riverway's president, Chuck, received the email, he was furious. He knew someone in his mill must have put the message there, and he was ashamed of the unprofessional behavior. Riverway had systems in place to prevent things like this from happening. In fact, right before every roll of fabric was shipped, an inspector, José, reviewed it for quality assurance. Chuck logged onto Riverway's software system for inventory and order processing, saw no notation about fabric flaws for this roll, and so he printed the photo and headed to Shipping to start his investigation.

Chuck found José, who was pulling a cart of fabric rolls, and showed him the photo. When José told us about this later, he admitted that he thought of denying it. He knew from Chuck's face that this was a serious matter, but he couldn't help but laugh. A week earlier, José, a Brazilian immigrant who was nearly 60 and had worked in factories and mills since he was a teenager, had inscribed 'Love U' into the fabric using the air hose that is intended for him to spray off straggling yarn and fiber before shipment. The repetitive work had gotten to his head, and he wanted to have some fun. Moreover, José incorrectly assumed that the flattened pile-knit fibers that formed the lettered indentation would have stood back up by the time the customer unrolled the fabric, so nobody but he would have ever seen the writing.

Chuck was frustrated with José but didn't file a formal disciplinary action. 'You could have written something much worse,' Chuck noted, and laughed nervously. 'At least this was about love. Don't do it again. It's unprofessional, and we could lose customers doing that kind of thing.'

Though he could laugh a little, Chuck was irritated because quality assurance is necessary for maintaining customers in the competitive textiles market. At Riverway, many see success as entirely dependent on quality control: the firm's goal is to ship textiles in which every yard of fabric in an order is identical, and where different batches are indistinguishable. Riverway produces standardized products for its customers, who in turn produce standardized clothing or industrial textile products for their customers. Rather than adding aesthetic or commercial value, natural or human-generated variations result in fabric considered defective. This is even true for variations that don't affect the function of the fabric, like the 'Love U' message, as José discovered. The customer does not want to see traces of the human hand in their product, no matter how affectively positive the trace may be in another context.

To produce that standardized product, it is essential that Riverway employees follow procedures and log data and measurements to ensure that the product meets the required standards. The mill uses Enterprise Resource Planning (ERP) business process management software to ensure this. The ERP system can help track imperfections and can allow workers to isolate whether the cause is in machinery, materials, or operators. With correct tracking, imperfections can be fixed before they interfere with production further down the line or are shipped to the customer. The ERP documentation system has been designed to eliminate undocumented flaws; it exists alongside several other communication and documentation systems employed in the mill, some informal and some formal, such as handwritten notes, tagging systems, technical manuals, and conversations among millworkers.

José's 'love note' fell outside the scope of what is captured by planning and documentation. There was no system catching when a worker might be bored and might want to have a little creative fun. Riverway's ERP system presupposes human predictability and discipline (designers would have designed the system assuming this 'user' behavior). José worked in Shipping at the very end of the production process: the apex of the mill's documentation, communication, and tracking

systems. Employees came to work with their own histories, personalities, aspirations, goals, and values, and thus engaged in their own ways with this complex repertoire of documentation and communication genres.[2] Human creativity made its mark in all these genres, whether high tech or low tech, formal or informal, sanctioned or unsanctioned by management. Despite systems meant to discipline and control, the imprint of the humans who utilized the genres was always slipping through. Jose's love note interrupted a common presumption of standardization: that the product could have been borne of a technological process devoid of human participation.

In this paper, we examine how Riverway workers interacted with (thwarting, refusing, leveraging, supporting, creating, improving) documentation systems at the mill. They engaged with managers and coworkers around new forms of technology and shifting valuations about skill and expertise. In the process, they made sense of their roles as workers in a declining industry where their skills and forms of expertise were nearly obsolete. The gradual digitization of documentation at Riverway was a sign of a shifting genre ecology[3] at the plant, which, in turn, was shifting relationships among technicians, managers, machines, and materials – and thus the meanings and value of work throughout the mill. All this change was accompanied by conflict, for changes like this do not settle easily in a precarious industry where people worry about job security and must make sense of their shifting place among new standards for expertise and new systems of managerial control.

Through analysis of conflicts in the mill, we examine how members of the mill's community of practice made sense of a changing genre ecology of tools for recording information, communicating asynchronously, and asserting their expertise. We show how technologies for making fabric and communicating about fabric production became symbols of valuations only tangentially linked to production. These technologies became lightning rods for debates about expertise, skill, and knowledge, and for everyday distinctions that workers and managers made about the value of their own work during a time of economic change marked by mill closures and the concomitant scarcity of textile manufacturing jobs.

This paper is part of a special issue on 'Genre Work in the New Economy' that sheds light on how genres have become a new communicative battleground under contemporary capitalism. By ethnographically examining people's engagements with communication genres in a struggling textile mill, we can, following Bauman (2000), examine how genres of communication and technology 'become the object of special ideological focus' in the mill. Technologies and their accompanying genres always enter a new place mediated by the meanings people make of them – their media ideologies of older technologies as well as the more recently introduced ones. Referring to media ideologies, Gershon (2010, p. 287) writes that,

> Just as language ideologies are inherently comparative, so too are media ideologies. As media scholars [Jay David] Bolter and [Richard] Grusin explain in their book *Remediation*, no medium is introduced onto an empty stage. Each new medium is instantly enmeshed in a web of media ideologies – old media determine how new media will be perceived. At the same time, every new medium alters how the already existing media are understood to shape communication.

In what follows, we examine how the knowledge required to make fabric in a struggling textile mill is likewise 'remediated' in that people make sense of new experiences by considering adjacent discourses as well as pre-existing agendas, values, meanings, and senses of who they are and what they value.

## Fieldwork methods and setting

This paper is based on research at Riverway, a pseudonym for a 150-year-old New England textile mill. Since 2015, the project has been led by anthropologist Caitrin Lynch.[4] The team includes faculty members in mechanical engineering and materials science; a rotating team of a total of ten student research assistants, all of whom worked in the mill (including co-authors Andrew Holmes and

Margaret Rosner); and co-author Adam Coppola, a post-graduate research assistant (a software engineer).

Lynch worked in all areas of the mill as a production worker for more than a year, which included attending weekly Production meetings and frequent onsite and offsite customer meetings. Lynch spent three summers with research students doing production work and engineering projects (focusing on efficiency solutions) in the mill. The students were mechanical and software engineering students and recent graduates; one was an anthropology major.

Concurrent with fieldwork, the team interviewed people involved in this mill and the wider industry, and Lynch attended several textile and apparel industry trade shows. The team coded and analyzed interviews using the constant comparative method to develop a codebook and employed co-occurrence tools and close reading to analyze trends. One particularly useful interview for this paper was a 'documentation tour,' in which students toured the entire mill with Frannie, an office worker in charge of the mill's Enterprise Resource Planning software. The aim of the tour was to inventory all forms of documentation used throughout the production process, from software entries and tagging to handwritten jottings.

At the time of writing, Riverway, a sixth-generation family-owned and operated knitting mill, is one of the few remaining textile mills in New England. Since the 1980s, Riverway has seen nearby mills shut down and move to places with lower capital and labor costs, including the southern United States, but especially overseas. In the first two decades of the twenty-first century, Riverway lost two different mainstay long-term customers, accounting for approximately 50% of its business, to production in China and South Korea. Riverway has laid off workers, shrinking from roughly 350 employees in the 1970s to fewer than 40 today; with that downsizing, the mill shifted from three shifts to one. There used to be a police detail at the complex's front gate during shift changes to direct traffic; now the largely empty lot's asphalt is broken, cracked, and mottled with weeds.

Riverway is not alone in suffering from global competition. Many US industries experienced a turbulent late-twentieth-century period of plant closings and outsourcing. Manufacturing fell from 27% of the country's GDP in 1950 to only 13.3% in 2000 (Smil 2015, p. 12). In textiles and garments, there was a loss of more than 900,000 jobs between 1994 and 2005 (USDA 2012). The textile industry workforce shrank by 67% from 1990 to 2010, and it declined in output by 47% between 2000 and 2010 (Atkinson *et al.* 2012, p. 28, Smil 2015, p. 137).[5]

Today Riverway makes fabric for small-batch niche customers for industrial use (such as filtration systems), for fire and military protective services, for pet supplies, and for apparel brands whose customers can pay well above Walmart and Target prices for clothing. Its business is focused on mass manufacturing consistent products without variability.

The bulk of Riverway's workforce consists of 'old-timers' in the textile industry; the three men featured in this paper were all in their mid to late 50s. Rather than using new technology, many older workers are more comfortable troubleshooting how to repair and run timeworn machines. Even using simple data entry on an Excel spreadsheet is difficult for some workers and often leads to operator error: one inaccurate click of the mouse can jump the user to the wrong cell, an unrecoverable problem until someone from the office is phoned to assist. The management, however, believes workers must embrace technological changes to 'be around in another 150 years' (a refrain we often heard; the president and other family members frequently invoke their desire to ensure the survival of the mill far into the future).

Riverway's management is faced with an aging workforce and a dearth of new experienced workers. It used to be that there were so many mills nearby, a worker could leave a job one morning and have a new job by the end of the day: in interviews, several people reported this as their own experience. From the managerial perspective, this meant management could easily expect to hire workers with relevant expertise and understanding of machinery and processes. No longer: Riverway's president, Chuck, says he can't find experienced millworkers, and after many failed attempts to recruit people in their teens and twenties into the field (even trying to partner with a local vocational high school), he has concluded that young people today don't want to work in textiles.

Management is actively working to figure out what kind of labor will weather these troubling times (a challenge exacerbated more recently by the COVID-19 pandemic). The mill has joined the growing trend in US business to hire temp workers for a trial period before committing to hire them permanently (Rogers 2000). Managers might have access to a large pool of potential workers, and they assume little risk in hiring them, but very few of these potential workers have relevant experience. However, some temps do have computer experience and computer-related aspirations.

New workers with comfort in digital technology may be able to easily work with digital workplace documentation systems that better align with supply chain standards – compared to the analog systems many of the old-timers employ. And yet, Riverway needs the old-timers, or the mill will lose experience and knowhow that nobody else has. Despite certain aspects of the production process that are digitized and modernized, many aspects still depend on old three-ring binders with blue-inked mimeographed or dot-matrix-printed instructions; clipboards with handwritten order numbers or measurements; old, printed tech sheets; and other inherited forms of expertise.

Riverway's employees possess vastly diverse comfort levels and experiences with computer technology. There are daily disagreements that result from these differences. Some people use the digital technology in their own analog way, for example by printing tech sheets and hand annotating them. In all cases, documentation processes and technologies have become a lightning rod for people to work out their identities and make sense of the value of their skills, expertise, experiences, and what matters most to them.[6] As Bauman describes, different forms of communication, documentation, and production technologies have become symbols of refusal of or celebration of attempts by managers or co-workers to regiment the workplace in the name of standardization. Bauman (2000, p. 86) writes:

> Prescriptive insistence on strict generic regimentation works conservatively in the service of established authority and order, while the impulse toward the widening of intertextual gaps and generic innovation is more conducive to the exercise of creativity, resistance to hegemonic order, and openness to change. These factors will be closely tied as well to hierarchies of value and taste (which genres are evaluated as relatively higher, better, more beautiful, more moral) and to the social regimentation of access to particular generic forms (who can learn them, master them, own them, perform them, and to what effect).

In Bauman's conception, standardization and regimentation in genres are conservative forces that foreclose the possibility of innovation and change. Furthermore, Bauman argues that processes of 'generic regimentation' include relative assessments of the value of some genres over others, as well as social practices that restrict or enable access to different generic forms. At Riverway, while managers were relatively new to the mill and used genres associated with the new economy, they nevertheless sought to foreclose creativity around workers' own genre work. The digitization of documentation was introduced by managers to ensure standardization in the final product; the managerial efforts were met with by workers who wanted to be able to bring to the process of making fabric their long-learned embodied knowledge and understanding that, they argued, cannot be standardized.

## Documentation genres in a new textiles economy

Because globalization requires more extensive monitoring of long supply chains, standard documentation practices have emerged among international textile manufacturers. They include high-tech industry-adopted software systems that track materials, machinery, and labor; instruct workers about product specifications; and document the labor and materials in the final product. At apparel industry trade shows, booths feature state-of-the-art software with capabilities including augmented reality that tracks garments from designer drawings to materials sourcing and production, all the way to the store shelves – accounting for every node in the supply chain.

'Producing' fabric in this way involves much more than the physical production of standard commodities; it involves participation in audit-minded supply chain systems that can keep track of and

categorize materials and machinery from various suppliers, transformations of inputs into products, regulatory compliance, and shipment of products. These systems require labor and communication among parties at different stages of production, and include communication among external producers, suppliers, and customers, as well as internal communication within the mill itself.

Even within a relatively small mill like Riverway, machine operators in each work center consult input documents to do their work, and they generate output documents to send to operators at the next work center. Some input documents, such as digital safety data sheets and physical tags, may be provided by the supplier or by the previous work center. Other input documents are provided by the mill's Enterprise Resource Planning (ERP) forms, a production manager, or the operators themselves in the form of handwritten notes or verbal instructions. In addition to documents that describe the current order, which are not typically used once the work is complete, machine operators also use static documents to inform their work (for example, machine manuals). Output documents include those that are given to the next work center or to the customer and logs that are kept internally for future reference.

'Enterprise Resource Planning' is a term for software that integrates all the different processes a business needs to run, so that inventory, accounting, human resources, customer relationship management, and more can be tracked and documented in one single software platform. It is used in all sorts of business contexts, not only textiles or manufacturing.[7] In the early 2000s, Riverway developed an Enterprise Resource Planning system that integrated scanner guns, desktop computer applications, and bar-coded tags to track products through each of Riverway's work centers: Receiving, Fiber Blending and Dyeing, Sliver[8] Making, Knitting, Shearing, Fabric Finishing, and Shipping.

The mill's production process is segmented into work centers, where different operations transform raw material ultimately into a final product that lands in Shipping for José, the 'love note' scribe, to pack and ship. Each work center (from Receiving through to Shipping) has its own input and output documents. An ERP system allows a manufacturer to continuously and in real-time track a product's state, including which work center it is in, its weight, its order number, the date, and more. This information, contained in a central database, eases the troubleshooting process and allows for productivity analysis at the factory level.

Before adopting this ERP system, Riverway had gone through a series of transitions for tracking information that is now contained in the ERP: handwritten notes, typewritten notes, computer-entered notes. Immediately preceding the adoption of an ERP system, Riverway used Microsoft Excel spreadsheets created by Frannie, who would create computerized reports – she knew which tables to look in, and how to use the data to generate meaningful figures and numbers. Frannie went on to build all the databases for the ERP system, automating away her responsibility for generating reports. In the ERP system, a set of 'relational' tables reference each other's values using keys. For example, there is a table of all the raw staple fiber used in the mill, each with properties such as weight and denier (the linear mass density of fibers), and each fiber is assigned an identification number. When another table has a fiber ID, it can access the fiber's properties on the original fiber table.

In addition to allowing relational data access, the ERP system allows employees to log 'transactions' (that is, changes to tables), so that the system can track what material has been used for what order and by whom. An order is tracked as a single entry in a database. When an operator begins to fulfill an operation for an order (blending, for example), the operator will 'punch out' the order from the database, then punch it back in when the work is completed. When the operator punches in, the ERP system logs a transaction and may request additional information about the state of the product, such as final weight and time spent on the operation.

We now turn to present two documentation-related conflicts at the mill to illustrate the power of documentation and communication systems to shape the experiences of work. We also show how people engage with each other around these systems and what the systems mean in the context of changing economic systems and values of labor.

## Conflicts and contexts #1: 'the Bible'

When we were first doing group fieldwork in 2015, we'd often find a technician named Tom working in the Knitting room. He's a white man, 56 years old, gray hair and mustache, belly barely held in by his jeans and plaid shirt. Tom would be working at a 40-year-old circular knitting machine that he affectionately called Lucy and referred to as 'she.' The pet name 'Lucy' always evoked for us the word 'loose' as a description of the quality of a well-running machine: no jams or hiccups and the motor, wheels, cams, and needles moving in a smooth, relaxed, and unhurried circle, selecting yarn, looping it, releasing fabric to spec and rolled up onto a tube in the center of the base. Lucy could make a variety of patterns of fabric, and Tom would set it up according to the specifics of a customer order: plain jersey, pique, double pique, double tuck, terry, Gouffre, interlock, rib, Lacoste, Ponte de Rom, and more.

One morning we came upon Tom setting up a new terry order on Lucy, but things weren't going well. Tom was resting his forehead on the machine, his eyes were closed, body still except for the slow and rhythmic rise and fall of his chest. He was trying to picture what the machine was doing, and why she was making runs[9] and holes. He lifted his head, walked over to his radio to turn off Mick Jagger. Back at Lucy, Tom peeked into his stitch counter, a little magnifying glass, and he used his dull pencil as a pointer to count and recount rows of loops ('courses'). Muttering something about carbon, wales, tension, and weight, he picked up a tech sheet that had instructions for this terry style and scoured the information on it.

A tech sheet tells Tom how the machine is supposed to be set up for the particular style: the needle arrangement, feed rate, yarn tension, and more. Tech sheets are white 8 ½ by 11 papers covered with printed diagrams, question marks, and numerical values, as well as greasy finger marks and handwritten notes in pencil and different color pens. The marginalia reflect different moments of consultation with the tech sheet. Most inscriptions fit within the designated spaces on the form, but some break the given structure. One tech sheet we saw had 'DUSTY DUSTY' written across the top, a possible warning from one technician to another, likely referring to carbon dust that is often generated when knitting carbon fiber.

Despite being marked by a history of use, the tech sheets don't capture all the information Tom needs. Sometimes the forms have not been filled out entirely. Sometimes, a field on the form would be filled out 'ASK,' as in, 'ask the manager' – the very person who created the tech sheet and gave it to Tom, and who wanted to figure out the best setup when Tom got to that point. The forms were also incomplete because certain factors for machine setup did not even have a spot on the form. Most importantly, there was no measure of yarn feed, that is, of how much yarn should go into the machines. Yarn feed is a basic measurement that impacts the weight of the fabric, an essential feature of a customer order.

And sometimes, despite setting up the machine with the exact same input conditions as on a prior run, a machine would suddenly begin malfunctioning. Tom told us that sometimes a machine is running great when he turns it off at the end of the shift at 3:00 pm, and when he turns it on the next day at 6:30 am, the fabric doesn't come out right. His explanation? Sometimes he attributed it to 'ghosts' or 'gremlins.' He had no explanation that made any more sense than that. Often, he simply shrugged. In this context, the paper tech sheets only suggested starting points for a textile style, and it was up to Tom to make the machines work.

A lot of what Tom did was based on trial and error, in response to what he saw coming out of the machine and to information he received from inspectors from the Quality department at subsequent stages in the production process. If the inspectors told him the fabric was coming out too heavy or light, or with holes or runs, Tom made adjustments. Considering the behavior of yarn and needles, environmental factors such as humidity, and the condition of Lucy herself, Tom would change the setup accordingly. He could figure out when it needed new parts, or lubricants, or a spray of air to unstick fiber from her innards. As Tom and some others in the mill would say, 'The machine tells you what it needs.'

On this fieldwork day, we watched as Tom tapped his foot, wiped sweat that was dripping from his hairline, and then reached in to fine-tune Lucy. Tom climbed up a ladder to tweak Lucy's quality wheel by inserting an Allen wrench to change the cams, each a smidgeon. His sweaty fingers started slipping and he muttered, 'Come on, just work this time.' 'Be nice to me.' He climbed down and reached up with his right forefinger to feel the yarn coming out of the cams. Waggling the yarn toward him, he checked the yarn tension. He nodded, then cranked Lucy to run her manually and leaned over to see what the needles were doing. He said aloud, 'This should do it,' and walked over to the green start button and powered her up, then leaned down and watched the fabric that Lucy pushed out. 'Please, please, this time you gotta help me out, Luce.'

We saw similar scenes play out day-after-day for months.

Tom graduated from high school and went straight from school to landscaping; he'd mow lawns in the summer, plow driveways in the winter. He arrived at Riverway about 10 years before us, and his motivation for the job change was that he needed to get health insurance and do less heavy manual labor.

Tom had been trained by Bobby, who started in textiles when he was 14 and had stopped working at age 72, just before we arrived. However, when Bobby retired, there were some skills that only he possessed, so sometimes the mill would call him in for help (and we had the chance to watch him work). During his time in textiles, Bobby had watched four successive mills he worked at cut down shifts, lay off workers, sell of machines, and eventually close. He found himself a new job each time. As Tom said to us in an interview,

> Bobby is old school and he's been in it all his life. And, he was the one that taught me. So, I learned a lot from him, old school way .... Hands on. Hands on. Ears open. Eyes open. Sometimes mouth shut.

When Bobby stopped working at Riverway, Tom gained autonomy in the Knitting room. In control of his own time, Tom could use his years of familiarity with Lucy, the knowledge he inherited from Bobby ('old school way'), and his many years of landscaping machinery operation and repair to problem-solve the daily disruptions of old machinery. He could spend hours alone, uninterrupted, playing with the parts of the machine, trying things out, seeing what happens. Scholars who examine work process and questions of expertise would see Tom's in-the-moment decisions and invoke terms such as adaptive expertise, supplemental working knowledge, and tacit and situated knowledge (Kusterer 1978). They might describe him as a craftsman, someone who has the ability to exhibit control and engage in 'situational decision making' (Franklin 1999 [1990], pp. 10–11), executing his own creativity as he works to create a final product that reflects his own skill and knowledge. And this is what Tom enjoyed: listening to Lucy, doing a craft, and feeling that the final fabric reflected and included his sense of self, his drops of sweat, his decisions, and his skill.

Tom's boss, Jim, however, was not impressed with Tom's approach to experimentation. In interviews and casual conversation, he often lamented to us that, 'We can't get the same fucking fabric twice.' Jim also invoked the term 'repeatability': both getting the same fabric off the machines throughout an order run *and* reproducing the same fabric when a past order is repeated. Jim considered the lack of repeatability a pervasive problem at Riverway, and he complained to us and his fellow managers and boss that the problem stemmed from poor documentation in the mill. As he told us, 'People don't write down what happens. There's not a good record-keeping system about, like, "This is what went *wrong* here. This is what went *on* here.'"

For his part, Tom told us that what he was doing resists documentation because it was an art. Jim disagreed, he thought making textiles is a science. 'Actually, it's math,' he corrected himself in an interview. Jim and Tom used to get in arguments for weeks, months, years on end about this.

For Jim, the answer to the question of 'Why can't we make the same fucking fabric twice?' might be 'Because we don't have good documentation processes.' Jim would want to document the math, especially one quantitative measurement: how much yarn was going into the machine. But for Tom, the answer might be,

> Because every moment is different. Every condition is different: the yarn, the mood of the machine, what the fabric wants to do, the humidity. I need to listen to what the machine is telling me and what the fabric is telling me and respond based on my experience.

In this way, Tom's explanatory model of what is happening with fabric, materials, and machines was very different from Jim's explanatory model. Jim explained it as a problem of poor documentation. Tom explained it as a problem of natural variability in the conditions of production. And these men with their different models were almost always at loggerheads.

We spent a lot of time in the mill with Tom, and we saw that Tom didn't have a documentable process. He consulted the tech sheets but didn't write anything on them – he didn't add his own decisions or tests to them. To Tom, a pencil was for pointing while counting courses, and nothing more. And we often heard Tom describe what he does as an art, or as a craft.

One summer we were at a meeting that Jim called because he wanted to advance the creation of new tech sheets that could capture and direct what Tom was doing; he hoped the engineering students on the research team could help. After a few minutes, Tom, realizing the purpose of the meeting, stormed out, slamming the door behind him. He later apologized and told us that he found it offensive that Jim believes that everything can be documented on paper. Tom considered this an insult that demeans his skill. 'They think anyone can walk in off the street, pick up a piece of paper and do this job,' he told us angrily. He also said he didn't want to write it down for reasons of job security: he worried that as soon as what he knows is documented, Riverway would no longer need him.

In that tense meeting, the focus had been on trying to create new and better tech sheets that Tom would use. At this point, Tom had a book, called a 'layout book,' which he would consult whenever a new order came in. When it was time to start a new order, Tom would receive tech sheets directly from Jim, but then he'd look at the layout book to supplement what Jim was telling him. The layout book was a forest green vinyl-sheathed-cardboard three-ring binder that included mimeographed papers, some dated 1967, a full 50 years before this meeting. Tom would look at this book, which he called 'The Bible,' for basic machine setup information that he felt he needed to go along with the tech sheets. He consulted The Bible for information that he considered unquestionable, unchanging truth. He treated the contents with finality, knowing that they would not be edited, and that the author was neither known and nor relevant – the truth was in the book.

Jim didn't like Tom using The Bible. As Jim explained in an interview, the layout forms only included 'pretty basic stuff,' because they were created back in an era when the mill made only a few styles, and 'They were all nylon-cotton based. They were low value. Nobody had put a lot of stock into repeatability.' And in those days, Riverway was thriving, they could turn away orders. In other words, back then the stakes were much lower about getting the order right the first time. The forms were good enough for then, but not for today's global business climate in which Riverway can only hope to compete on technical excellence. Today, Riverway is struggling to get and retain orders, always in threat of competition from lower bidders. And, Riverway makes fabric with material such as Kevlar and carbon fiber that sells at prices like $60 per yard. As Jim said, if it is only during Quality inspection that anyone determines that an entire roll is out of spec, this means money is going down the drain. Repeatability is an important component of today's high stakes game of US domestic textiles production.

When that documentation meeting took place, Jim was trying to get Tom to work with the student researchers to create a new sheet that would track information, leading to more fabric repeatability. Most importantly, that new sheet would note the yarn feed. A few months after this meeting, Jim took away Tom's layout book, hid it, and started to provide Tom with new tech sheets that Jim had designed himself.

Later, Jim explained to us why he took away Tom's Bible. It was because 'we weren't measuring properly what was going into the machine.' And, he explained:

> Because it, because I wanted to, not that he would have done anything bad with the layout book, but I was trying to get him into a new way of, of looking at things. So, the layout book had no measurements of, of,

> um, you know, yarn feed, measuring the yarn going into the machine. But, really what it got down to is the book, the book had nothing in there that would make Tom make the fabric any better. The, the information was so basic.

Jim started giving Tom new tech sheets that Jim had designed, which included more information than the old ones, and, Jim explained, 'showed them what they did the last time, which the book never did.' Without a history of proper documentation, though, it would take time to build up a full history of 'what they did last time.' Tom began to use the new tech sheets Jim gave him, and Tom could still use his memory, intuition, and a trial-and-error approach. But he missed The Bible. Though he enjoyed the troubleshooting process, day after day he was frustrated by out-of-spec fabric, by rejections coming to him from inspectors, and by Jim's constant complaints. Tom didn't need to use this new system very long because a new employee arrived, bringing with him even more sophisticated tech sheets, and, more importantly, math.

## Conflicts and contexts #2: responsive 'smart' spreadsheets

A year after the contentious meeting between Jim and Tom over improving tech sheets, we were back at Riverway. In its search for new markets, Riverway had invested in a new circular knitting machine to fill a promising new set of orders. Tom had moved into another area of the mill, where he was the supervisor, to make way for Stan, a new head Knitting technician hired for his experience with the kinds of machine Riverway had newly purchased. Stan was white, 55 years old, a college-educated engineer, always neatly dressed in collared shirt and khaki trousers. Any grease he picked up would be contained to his work apron. In the search for cheaper labor, the knitting mill where he had worked for 15 years had recently closed and moved some operations to the U.S. South, where labor is not unionized, and others to Mexico. In his former job, Stan had been the head Knitting technician, leading a staff of several dozen.

One day, three of us researchers headed over to the small office that Stan and Tom shared, their desks facing opposite walls. Papers, notebooks, boxes of tags, machine parts, yarn cones, fabric swatches, and Dunkin' Donuts cups were on every surface, except for Stan's desk, which was clear and neat. Tom and Stan were each sitting at their desks, back-to-back, their chairs nearly touching. Tom was talking to a machinist and an operator who were standing in the doorway, discussing the best way to prioritize orders that were coming through. Each of them spoke louder than the person who spoke before, and the office was just off the production floor so there were many competing sounds.

The noise level was a problem for Stan, who sat with his back to Tom's discussion, looking quietly at his computer. He told us later that it was hard to get computer work done with so much talking all around him, and as he scrolled through his computer files to show them to us, we could see that his Excel tables contained mostly blank cells. The spreadsheets are intended to capture critical information about the yarn Stan was using on different machines, such as the suppliers' names, what materials it is made of (wool, cotton, Nomex, polyester, Kevlar), what colors the yarn comes in, and denier. But today the spreadsheets are mostly blank because this information has never been captured before. Doing so is Stan's mission.

When he came to Riverway, Stan not only brought his expert knowledge of the industry but he also brought along a digital toolbox of forms, including tech sheets. He explained to us that these digital forms are so common in the industry that he's not breaking any non-compete agreements by hanging on to them. The forms he brought with him are not mill-specific, but instead are industry standard. In fact, he was shocked to arrive at Riverway and discover that as late as 2017 they were not using digital tech sheets.

The ERP that Riverway uses was not originally for the textile industry – and nobody had yet developed digital tech sheets to use within that system. Stan immediately decided to put together a database, using Microsoft Access, and with it to usher in a new workflow. Riverway's ERP, with its scanner guns, barcodes, and Excel sheets, helped with inventory management. But there

was not yet a computerized system about how to set up machines to get the specifications for an order. Stan decided to make these forms using Microsoft Access, a relatively straightforward database system, because he had used Access at his prior job.

Stan wanted to create a digital database of tech sheets including relational tables for supplies such as yarn (containing information about fiber content, weight, color, and supplier). A table of knitting jobs draws on the yarn table information to automatically create tech sheets: it only needs to know the ID number of the yarn, and it can grab whatever information it needs about the yarn. The power of 'relations' is in saving time through automatic lookups; the operator does not need to search for information, rather, it comes up automatically when an order number is punched in. Moreover, the relational table can calculate the relationship between the yarn's tension, the motor speeds, and the feed rates, which automates the manual method we so often saw Tom doing. These tables could also be integrated with the ERP system if desired.

To get Tom to use better tech sheets, Jim had taken away Tom's Bible and tried to get him to use sheets that accurately measured the correct information, most essentially, the yarn feed. But now that Stan arrived, Jim gave up on the sheets he was trying to make. As he explained in an interview, 'When Stan came in, I dropped all those sheets and I went to his form because he had a much better form.' Jim explained that now, 'More than 95% of the time, Stan's way is the correct way.' Why, we asked? 'Because he is using math.'

When we first started doing fieldwork, we would often see Tom standing for hours in front of a knitting machine like Lucy setting it up to produce a new style of fabric. Tom used his years of experience working in the mill, and also doing manual labor elsewhere for many prior years, plus his love of troubleshooting and his perseverance to guide him as he used his hands, hardened from a lifetime of hard work, to complete the task. In knitting, 'tension' refers to the tightness of the yarn being fed from spools into the machine, and thus how much yarn is going into the fabric per area of measurement. It is one of the most important variables in knitting: consistent fabric production requires tension to be accurately controlled. To check the tension of the yarn, Tom would carefully slide his fingers down the length of yarn feeding into the machine. 'Let's see where we are at,' he would say and then, with the application of light downward pressure from the underside of his fingers, he would run his fingers up and down the yarn. His muscle memory was the tool he used to inform his measurement.

In comparison, Stan would sit in front of his office computer preparing to set up another machine with a new style. In contrast to Tom who would stand and lean on Lucy (watching, touching, listening), Stan would sit in front of his computer like it was mission control. Stan had an Excel spreadsheet open in front of him and embedded in it were the formulas he would use to set up the new machine. These formulas take standardized measurements to calculate the necessary parameters for machine setup.

These values that are calculated through Stan's spreadsheets are calculations that a person could make, but a computational tool renders those calculations more accurate, quicker, and less computationally burdensome. It also automates an operation that generations of early knitting technicians had previously done with a combination of pen, paper, observation, and the use of muscle memory by touching the yarn and fabric.

Stan's spreadsheet would be useless without accurate data that gives its algorithms meaning. To collect tangible data, Stan takes a small handheld 'tensiometer,' called a Zivy, and touches it to the yarn as it feeds into the machine, to measure the yarn tension in standard units of Newtons. Riverway has had a tensiometer, but when Stan arrived, the Riverway Zivy was collecting dust in a corner, because Tom's method, and the method of Bobby who had taught Tom, was to measure the tension by how the yarn feels to the technician's touch. In fact, Jim had purchased the Zivy a few years prior to Stan's arrival, but nobody had ever bothered to use it.

Under Stan's supervision, the Zivy became necessary because the tension must be precise (with some tolerance) for the digital spreadsheets to produce useful results. Stan's spreadsheets use the specific numerical value captured by the Zivy. Before Stan introduced his spreadsheets and the

formulas within them, tension was qualitatively considered by Tom using his muscle memory. This was a skill Tom proudly developed through years of practice. Tom considered the handheld detection of tension to be a key skill that demonstrates his mastery of the job. This skill is part of what brought meaning to Tom's work, and the introduction of Stan's new responsive 'smart' spreadsheets forced Tom to change how he thought about his own skills and expertise as well as his identity as a worker.

Like Jim, Stan didn't respect Tom's methods. He told us, sarcastically, that by running your fingers along the yarn as the machine is on, as Tom does, 'the only thing you measure is how many fingers you can cut off.' The combination of the Zivy, the Excel spreadsheets, and the database executed the same functions for which Tom was using muscle memory, but Stan's method performed it with standardized units that allowed for better (quantifiably more accurate) prediction of overall production line throughput, no longer relying on Tom's trial-and-error approach. Stan was proud of his application of science and math to the problem of knitting machine setup.

That day we were with Tom and Stan, back-to-back in their office, Tom concluded the meeting with the two floor workers who were standing in the doorway by instructing them to employ learning-by-experimentation: 'Alright, go try that out and let me know how it goes.' Tom then turned around and glanced over Stan's shoulder. Stan was on his computer, transcribing numbers from a binder into an Excel spreadsheet. In an interview earlier in the day, Tom had told us that he wants to learn how to do what Stan is doing, and we recognized that desire in Tom's wistful facial expression as he looked over Stan's shoulder.

Tom had described to us that Stan's paperwork has led to new processes in other areas of the mill. When Tom was the head Knitting technician, he'd get feedback from the inspecting room about the fabric he had made, and then he'd engage in some tweaking and trial and error on Lucy or other machines. All that is unnecessary under Stan's approach, because Stan's approach anticipates margins of error. Stan's numbers mean there is no need to experiment: the fabric will come out right if the machine is set up according to the paperwork. Stan came in with a computer and changed things up, ending the era of experimentation. The math and algorithm-driven paperwork was now in control.[10]

Even though Tom had moved from the Knitting room to another department, Stan's approach made Tom uncomfortable. Tom felt like he was losing control over an area of competence that provided great enjoyment: tinkering, experimenting, making decisions. Tom had liked working in Knitting on his own. He liked being his own boss and he didn't want a machine, a computer, or a piece of paper to control him. And, he didn't want to write things down, because he wanted to protect his job. For so many reasons it was important to Tom to believe that his job as a knitting technician could not be codified in a computer, or in any book or piece paper (never mind smart responsive predictive 'paper' of a database). He would have preferred being back in Knitting over being a supervisor in another area of the mill, but the Knitting department didn't need two technicians. Years ago, two technicians might have been needed, but not today when so many machines are idly collecting dust because of a dearth of orders.

When we asked Tom how he felt about Stan's new smart tech sheets, Tom said he felt like he's 'a dinosaur and being pushed out.' But his coworker who was nearby during this conversation corrected Tom and said, 'This whole mill is a dinosaur.'

We can see what Tom's coworker meant. Given the state of technology adoption in the global apparel industry, Riverway is a dinosaur in the age of robots. Stan's predictive paperwork and Tom's experimentation were different approaches to making fabric that reveal a struggle between old and new and point to the efforts of some people at the mill to use twenty-first century technology to keep this nineteenth-century mill going. Tom didn't want to be controlled by machine-generated paperwork. He wanted to be the one in control. But it looked then like Tom was losing out in the competition between dinosaurs and robots (by which he and his coworker really mean a battle between people and machines, or between human intuition and computer-generated automation). Tom just hoped to hold on to this job long enough so he could work until he was old enough to

retire and collect Social Security. This dream would depend on if Stan could ensure that Riverway can 'make the same fucking fabric twice.' If 'repeatability' were achieved, maybe more orders would come in, and the mill would keep needing labor. Given that the president couldn't let Tom go if there were no willing replacement workers, this suggested to us that Tom's retirement schedule might work out.

For Stan, a textile mill can and should be a paradigmatic example of the triumph of 'prescriptive technologies' (Franklin 1999 [1990]). Stan came to Riverway with his predictive mathematical responsive spreadsheets and changed the nature of the job for a number of people in the mill. Stan's digital toolbox of forms included tech sheets with the same purpose as instructions for a new order that Tom had been getting from Jim, his manager. Stan's tech sheets were the latest in a line of paperwork at Riverway, each with their own histories of people, processes, and products written onto on them, in pencil marks, blank boxes, and grease smudges. And the format of the papers at Riverway also reveal a history of technology: Tom's earliest versions were dated 1967 and come from mimeographed papers. Tom also frequently consulted with forms that were dated 1990 and created with a word processor, then printed with a dot-matrix printer and annotated with handwriting. And now there were these predictive mathematical responsive spreadsheets that work with a Microsoft Access database and Microsoft Excel spreadsheets. This set of three very different forms of documentation has resulted in debates and struggles, advocates and detractors. When we interviewed Tom about his Bible, we brought the Bible with us – Jim lent it to us. Tom caressed it on the table in front of us, indicating his affection for and attachment to it, like he was reunited with an old friend. These forms of documentation embody a history of relationships among people and between people and machines and fabric. They also embody changing notions of and experiences of skill, knowledge, process, and the value of fabric and the value of work.

## Technology and mindsets

The metallurgist and physicist Ursula Franklin analyzed how technologies have affordances for different social and cultural systems.[11] Technologies are not merely engineering and design solutions, but rather different technologies enable different types of behaviors, relationships among people, and processes. Franklin wrote,

> Technology is not the sum of the artifacts, of the wheels and gears, of the rails and electronic transmitters. Technology is a system. It entails far more than its individual material components. Technology involves organization, procedures, symbols, new words, equations, and, most of all, a mindset. (Franklin 1999 [1990], pp. 2–3)

With her emphasis on 'mindset,' Franklin highlighted how technologies cultivate ways of interacting with the world; they afford different kinds of beliefs, attitudes, dispositions, and value systems. Franklin considered technological change to be a means through which social systems have been devised that enable more or less social justice and human agency. Franklin distinguished between *holistic technologies* (typically used by craft workers or artisans) and *prescriptive technologies* (associated with a division of labor in large-scale production). These two kinds of technologies are distinguished by the extent of worker control over work process. Holistic technologies allow artisans to control their own work from start to finish. Prescriptive technologies organize work as a sequence of steps requiring supervision by bosses or managers. Franklin argued that the dominance of prescriptive technologies in modern society discourages critical thinking and promotes 'a culture of compliance,' and she referred to prescriptive technologies as 'designs for compliance' (Franklin 1999 [1990], p. 16). Franklin described the difference as follows:

> Holistic technologies are normally associated with the notion of craft. Artisans … control the process of their own work from beginning to finish. Their hands and minds make situational decisions as the work proceeds, be it on the thickness of the pot, or the shape of the knife edge, or the doneness of the roast. These are decisions

> that only they can make while working. And they draw on their own experience, each time applying it to a unique situation. The products of their work are one of a kind. However similar pots may look to the casual observer, each piece is made as if it is unique … . Using holistic technologies does not mean that people do not work together, but the way in which they work together leaves the individual worker in control of a particular process of creating or doing something. (Franklin 1999 [1990], p. 10–11)

Franklin argued that artisanal workers may specialize in particular products, but they don't divide up the tasks that make up the products. They are 'in total control of the process' (Franklin 1999 [1990], p. 12). By contrast, assembly-line workers laboring under prescriptive technologies specialize in a step in a process.

Employing prescriptive technologies, Riverway aims to produce a standardized body of work that can be shipped to customers, with one run of the same order indistinguishable from another. At Riverway, the goal is to produce standardized (or, 'repeatable,' per Jim, the manager) fabric. In commercial textiles, natural variations do not add aesthetic or commercial value. Instead, they result in fabric that is considered defective, with problems such as heavy weight, press-offs, holes, streaks, and end-outs.[12] Although consistency is a managerial goal at Riverway, that goal is not always shared by employees. Tom, who reveled in the muscle memory he leveraged at work, sought creative and artistic value in his work. By embracing virtues of craft and creative thinking, Tom, and others like him at Riverway, have tried to resist what Paxson (2013) refers to as the 'steady creep of standardization' in a work setting where consistency is the goal. Prior to Stan's arrival, Tom had been able to find moments in the work process where he could insert creativity and playfulness into his job.

Consider José who inscribed 'Love U' on a roll of fabric before shipping it. José worked in the Shipping department at the end of the production line. He measured and rolled finished fabric, sprayed it with an air hose to remove any stray particles and yarn, and packaged it for shipment. José was an artist at heart. His cartoons could be found all over the mill, on old chemical barrels, on the walls, and around his workstation; when new graffiti materialized, fellow employees instantly recognized the distinctly 'José' look (strong lines, a lot of black and white, big eyes, vivid cartoon depictions).

In an interview with us after he was reprimanded by the mill president, José explained why he wrote 'love you' in the fabric. He said he likes to play sometimes at work to forget the monotony of the job: 'You got to play some to forget things, you know, not because you want to play. You say things, you do things just to … ' José paused and rephrased, 'You're not going to stay over there and cut, cut, cut all day, you know.'

Like Tom, José is an example of an employee who sought creative and artistic value in his work. Key to craftsmanship, Paxson explains, is the idea first elucidated by designer Pye (1968), that,

> Working with irregularities, even turning them into virtues of design, generates the diversity of form that Pye identifies as the chief value of craftsmanship in an industrial age. In this way, craft resists the steady creep of standardization in a global market. (Paxson 2013, p. 133)

When José said 'cut, cut, cut,' he was referring to a standardized method of work; his playfulness was a critique of and resistance to that standardization. Jim the manager would undoubtedly object to this instance of yet another barrier to his goal of repeatability.

In his playful efforts to put his own self into his final product, José reaffirmed an element of holistic technological practice: that he wanted to be in control. He wanted to make decisions, use his creativity, exercise his distinct skills, and see this process reflected in the final artifact. We heard the same from Tom, after he got moved out of his job as Knitting technician.

Franklin argued that in environments where prescriptive technologies have become the norm, people have become acculturated to the notion that it is not appropriate for a worker to use imagination, situational judgment, and invention. When José inserted his individual creativity into a prescriptive labor system, he went against received notions about the control of the work

process and the final product. Naturally, then, in this work arrangement, he would have been reproached.

José not only resisted the standardization of *product* in a work setting where standardization is the goal. He also resisted the standardization of *process*. We see in his playfulness an assertion of self and a refusal of compliance and external control. José's story is an example of someone pushing against technologies that are 'designs for compliance,' where managers consider external control normal and necessary.

Riverway's management allowed, at times unwittingly, moments in the work process where José, Tom, and others could insert creativity and playfulness into their jobs. But when a manager like Jim lamented that 'we cannot make the same fucking fabric twice,' he was expressing frustration about non-standardization creeping into the workplace. Jim did not want to risk making fabric that is not correctly made and therefore not sellable, after all the work of going through the entire mill, from Blending and Dyeing, to Knitting and Finishing.[13]

Stan's state-of-the-art process controls, manifest in Stan's industry standard paperwork, should have promised Riverway's management hope of lowering the risk of producing damaged fabric. However, in so doing, they would have raised the risk of workers like Tom and José being unhappy and dissatisfied with work. Math, not humans, would now be in control. Even Quality inspectors would have less work to do, fewer opportunities to use their judgment and make decisions.

In the stories of José, Tom, and Stan, we see three very different men bringing their own values into their engagement with technology and documentation practices in the workplaces. In their interactions with technology and documentation at the mill, they each brought their personal senses of who they are, and what matters to them. Here we consider each man in turn.

José emphasized enjoyment, love, and art. He embraced 'play' as a response to monotony. José participated in all the documentation he was required to do with the computer, inventory gun, and tagging system. When fabric reached José, and passed his final inspection, it had passed all Quality Control stages and was ready to ship. But in writing his 'love note,' José asserted his individuality and his independence from the elaborate documentation and regulation system that surrounded him. Certainly José was not a modern-day Charlie Chaplin in the film *Modern Times*, a cog in the wheel of industry.

Tom emphasized problem-solving, working with (and not controlling) machines. He delighted in a curious sense of mystery and not-knowing (even with participation by ghosts and gremlins), and he brought his full embodied self to his work with Lucy, a personified machine with whom he engaged in a daily dance of push and pull. And Tom refused to write anything down both because art is not documentable and because he wanted to protect his job security.

Stan brought to work his identity as an engineer who could control machines with the rational use of math and science. For Stan, human affect and decision-making was irrelevant at work. Humans do not need to think, except the one human who created the database. They just need to stick with numerical data and metrics and follow what the machine (the computer or the knitting machine or the Zivy) tells them to do. The resulting fabric will be flawless.

## Conclusion: individuals among communication genres

In his 1975 book *Working*, the journalist Studs Terkel wrote:

> [Work] is about a search … for daily meaning as well as daily bread, for recognition as well as cash, for astonishment rather than torpor; in short, for a sort of life rather than a Monday through Friday sort of dying. (Terkel 1997 [1975], p. xi)

In many workplaces in the United States, employees strive for these ideals in the face of technologies of workplace communication, organization, and discipline that daily restrict their ability to achieve recognition or astonishment. An ideal workplace might enable workers to feel a sense of accomplishment, to have regular challenges to meet, to experience a sense of mastery and control, to

have social interaction and friends, and to feel that they are recognized for who they are and what they can do.

All three of the Riverway men featured in this paper, all in their mid to late 50s, sought recognition and expertise at a workplace that struggled to stay in business as they individually fought to stay employed and relevant as they grew older.[14] These men saw daily reminders of the precarity of the mill. Inside of work, they would see a disintegrating building, ancient machines, dusty yarn, closed-down workstations, and empty loading docks, and they would hear convincing stories of ghosts inhabiting the same space as them.[15] In nearby towns, they could see once-thriving mills converted to condos or overgrown with ivy and weeds. And they saw technology being leveraged by managers as a response to precarity, an attempt to improve the efficiency and quality of production in the fight against global competition. They'd repeatedly hear from management that communication and process improvements would be the key to Riverway's survival.

In this context, communication genres (tech sheets, hand-written notes, and spreadsheets) became a lightning rod for manager and worker response to changing notions of expertise, to changing understandings of individual contributions, to changes in recognition of the value of different kinds of skills.[16]

In this mill, one of the few surviving textile mills in New England, workers interacted with new technologies as they made sense of and asserted their wish for creative control in the context of a precarious workplace – and of their own aging and accompanying worries about obsolescence of their skills and talents and employability. But none of this was easy. Tom felt like a dinosaur in the face of Stan's computer wizardry. José was reprimanded for writing a love note on the final product. And Stan ultimately left Riverway, unable to convince those around him to embrace the transition to smart data sheets. Tom then spent some time trying to figure out what Stan had been doing with those data sheets, but soon things just went back to how they had been before Stan arrived. The stories we have shared of the conflicts over a love note, over a refusal to document work, and over a desire to transition to computational 'smart' data sheets all show how communication genres become arenas for people to make sense of and assert what matters most to them in a high-stakes environment where jobs are on the line.

Our fieldwork showed how the different communication genres used at Riverway, such as responsive 'smart' tech sheets, became a 'vehicle for encoding and expressing particular orders of knowledge and experience' (Bauman 2000, p. 85). Though the conflicts we have described appeared to be arguments about how to deploy technology to track information to make standardized fabric (how to make the same fabric twice), there was much more at stake than an attempt to pump perfect fabric out of the mill. These were arguments about changing estimations of the value of expertise, about the relative role of human touch or automation, about the role of documentation and efficiency compared to a way of being and doing that was more ephemeral and indescribable. When José put in his own personal touch, his 'Love U' maker's mark, he asserted the primacy of the human touch in a place where the battle between human touch and automation is being fought daily. When Jim took away Tom's Bible, he was insisting on the need to side with standardization, not 'old school' passed on wisdom. And Jim was ultimately willing to defer to Stan because Stan showed up at Riverway with a system that is the ultimate in standardization: it's math, it's putatively outside of ideology, it's even more valuable than science.

At Riverway, communication genres are the quotidian arena in and through which values around tradition and change are worked out in everyday practice. Genres for the standardization and regimentation of production were introduced by management to create processes aligned with mathematical certainty and thus supposedly impervious to human error. Stan and Jim presented smart spreadsheets as one such genre, and thus as incontrovertible and accurate, and valuable for foreclosing human decision-making and error. But, as we have shown, workers resisted this genre, instead asserting the value of their long-established open-ended, embodied, improvisational techniques. In the end, or at least for now, human improvisation beat out mathematical certainty with Stan's departure from Riverway. After Stan left, Jim's frustration about the lack of

'repeatability' in fabric stayed on, Tom was back to working with Lucy, and José continued to find artistic ways to do more than simply 'cut, cut, cut all day.' Richard Bauman's arguments about 'generic regimentation' aimed to link standardization and norms with efforts by those in power to tamp down on innovation and preserve tradition. In the Riverway case, while managers aimed to institutionalize some conventional signs of innovation (for example, math, science, and computers) as signs of a leading approach, they nevertheless aimed to impose such innovation by precluding the creative traditions of worker-sanctioned, embodied, everyday innovation (borne of earlier managerial-imposed forms of standardization) that managers blamed for the creation of out-of-spec fabric itself.

## Notes

1. The person named 'Rob,' and his activities once he received the roll of fabric, are largely fictionalized to convey the customer experience, as are the specific words Chuck used in conversation with José. However, the story about the creation of the 'Love U' fabric, the customer complaint, and the aftermath is based on fieldwork interviews, discussions, and observations at Riverway and at the customer's facility, with Chuck, José, and the customer. The analysis of José in this paper is indebted to analysis (with a different focus) that Caitrin Lynch has done with Debbie Chachra (Lynch and Chachra, under review).
2. Communication genres in organizations can be defined as

   > socially recognized types of communicative actions – such as memos, meetings, expense forms, training seminars – that are habitually enacted by members of a community to realize particular social purposes … . A genre established within a particular community serves as an institutionalized template for social action – an organizing structure – that shapes the ongoing communicative actions of community members through their use of it. (Orlikowski and Yates 1994, p. 542)

   We will argue, however, that genres can become more than merely habitual enactments, as this definition suggests.
3. We use the term 'genre ecology' after Spinuzzi and Zachry:

   > A genre ecology includes an interrelated group of genres (artifact types and the interpretive habits that have developed around them) used to jointly mediate the activities that allow people to accomplish complex objectives. In genre ecologies, multiple genres and constituent subtasks co-exist in a lively interplay as people grapple with information technologies. (Spinuzzi and Zachry 2000, p. 172)

4. Caitrin Lynch was PI of a grant that supported the entire team National Science Foundation, Standard Grant: Textiles, Technology, and the Return of Manufacturing in the United States. Award Abstract #1654944.
5. These statistics are prior to the COVID-19 pandemic, which further impacted the industry. A November 2020 report (Friedman 2020) indicated that 5.8 percent of US textile/garment supply chain manufacturers 'are likely to face severe risk' due to pandemic-related manufacturing downturns. A May 2021 (Just Style 2021) industry article about the US textile and garment industry noted that 'Covid-19 has created unprecedented demand destruction for apparel and textiles.'
6. Similar to our use of the term 'lightning rod,' Prentice (2019, p. 360) describes PowerPoint as a 'social crucible.' We are indebted in this paper to Prentice's analysis of how values inhere in and are played out in PowerPoint in Korean offices.
7. Today's ERP systems can be traced back to manufacturing tracking systems of the early twentieth century, but the term 'Enterprise Resource Planning' appears to have emerged in 1990. See Dechow and Mouritsen 2005; Elbanna 2006; Grant et al. 2006.
8. 'Sliver,' which rhymes with 'diver,' refers to long bundles of carded fiber that are fed into knitting machines for thick, fluffy, pile-knit fabric.
9. A 'run' is like a line with no fiber that runs down snagged tights or pantyhose.
10. Though, in reality, that paperwork is not failproof. Unanticipated factors, such as the humidity of the knitting room, can impact the fabric. (This is not a highly climate-controlled mill.)
11. The following discussion of Ursula Franklin's work is indebted to analysis that Caitrin Lynch has done with Debbie Chachra (Lynch and Chachra, under review).
12. Heavy weight, press-offs, holes, streaks, and end-outs are terms that describe defects in fabric that can result during production: fabric that exceeds the weight required in the spec; portions of fabric where there is too much yarn; sections where there are holes/gaps created by malfunctioning needles ('press-offs'); or vertical lines with missing yarn ('end-outs').

13. Cf. Pye's (1968, p. 20) 'the workmanship of risk,' by which he means 'workmanship using any kind of technique or apparatus, in which the quality of the result is not predetermined, but depends on the judgment, dexterity and care which the maker exercises as he works.'
14. Cf. Caitrin Lynch 2012 for an ethnography of aging and work in another factory setting in the United States.
15. For a discussion of ghosts at Riverway and in the adjacent abandoned mill, see Lynch and Coppola, in press.
16. Cf. Prentice 2019, p. 353, regarding PowerPoint in Korean businesses where 'everyday activities like drafting documents are potent sites for encountering tensions between the individual and the institutional.'

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