In Memory of the Q-File

Spontaneity, Digital Automation, and Deskilling in Theatre Lighting

Martin Young

A Thorn Q-File Electronic Lighting Control Console, complete with circuit mimic.

When Thorn Lighting closed down its Theatre Lighting Division in 1981, Divisional Manager T.W. Shaw published a farewell statement in a trade magazine expressing pride in having contributed to "what could well be the most historic era in this branch of the dramatic arts" (1981:2). The era in question, from the mid-1960s until the end of the 1970s, might struggle to lay claim to such lofty historical exceptionalism in most accounts of theatre's development, but in his own particular field Shaw's immediate retrospective assessment carries some weight. Though critical discourses of digital theatre have not afforded this period any particular significance, it is nonetheless a key turning point: one of Thorn Electric's major products, the Q-File lighting console, signals the introduction of digital technology to the production of live theatre.

In the mid-1960s, other "backstage" work, such as the movement of scenery, was achieved mechanically through the manual efforts of a disciplined team of workers (just as it had been a century earlier and, certain developments notwithstanding, still largely is). Sound was played from

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tapes or created live. Projection used physical slides. In the wider sphere of theatrical production, scripts were typewritten, box office bookings were taken by telephone, and rehearsal schedules were posted on notice boards. Throughout the 1980s, theatre production would be influenced obliquely by the computerization of the logistics industry and the growing availability of digital calculators, watches, and word processors, but stage lighting control—by some margin—was the first introduction of digital technology into theatrical performance.

Though antecedents can be identified, the launch of Thorn Electric's Q-File in 1967 is generally agreed to be the first viable use of digital memory in lighting control (Reid 1987a; Simpson 2003:356). The Q-File was developed by Thorn at the instigation of the BBC to meet the needs of television studios but quickly found use in theatres owing both to the huge improvements it offered in the technical capacities of lighting—allowing for the precise and coordinated control of multiple fixtures—and to its reliability. Even Frederick Bentham, a leading engineer for Strand, Thorn's chief rivals in technical innovation, was forced to admit: "when the historian one day takes up his pen he will have to say that ready acceptance of Q-File for the theatre sprang from the fact that if at that time you wanted a memory system which worked you had to have Q-File" (1980:157). And yet surprisingly few historians have been motivated to take up their pens (or keyboards) and pursue this as anything more significant than a niche detail of technological development.[1] As a historical landmark in the digital production of performance, the Q-File *should* hold some self-evident significance for how we discuss performance and the digital today, yet its relevance to current discourse seems peripheral at best. Why are these discourses ambivalent towards digital technical equipment? An alternate paradigm for understanding digital performance that has labor processes and the demands of capitalist industry at its heart is overdue.

Theatrical Performance and "the Digital"

When digital computer technology is so integral to ordinary theatre-making, what does the analytical category of "digital performance" offer, and what practices does it lay claim to? There is a wealth of critical scholarship within theatre and performance studies on digital performance or the relationship between performance and the digital, but these concepts remain difficult to pin down. Bill Blake demurs from offering any concrete definition of his subject in *Theatre and the Digital*, positively designating it "a completely unspecified concept" (2014:5). In their landmark book on digital performance, Steve Dixon and Barry Smith give the following gloss: "We define the term 'digital performance' broadly to include all performance works where computer technologies play a *key* role rather than a subsidiary one in content, techniques, aesthetics, or delivery forms" (2007:3). The capacious scope of Dixon's study pointedly excludes the increasing application of computer technology to backstage departments like lighting, sound, flying, etc. The areas of research that now dominate in the study of digital performance are live broadcast, social media, motion capture, and virtual reality, and the integration of audio and image into live performance through projection,

Figure 1. (previous page) Promotional image of the Q-File in use; a clean and compact desk providing a strong contrast to earlier boards and consoles. Detail from the Thorn Q-File brochure (1969).

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1. Some accounts of this history that have informed this article include, in addition to the already cited sources, Sandström (1997:15–19) and Halliday (2012). Technical documents relating to the Q-File are freely available online as part of the Backstage Heritage Collection at www.theatrecrafts.com/bhc/equipment/thorn-q-file.

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screens, and headphones. Beyond these technologies, critical accounts of digital performance tend to address recurrent themes, including liveness, authenticity and artifice, the social impact of technology, posthumanism, interactivity, and immersion. It is this constellation of research interests that determines the boundaries and constitution of digital performance as a subdiscipline in practice where no such delineation is possible in theory.

In recalling the Q-File, and so tracing the incorporation of digital technology in performance back to its industrial origins, I am steering away from a habit of equating "the digital" with newness and futurity. But I am also attempting to avoid the tendency to historicize digital performance by reducing it to certain aesthetic and formal trends, an approach that prompts scholars to look back decades or even centuries before the advent of digital technology. Such a project obviously entails a process of selection with regards to what the essential qualities of digital performance are, and it is noticeable that with the turn of a page, Dixon and Smith's "genealogy of digital performance" becomes a "history of multimedia performance and its antecedents" (2007:37–38). As such, they, like Matthew Wilson Smith (2007) and Chris Salter (2010), locate digital performance within the tradition of Wagner's 19th-century *Gesamtkunstwerk* (in which, of course, computer technologies played neither a key nor a subsidiary role).

A comparable genealogy is suggested more recently by Nadja Masura, identifying early 20th-century theatre-makers who experimented with projected images as "the most significant precursors of Digital Theatre" (2020:3). Looking back further still to antiquity, Kara Reilly asserts that "Digital performance has a rich history extending back as far as the *deus ex machina*" (2013:1). The question remains: *what* makes these practices the precursors to digital performance? Does "digital performance" denote anything more than the use of theatrical apparatus to render spectacle and incorporate visual elements? Susan Broadhurst similarly identifies digital performance as Gesamtkunstwerk, though for her the concept is not a historical antecedent but a dehistoricized category indicating an "insistence on free creativity, invention and experimentation [that all] correspond to such Dionysian features as immediacy, disruption and excess [...T]he digital by its very nature is open to a multilayered system of interpretation [characterized by] an exploration of the paradoxical and open-ended nature of reality" (2007:10).

Where, then, does this leave the Q-file, a device produced in the late 1960s for the comparatively prosaic task of accurately recording and recalling lighting dimmer states? There is potential for miscommunication here, because a separation has opened up between "digital" as an ethos or paradigm and "digital" as indicating the presence of electronic computing technology. While Dixon and Smith made the "key role" of computer technology nominally central to their concept of digital performance, Maria Chatzichristodoulou has articulated an approach that typifies more recent work: "when referring to the digital, we do not refer to a specific technological paradigm but look to address a wider set of sociocultural phenomena that cannot be reducible to computer technology" (2017:313). But if we are content to leave electronic computing technology aside for a moment, what are we left with?

Through its prioritization of intermediality, this scholarship is concerned with performance work that embraces variation, ambiguity, and fluidity, and avoids rigid categorization and positioning—and these qualities in turn are taken to be the defining attributes of "the digital." Against the grain of this tendency, I suggest that there is a more appropriate word for processes that are defined by the possibility of continuous variance of position: "analog." If "digital" has an ethos, it is one of regularity and precision, of the elimination of ambivalence and spontaneity, and of the reduction of messy signals to quantifiable forms.

It seems, therefore, that this performance scholarship participates in what Alexander R. Galloway has retrospectively identified as an "analog turn" in the theoretical humanities: the major critical concerns of the second half of the 20th century—structuralism, semiotics, text, code, the symbolic order of language and signs—have been superseded in the past few decades by contingency, variance, pragmatism, and assemblage, leading Galloway to crown the period since the mid-1990s "the golden age of analog" (2022:231). It is ironic (though perhaps not coincidental) that as we have entered ever more fully into the "Digital Age," dominant modes of critical engagement have become increasingly

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analog and, correspondingly, as performance has become ever more conditioned by digital technology, its theorists have sought out decidedly nondigital paradigms through which to explain it.

Industrial Technology

The dominant ways of conceiving of and discussing the relationship between performance and the concept of the digital are oddly unaccommodating to the Thorn Q-File, illustrating the point made by Jessica Hillman-McCord that "despite the extent of work on multimedia performance, fewer scholars have examined how the digital touches more practical elements of the form"; the integral role of digital technologies in the day-to-day production of theatrical performances is seldom the direct focus of critical attention (2017:4).

My strategy for addressing these questions is to recenter electronic computer technology—not so much because it is necessarily essential to the concept of the digital per se, but because doing so has meaningful implications for the study of performance. Chief among these is that it implies a switch in perspective from spectatorship to production. That is to say that while ostensibly oriented around the use of technology in performance, the majority of scholarship on digital performance has been concerned primarily with aesthetics and the affective impact of performance on audiences. But there is much to be gained from examining the processes that are kept out of the audience's view. To consider the relationship between performance and technology requires us to think of technology not as a force in its own right (as something to be related to) but as a means to an end, as the application of knowledge, technique, and engineering to a conscious external purpose—as a tool in a labor process.

This end to which technology is applied is what Michael McKinnie calls "a fundamental problem of making theatre: how to produce a performance [...] and then reproduce it over time and space" (2021:34). In *Theatre in Market Economies*, McKinnie is concerned with the industrial character of theatre production, and in particular with how the demands associated with the market directly determine the form of both the production process and the product. This shifts the emphasis of critical analysis away from the "Dionysian" features identified above and towards questions of manufacture and management. As McKinnie writes, "virtues commonly attributed to the theatre—its artistry, its ephemerality, its uniqueness, and so on—are inextricable from the routines, systems, and technologies upon which any production process depends" (55). This approach does not disregard the aesthetic content of performance entirely but rather reveals it as anchored to a set of material processes that are themselves determined in part by the external pressures of the market.[2]

Central to this is the question of accurate repeatability. The ability to accurately reproduce a performance time after time is therefore, for McKinnie, a "fundamental economic problem" (20). Jonathan Burston has described how British theatre producer Cameron Mackintosh capitalized on the success of hit musicals in the 1980s by developing the strategy of "cloning a show," meaning that performances in venues around the world could aim to be precise replications of the Broadway or West End original—a production logic Burston terms "theatrical Fordism." Integral to this was the advance of digital technology in lighting and other areas of design that allowed "identical results from production to production" (2009:161–63). In order to be able to produce theatrical performance as a vendable commodity, and to maintain theatres as safe and orderly work environments, venues employ systems and techniques that regulate the production and create reliably predictable performances; the action takes place as choreographed, performers stand where their blocking dictates, the duration of the show can be accurately anticipated, and the same lighting states are reproduced at the same intensities night after night.[3]

2. This process, the "real subsumption of labour to capital," is explained as it relates to theatre and performance in Blackwell-Pal et al. (2021:35–36).

3. Derek Miller (2018) has illustrated this with a close reading of the stage management show reports for a Broadway production, charting the remarkable consistency of performances throughout the run, as indicated by the narrow margin of differences in the run times, and considering the relationship between the production and each individual performance that strives to reproduce it. On a similar theme, see Young (2020:44–48).

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In light of these reliable systems, Patrice Pavis recognizes that the complex designs made possible by digital lighting memory create "a theatre that is entirely computerised, where everything is tightly controlled" and, suggestively for my argument, goes on to propose *this* as the basis for a connection to the Gesamtkunstwerk (2013:137). While I maintain that there is no unproblematic way of asserting a predigital genealogy for digital performance, the disciplined, rationalized, regulated stage management practices of the industrialized bourgeois theatre of the 19th century might lay a strong claim.[4] If the Gesamtkunstwerk shares some quality with the digital it is not because it experimentally combined multiple artforms into one intermedial whole but because it did so on the basis of strictly regulated and repeatable execution.

This means that the impact of digital automation is not initially or primarily felt in the realm of aesthetics but in a transformation of the labor process; as a detailed write up by Thorn's own R.E. Jones in the *Royal Television Society Journal* marking the console's launch made clear, "the 'Q-File' system can be simply summarized as a means by which the normal processes of stage and studio lighting can be performed with extreme ease and speed"—not a wholesale transformation of the performance, but an optimization of the production process (1967:270). The defining contribution of digital technology in performance therefore comes in the form of digital memory, which better facilitates the industrial theatre's need for the accurate execution of predetermined action. Here, then, we can turn away from conventional discourses of digital performance, into which the Q-File does not meaningfully fit, and consider it instead on its own terms as a piece of industrial equipment.

The Q-File

With its name alone, the Q-File announced a decisive shift in the principles of stage lighting control, trumpeting the system "in which 'cues' (i.e. lighting changes) are 'filed' (i.e. memorised) during rehearsal" (Thorn 1969:2). Upon its release it was a huge success, with dozens installed in television studios and theatres across the UK before expanding to the US where it was distributed by Kliegl Brothers Lighting. According to one lighting designer quoted in Kliegl's promotional materials, "There's great antipathy in our industry—and rightly so—to the computer taking over the role that people should perform," and yet "Q-File proves wrong those people who thought that the age of electronics was taking over creativity."[5] The Q-File seemed to offer a technical solution that would allow the full realization of the artistic and creative ideals of designers.

To the modern eye, the unit itself, almost exclusively reproduced in black-and-white images even in the glossy color brochure, has all the hallmarks of old-fashioned tech, built of sharp angles, chunky square buttons, and a wood-paneled chassis.[6] But it was also a slick and refined piece of ergonomic design, priding itself on being compact and space-efficient—the brochure boasts "a panel *only 2 square feet* in area"—and bringing an ever greater range of mechanical control beneath the fingertips of the operator (Thorn 1969:5).

This reduction in size was achieved primarily through what was left out. It had been common, prior to this point, to have rows of faders on a lighting console, with each fader allowing the user to manually adjust a specific electrical circuit, controlling the flow of power to whichever lighting fixtures were plugged into it and so dimming or brightening their light output.

These faders were themselves a refinement of the system that had predominated throughout the first half of the 20th century, which entailed large, upright dimmer units with hefty levers sticking out of them. Rather than the action of a single finger, fading circuits up or down was the

4. McKinnie identifies these 19th-century origins of modern stage management and blocking practices as part of his argument (2021:45–47). For a more comprehensive history of British stage management practices, see Cattell (2015).
5. This testimonial comes from the front page of the company's in-house sales journal, *Kliegl Representor* (Kliegl 1972).
6. While modern lighting consoles are mass produced units, many of the Q-Files were custom installations, and even Thorn's own contemporaneous promotional materials provide different diagrams of the configuration of the control panel.

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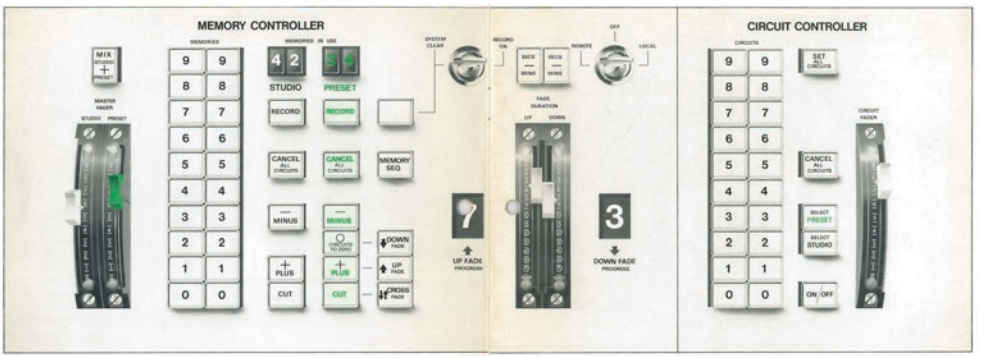

Figure 2. The original console layout, bringing the full range of the lighting system's capabilities within finger's reach of the operator. Detail from the Thorn Q-File brochure (1969).

full-bodied work of both arms, and banks of these freestanding units would be operated by teams of hardworking and highly skilled technicians. Christin Essin (2015) has provided a vivid account of not only the strenuous work that this form of lighting control demanded but also of the issues that arose when it confronted Broadway's digital revolution in the 1970s.

Little faders had not yet fully succeeded in displacing big levers across the industry before the Q-File in turn dismissed them as an "unnecessary and space-consuming arrangement" (Thorn 1969:6). The Q-File had only one circuit fader. *Which* circuit (or circuits) it corresponded to at any given moment was determined by the user tapping the corresponding number buttons. The operator could no longer glance at the bank of faders to check what was up and what wasn't (this function had been replaced by a "Mimic Display Panel" of indicator lights at the top of the console that would light up at varying brightnesses to show active circuits). More impressively, this lone fader was controlled by a servomechanism, meaning that not only could the user push the fader to set the lighting circuit to the correct level, but the machine could also reposition the fader when a new circuit was selected to indicate what level it was currently at.

Despite this declaration of their obsolescence, faders are still a day-to-day feature of lighting control (especially in educational settings and smaller venues), and there is an undeniable sense of creative immediacy in laying one's hands on a row of faders and gliding them back and forth as the light-image onstage shifts before you in real time. The interaction is sensuous, as it allows you to sculpt and explore the infinitely variable nuances of light and shadow across the action, arriving organically at the desired image.

This is, frankly, not the case when tapping in numerical commands (at least not in my experience). This slower and more technically fiddly mode of interaction, however, allows for much more precisely plotted designs (this precision was made necessary by Q-File's origins in color TV studios, where cameras had to be recalibrated if light levels were not reproduced exactly). The immediate tactile pleasure of crafting light with faders could not deliver such reliable results (and besides, this pleasure soon wears thin when you have to manually recreate the effect live for each performance). With the Q-File, the activity of operating a show was now defined not by balancing light levels but by recalling saved files.

This complete shift in the mode of interaction between the technician and the machine that came with the turn to digital memory was a significant selling point. Jones wrote: "Ideally, it should be possible during rehearsal to plan all states of lighting and their manner of change and subsequently to recall these changes by a single GO button operation manually synchronized with the action" (1967:267). The Q-File did not quite achieve this ideal. It still required a degree of skilled operation from the technician, mostly in regards to timing; fade times of cues had to be set manually and, for more complex changes, different preprogrammed memories would be recalled sequentially and overlaid. Jones spins this positively, insisting that the system "retains sufficient flexibility to enable the operator easily to accommodate the inevitable variations which occur 'on the night' during a live production" (267).

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What Jones envisioned as Thorn's ideal has now come to pass: the near total automation of lighting control. That is, at the push of a GO button any combination of light fixtures can be altered to any combination of intensities. Motorized moving lights would not arrive for another decade, and would take even longer to make their transition from rock concerts to theatre, so Jones could scarcely have predicted modern intelligent lighting fixtures with their own onboard computers and their ability to move, refocus, and change color, but these functions, too, are simply delegated to digital memory. And with that, the live execution of highly complex lighting changes requires neither intellectual engagement nor manual dexterity from the operator.

I say *near* total automation because that button still needs to be pushed. That is, a live operator is still necessary to initiate cues during the performance. While everything else—intensity, position, color, focus, fade curves, duration—can be delegated to the machine, the *initiation* of cues has remained stubbornly resistant to automation for the simple reason that it requires direct responsiveness to the actors onstage—in Jones's terms, it must be "manually synchronized with the action." The rapid pace of progress in gesture and speech recognition technology in the 21st century makes conceivable the possibility that lighting control systems will at some point be able to respond directly to cues from actors without the need to employ a lighting operator at all.[7] For now though, a person is required to push the button, and it is this person and this button pushing that interests me here—the interaction of machine, operator, and performance at the point where digital capabilities interact with human action. The embodied experience of the lighting operator raises questions about the relationship between technician and the live performance, the way that class and status are encoded into the work, and finally how labor-saving automation in the theatre relates to the material process of industrial deskilling.

Liveness and Digital Memory

Jones's comments on cues "manually synchronized with the action" and the need to accommodate the "inevitable variations which occur 'on the night' during a live production" bring us back to some of the central concerns of digital performance scholarship—the themes of immediacy, spontaneity, and liveness. In a 1965 article on stage lighting control, the American lighting designer David Thayer attempted to start from scratch and, taking nothing for granted, sought out "arguments for the continued existence of live theatrical performances" at all when "mechanically reproduced performances" (i.e., films and television) were cheaper and more reliable. Of the arguments in favor of live performance, "the most important is the conviction that there is something worthwhile in the spontaneous interaction among actors and audience which creates a unique experience of the drama at each performance" (1965:21).

Here, Thayer was in step with the emerging discipline of theatre and performance studies. As Richard Courtney wrote a decade later:

> the arts of the playhouse (theater, opera, ballet, and the like) have elements of spontaneity built in to the art form. [...T]hese arts rely on varying degrees of inherent and intended spontaneity to give them their specific artistic characteristics. (1973:79)

For Richard Schechner, writing in 1968, this presented the rationale for a more actively involved lighting operator: "If human performance is variable (as it most certainly is) then a unified effect [...] will be better assured by a nightly variation of technical means" (48). Thayer, too, embraces this variation as a specifically desirable phenomenon, which lighting should be enabled to actively support. "Deviation of one night's performance from another should not be encouraged for its own sake," he writes, "but must be allowed for if the maximum affective potential of live performances is to be realized" (1965:21). While this idea has received considerable challenge in the decades

7. In the 1980s Tasco developed lighting software, running on Windows 1.04, which featured voice recognition for programming (PLASA 2005:65). In 1995, Francis Reid wrote that "the voice activated dimmer is reported to be imminent" (1995:54). In 2018, Richard Cadena similarly predicted that the rapidly improving voice recognition capacities of smartphones could soon be applied to stage lighting, making programming quicker and easier (2018:47).

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since, most prominently from Philip Auslander, there is a line of direct continuity from here to the so-called Dionysian ethos that has been ascribed to digital performance.

For Courtney, it is essential not simply that spontaneous variation be possible but that "mistakes can be made in front of the percipients while the art form is being created" (1973:79). It is in this capacity for error that the fact of liveness generally appears in writing on theatre lighting control. Both operator and machine need to be able to handle things going wrong; machines are less prone to error than humans, humans are better able to react to the unexpected than machines. Even where things go smoothly, the capacity for variation is encountered as a problem, as in Bentham's blunt assessment that "the trouble with action on stage is that it is not precise in its timing" (1980:157). This fact places an onus of responsiveness on the operator ("one might have to slow down or hurry in the progress of a cue," Bentham continues). The machine's capacity for split second precision in the (re-)creation of theatrical effects makes it ultimately ill-suited to theatrical performance, which is inescapably subject to the caprice of human spontaneity, and so its reliable processes must be supervised by another human who is accustomed to the performers' subtle imprecisions.

Spontaneity has historically sat in conflict with automation, which has taken the form of predetermined processes being mechanically executed with no capacity to react to live contingencies. The ability to preset and instantly recall combinations of different lights at specific levels was integral to the nascent art of stage lighting design; what was determined in rehearsal could be accurately reproduced during performance just as the person in charge (designer, director, or producer) had intended. Of the old system, with operators having to recreate lighting states from scratch over the course of each performance using manual dimmer controls, Bentham complained: "What happens, of course, is that the producer is either persuaded into thinking that his particular cue is being carried out, or he gives up in despair and settles for something more simple" (1956:15). The aesthetic and practical contribution of stage lighting was directly inhibited not so much by the limits of what was technologically possible as by what technicians could reliably execute in performance. The ability to recall preset states was therefore a crucial step in broadening the possibilities of the artform.

With the advent of microprocessor technology in the 1960s, theatre lighting control was fundamentally transformed into a matter of the recording and recalling of information. Thayer observed that "preset systems [were] as nearly related to data processing as to power distribution" and that "a lighting control system may be thought of as a machine for handling and re-handling data" (1965:19–20)—a novel idea at the time. He addressed the question of memory more broadly, noting that one of the most time-consuming activities in a technical rehearsal is the accurate recording of lighting information. He would no doubt have been sympathetic to Percy Corry who, almost two decades earlier, described "the practice of hurriedly decorating the back of a cigarette packet with curious hieroglyphics during the pauses at the dress rehearsal," a habit which, though it "may be popular [...] cannot be guaranteed to be efficient or foolproof" (1947:6). Writing on the cusp of the introduction of digital memory, Thayer indicates the significance of more low-tech methods: "Typically, the dimmer settings, switching and the gross timing of a cue are 'remembered' by being written down while the precise timing is remembered by the operator" (1965:25). Just as it is an actor's job to remember their lines and blocking, so too the lighting operator was employed in part as a repository for information too precise and subtle, and too contingent on other elements of performance, to be incorporated into any system of written documentation. Digital playback partially transferred this act of memory from the operator to the machine. It was now possible to achieve states and changes that would be out of the question for even a large and well-rehearsed team of operators. Every lighting channel in the venue could be shifted from one precise value to another at the same time with exact accuracy.

This new technical capability seemingly opened the door to a radically altered role for the technician. Thayer looked forward to the possibilities that automation enabled:

> Although some portion of the timing of cues and operation of the control system must be left to the memory of the operator, development of recording methods which leave the least possible routine information to human memory will release the operator's attention from the mechanics of reproduction and allow him to concentrate on creation of the lighting design. (25)

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Likewise, Schechner recognized that new technology encouraged "either the complete programming of all material," that is, fully self-operating environmental experiences without human performers, "or the nearly total flexibility of bits that can be organized on the spot, during the performance." His hope was that "the 'performing group' is expanding so that it includes technicians as well as actors" (1968:48).

This optimistic assumption that transferring the operative process from the person to the machine would necessarily empower the technician to focus on more artistically engaged concerns proved to be somewhat naive, however. The same technological development that enabled the automation of cue timings also entailed the digital storing of all cue information, obviating any need for the operator to "create the lighting design" during performance (that is, manipulate the technological equipment in order to produce the intended aesthetic and practical effect). As Francis Reid reflected in the late 1980s, the introduction of digital memory could genuinely be said to have "released operators from beat-the-clock feats of dexterity and drudgery" (1987b:16). Contrary to Thayer's ambitions, however, it did not do so by transforming the operator into a more artistically engaged contributor to performance, but rather by alienating them further and further from the creative side of performance. As Ric Knowles has since noted, the use of prerecorded cues (and the authority of the stage manager who cues them) "denies sound and lighting board operators—constructed as technicians—anything but minimal capacity to respond to the day-by-day rhythms of the show" (2004:61). While Thayer had been able to claim in 1965 that the personality of the operator is evident in each performance and that the replacement of an operator, just as the replacement of the actor, changes the performance to some extent, this was less and less the case in later years. Lighting board operators were now attendant technicians, going through the motions in the execution of digital sequences.[8]

Gentlemen in Tuxedos

The separation of the lighting operators from the creative production of the show was matched by a physical separation from much of the productive work that brought the performance into being. The old lever-driven lighting consoles were typically housed in the wings, at stage level, involving their operators in the behind-the-scenes hustle and bustle during the performance and making them part of a kind of backstage workplace community. Digital lighting boards, being more compact, could be housed in a smaller space, far removed from the dimmers they controlled. And, being capable of more precise and elaborate cuing, they benefited from a clear view of the stage from the audience's perspective. They were therefore located out in the auditorium, and this transition from working in the wings, in a space shared by stage crew and performers, to working at the back of the auditorium, is one of the key ways in which Essin tracks the alienation of lighting operators during Broadway's computerized control revolution of the 1970s; "once amid performers moving in unison," she writes, they were now "distanced and isolated from the stage," in the process becoming "more white collar than blue collar" (209).

The transition from the physically exhausting work of standing to operate lever-driven dimmers to the seated control of keys and buttons evidently represented a degree of cultural elevation. The new lighting operators were undertaking a more respectable form of work, not only compared with their predecessors but also with their contemporary colleagues. The coding of these different forms of work in terms of the relationship to class and status is indicated in Frederick Bentham's summary of the range of lighting work in 1974, noting the stark contrast between "a gentleman in a tuxedo caressing the keys of his computer control at one end, and a bloke with his mate on a long ladder fighting a nearly red hot spotlight at the other" (1974:233). To operate a digital lighting board was an authoritative and esteemed position, differentiated in the backstage hierarchy from the sweated manual labor of other workers.

8. This historical development, and its connection to the emergence of the designer as a creative professional distinct from the technician, is discussed in more detail in Palmer (2013:232–47).

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This corresponds to Eleanor Skimin's compelling contention that a seated posture is an exemplary pose of bourgeois power. In her analysis, the seated figure is one who is exempt from manual labor and whose work (if indeed they work at all) is intellectual, administrative, and managerial. The seated figure's existence, in the home or in the office, is made possible by the work of others. This seated pose, suitable for contemplation and discourse, is how the audiences of bourgeois theatre and the protagonists of its domestic dramas encountered the world. Skimin notes too that this drama (that is, 19th-century realism) was "effectively a static theatre driven by the sitting room tête-à-tête," and yet its sedentary scenography was ever reliant on "invisible stagehands keeping the illusion onstage intact" (2018:81–83). The introduction of digital lighting equipment in the late 1960s, and, in the decades that followed, of automated processes in the departments of sound, rigging, scenic movement, and stage management, belatedly incorporated at least some of the technical crew whose work would previously have been defined by strenuous manual labor into the seemingly more privileged world of seated, mental activity.

This is only half the story, however, because just as lighting operators experienced an elevation by being seated, so too was sedentary work increasingly being proletarianized. Between the 1960s and the 1980s in the UK there was a substantial decrease in the hours of physical activity undertaken during work time (a trend that has continued since the mid-1990s) (Ng and Popkin 2012). In the sociological and medical literature, "sedentary" time indicates that no more energy is used than is required to simply sit or lie down. This shift towards an increasingly sedentary working life has been linked to a range of health problems including "an increased risk of diabetes, cardiovascular disease and cardiovascular and all-cause mortality" (Wilmot et al. 2012). As early as the 1950s, a higher rate of coronary heart disease was observed in bus drivers than in the conductors who worked on their feet alongside them (Morris et al. 1953). As an important counterpoint to Skimin's research, which reinforces her analysis of the bourgeoisie's seated power pose by throwing it into stark historical relief, this changing status of the sedentary posture throughout the 20th century further complicates the meaning of lighting operation. The seated position of the lighting operator is caught ambivalently between a bourgeois power-pose and an impotent slouch.

Buttons and Deskilling

With the Thorn Q-File not only could lighting states be near-instantly recalled, but the effort required to do so was utterly transformed in both degree and kind. The brochure boasted that:

> except in rare instances, any lighting change can be initiated by pressing one push button. The timing of changes is therefore reduced to the ultimate simplicity of a *single operator action* "on cue." (Thorn 1969:5)

From the days of the old team-operated manual control systems—physically strenuous, imprecise, and labor intensive—this new ability to run whole performances by pushing a single button when cues come was an overwhelming transformation.

The transition from levers to buttons is itself a profoundly ideologically inflected process. In a study of the social politics of button pushing, Rachel Plotnick highlights the significance of the conceptual separation of action from effect, and how it both stems from and reproduces hierarchies of power. Of the early phases of button-pushing technology, she writes:

> to operate a machine with one's hands necessitated not only inventing a new form of control (which took shape as a button), but it also gave rise to a new kind of controller who used fingers to delegate tasks to other humans and machines in ways that were designed to be simplistic, ergonomic, and at a distance. (2018:xvi)

Plotnick's early button pusher, then, is another face among Skimin's seated bourgeois, commanding distant effects from their merest gesture.

The core dynamic is not merely a shift from one mode of interaction to another, or even from physically strenuous to less demanding work. It is, at its heart, a transition from a mechanical

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process, in which the physical interaction of the operative has a direct and perceivable relationship to the outcome, to a digital process, in which the operator's gesture initiates an automated function. Pulling a lever or sliding a fader on the old-style consoles would physically alter the amount of contact made between two electrodes and thereby alter the size of the current passing between them, which would in turn increase or reduce the intensity of light. The operator could see the mechanism in operation and trace a clear trajectory from their physical intervention to the outcome. Pushing a button to operate a digital console, by contrast, functions on the principle of separation and opacity between the two.

In the then recently coined parlance of computer science, the lighting control apparatus had become a "black box"—an element of a system of which the internal operations are entirely opaque and unknowable to other elements of the system (in this case, the user) (Bunge 1963). To approach something as a black box is to understand it only in terms of its inputs and outputs. There is nothing uniquely digital about this; in the 1950s the cyberneticist W. Ross Ashby observed that: "In our daily lives we are confronted at every turn with systems whose internal mechanisms are not fully open to inspection, and which must be treated by the methods appropriate to the Black Box" (1957:86). And yet, this attitude of not understanding technological processes that we participate in, administer, or initiate is one that fully characterizes the digital world.

That workers encounter the objects of their labor as ever more alien and unknowable is not simply a function of the increasing technical complexity of productive machines. John Roberts discusses this phenomenon as a consequence and extension of the deskilling of labor that has accompanied the expansion of capitalist industry since its origins. This deskilling transforms both the physical and mental activity of workers:

> In stripping the worker of both manual craft skills and accumulated knowledge and intellect, management forces a split between conception and execution at the point of production [...] leaving the worker with an attenuated grasp of the technical processes that he or she now simply monitors or adjusts. (2007:83)

This transformation of the worker from a craftsperson skilled in the use of tools to the attendant of a sophisticated machine is not simply a subjective experience of alienation; it is a historical tendency across industry, which has fundamentally altered the class power and political agency of those who undertake productive work. "The outcome is that today workers in industry are less able to operate the industry in which they labor than at the beginning of the manufacturing process in the middle of the nineteenth century" (Roberts 2007:83). So, if as Plotnick suggests the use of buttons allowed the powerful to exert greater control, it soon also came to signal workers having substantially less control over their work. As she notes, the 1960s was still in the thrall of "long-held stereotypes of digital commanders as nonworkers and button pushing as nonwork" (2018:239).

Deskilling is an essential implication of automation, and yet while automation is key to the operations of the theatre industry, discussion of deskilling in theatre and performance is fraught. Roberts gives his account of deskilling in the course of a critique of the readymade artwork. As Claire Bishop notes, "de-skilling entered art discourse in the 1980s, in the context of writing on conceptual art" (2011). Throughout the second half of the 20th century, through innovations such as the readymade and the emergence of live art, artists explored the purposeful rejection of technical skill and training. Though she recognizes the historical coincidence of intentional deskilling among artists with deskilling in the economic sphere, Bishop presents the phenomenon far more in terms of a renegotiation of disciplinary and generic boundaries, and highlights the concomitant process of "re-skilling," that is, of artists acquiring or assuming new expertise and entitlements as they switch fields of practice, a "bringing to bear of one set of competencies on those of the newly elected discipline" (2011).

For similar reasons, Roberts is emphatic that "deskilling in art is not the same as deskilling in productive labour" (2007:87). And yet, as McKinnie's focus on the industrial organization of theatrical production illuminates, theatre work is, or at least has the capacity to be, productive labor,

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subsumed under the imperatives of capitalist industry. There has been a correspondent deskilling and fragmenting influence on those aspects of the theatrical labor process where automation has been possible.

For Roberts, deskilling is directly linked to demanualization, that is, the progressively diminishing importance of the human hand in productive labor. The live analog operation of stage lighting technology, whether on the old upright, lever-driven consoles or the fader-operated desks that supplanted them, required the considerable development of specific skills. Whether pulling levers or stroking faders, this work had a sensuous tactility—it was manual and dexterous, and these features defined the worker's experience of the work and of themselves doing it. Digital technology, which reduces hands to fingers and physical processes to numbers, transforms this. The operator is no longer a skilled participant in the nightly creation of performance, using the technical apparatus as a tool to produce an effect. Now, their labor process is determined for them by the machine; the human function is confined to merely an activity that the machine has not yet superseded. The only spontaneity available to them is error. As one of Essin's interviewees, Mike Sullivan, a veteran of Broadway lighting control, lamented: "Now it's just buttons, you know what I mean? [...] What fun is that? It's all automated" (in Essin 2015:209).

The Systemization of Work Processes

The Q-File is both a key historical moment in digital theatre and a totemic stand-in for a wider set of theoretical concerns. Precisely because it does not seem to fit neatly within dominant disciplinary discourses, I've viewed it as a kind of *Verfremdungseffekt*, which prompted a fresh examination of those discourses' ideological underpinnings.

While the prevailing understandings of the relationship between performance and the digital have focused heavily on aesthetic effect, I propose that the influence of digital logic is felt most keenly in production and that to consider the digital in performance is therefore an invitation to consider the organization and transformation of labor processes. Digital technology has, from its first introduction into theatre, been a tool of standardization, regulation, order, and repeatability in the interests of industrial efficiency and market performance. The result of its use is the relegation of those who produce the nightly performance to technicians following precise cues, experiencing an increasingly normalized alienation from the creative production of the performance and from the theatrical labor process in general. The free Dionysian spirit of boundless variance that theorists have so firmly ascribed to digital performance is quite remote from this experience.

I have laid a heavy emphasis on the specifics of the technology involved. But what if, after all this, we *do* take Galloway's lead and move beyond the "the consumer-electronics definition" of the digital (2022:228), identifying the concept not with specific technologies but with "system[s] of mediation constructed from quantitative difference" (226)? There is a case to be made that the replacement of teams of workers with a computerized machine controlled by a single operator was possible because the work that they were doing was, in a sense, *already* digital. By this, I mean that lighting technicians in the middle of the 20th century were not routinely invited, as Schechner and Thayer urged, to exercise their free creative and improvisational capacities, but were rather employed to do the task of adjusting the correct numbered circuits to the correct numbered intensities over the correct number of seconds. If stage management is the industrial rationalization of the theatrical production process, it has historically been prevented from reaching its full realization by its reliance on human workers. But the reduction of the intricate command over light and shade down to a sequence of numerical values—that is, to a digital logic—made its computerization all the easier. As Marx suggests, deskilling is not only the *outcome* of automation; it is also its precondition ([1867] 1990:497). Those seeking out digital phenomena in the world of performance should be looking for the simplification, standardization, specialization, and systemization of work processes.

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