

HISTORY OF MEDICINE

Mr. Gilbreth's Motion Pictures — The Evolution of Medical Efficiency

Caitjan Gainty, Ph.D.

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A video is available at NEJM.org

The efficiency movement of the early 20th century has long been seen as an infertile tangent to the story of American medicine and its modernization. Indeed, rationalized labor practices that started on the factory floor have found a difficult fit in the standard historical narrative describing this moment as one in which the medical profession concerned itself primarily with the elevation and consolidation of its authority. When the efficiency movement's crossover into medicine has been acknowledged, it has been largely in regard to failed attempts by individual practitioners or smaller institutions to apply the principles of Frederick Winslow Taylor, efficiency's great celebrity, to the work of resistant professionals.

But when efficiency met medicine in the early 20th century, their relationship was no mere dalliance, and its form often diverged sharply from the Taylorist vision. One of its key figures was the industrial efficiency expert Frank Gilbreth, though his techniques were considered by many to be simply publicity-seeking smoke and mirrors. In place of a stopwatch, Gilbreth employed still and motion-picture cameras in his measurements, and he expanded his visual efficiency services — dubbed “motion study” — from industrial settings to the medical profession in the early

1910s. When he gained access to hospitals, Gilbreth transformed their operating rooms into efficiency laboratories, covering all available surfaces with gridded lines, and requiring the masked surgeons and nurses to don numbered or lettered caps to aid in his analysis of their movements across the axes of the surgical space (see video, available with the full text of this article at NEJM.org).¹

It was not accidental that Gilbreth's initial forays into the hospital took place in the operating room. Surgeons saw in motion-based efficiency study the potential to reduce, through faster operating procedures, their patients' exposure to what was at the time a leading cause of patient deaths: ether. Furthermore, they found in the process both the challenge and assurance that the outcome of a surgical intervention lay quite literally in their hands. Improving the efficiency and precision of the surgeon was as important as ensuring the quality of the tools he held. For these reasons, interest in efficiency was almost a professional requirement. Indeed, the American College of Surgeons (ACS) led the effort to incorporate efficiency measures into the standardization of U.S. hospitals. And it was early-century surgeons such as the outspoken Ernest Amory Codman of Massachusetts General Hospital who were invoked when

efficiency came to the fore once again in the later decades of the 20th century.

So it was that one Monday morning in March 1915, two surgeons from the New York Hospital traveled to Gilbreth's home to take part in a conference on surgical efficiency. The three men assembled in the Gilbreth family dining room, intending to make a motion picture. Drs. Eugene Pool and Frederick Bancroft were not unaware of Gilbreth's reputation for self-aggrandizement, and they knew he hoped to gain publicity from the meeting. Nevertheless, at Gilbreth's request and as his cameras recorded, they began to pantomime surgical procedures using his kitchen tools as implements — the first step in the motion-picture process that Gilbreth called cyclegraphy. Using a technique similar to one used by the earliest filmmakers to study physiology, Gilbreth attached small electric lamps to his subjects' fingers and then captured their movements with long exposures. The result was a kinetic map of light traced over blurred, ghostly figures (see photo). Gilbreth would model these traces into three-dimensional dioramas and then coax them into more “efficient” vectors. All that remained was to teach this perfected motion to his subjects.

This project was guided by a logic of efficiency largely unfamiliar to us today: the notion



Cyclegraphic Image of a Woman Working at a Gridded Table.

that one could establish the one best way to improve a task not by studying that task, as Taylor insisted, but rather by studying only the variable of motion. Gilbreth considered motion to be the essential and governing feature defining the efficiency of work, and to measure it he spurned the stopwatch in favor of what he considered the far more objective camera lens. In the case of surgeons, the motions of greatest initial interest to him were those considered common to all procedures, including the making of an incision or, better, the “tying of a stitch,” a procedure that Gilbreth asked to record at his conference with Pool and Bancroft. To his astonishment, the motions of Pool’s pantomime were quite different from what he typically saw when working with other test subjects. Pool’s technique was already so efficient that the bulbs attached to his fingers traced

what seemed to be an optimal path through space as they advanced toward completion of the final stitch.²

The archive suggests this was a fruitful day for Pool and Bancroft, who would go on to co-author an article on surgical systematization in which their debt to Gilbreth is evident — particularly in an illustration depicting 16 hands, each engaged in a “manual signal system” devised to augment the standard set of more conventional surgical motions.³ And Gilbreth’s work continued to bear fruit in other medical contexts, even as he faded from the history of the efficiency movement. There were, of course, other proponents of medical efficiency — Codman, the ACS, the Mayo brothers, and Robert Dickinson, for example — but Gilbreth’s work with motion and images set the stage for increasingly visual and aesthetic approaches. His legacy could be

glimpsed in later efficiency journals such as the *Modern Hospital*, whose articles often considered such visual elements as architecture and object design to be essential engines of an efficient hospital. It could be seen in the 1920s and 1930s, when the drive toward streamlining in engineering crossed into popular and medical culture as a material and practical marker of effectiveness. And it could be found in work with evolving medical imaging technologies all the way up through the recent advent of computer- and robot-aided surgery.⁴

Understanding Gilbreth’s work can help clarify what the look and feel of medicine today — the design of its material environment — owes to early enthusiasm for medical efficiency. Our debt to that era has been obscured in part by the fact that outside surgery, there was no clear, measurable relationship between efficiency and effectiveness in medicine in the early 20th century. Though medical practitioners were relatively good at investigating disease, they were still a bit hamstrung in their abilities to effect treatments or cures. There was thus no clear sense of what exactly needed to be made efficient.

Gilbreth and his contemporaries recognized this problem, and they cast about for ways to quantify the product of the hospital. Gilbreth’s proposed product, “happiness minutes,” did not gain traction.⁵ Nor did any others, really. Worries about what medicine produced continued well into the antimicrobial revolutions of the 1930s and 1940s. Soon, however, medical efficiency became more about process than product, and “efficient” became a

The Frank and Lillian Gilbreth Collection, Archives Center, National Museum of American History, Smithsonian Institution

catch-all for faster, simpler, or even just good. Its original, creative sense had been lost.

Today, we trace medical efficiency more or less directly to Taylor, despite the fact that his personal interest in and impact

tivations encourages us to excavate, as Archie Cochrane proposed in the 1970s, the relationship between efficiency and effectiveness or, as we might put it today, the link between efficiency and the “goals of care.” These cate-

own. What are the products of medicine?

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From the Department of History, King's College London, London.

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on medicine were minimal. But there is good reason to remember Gilbreth and other medical efficiency actors of the same period. Though we may now hold a different perspective on what medicine does, remembering efficiency's myriad forms and mo-

gories are neither self-evident nor fixed, and though we have come such a long way from Gilbreth's showy visual examinations of efficiency that we have difficulty interpreting their significance, we might do well to make that original, creative question our

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