A central aim of human performance technology (HPT) practice is to produce desirable results that are valuable to both the organization and the organization’s employees by implementing effective and efficient interventions. To increase the probability of producing desirable results, it is important to utilize both systematic and systemic processes (Stolovitch & Keeps, 1999). Simply put, a systematic approach refers to constructing and following a step-by-step plan, similar to climbing a ladder one step at a time or following a road map, until reaching the desirable performance level. A systemic approach refers to considering all the necessary components that are mutually influential on one another by identifying often complex linkages among them. This approach is compared to a spider web in which strands are interconnected (Rothwell, 1995). When an area of a web is broken, it will not function well as a web, and without a fix it could eventually collapse.

The importance of using systematic and systemic approaches and focusing on results-oriented and value-added practices has been emphasized in various HPT-related theories and models, such as Frederick Taylor’s Scientific Management (1911/1998), Thomas Gilbert’s Behavior Engineering Model (1978), Joe Harless’ Front-end Analysis (1973), and Kaufman’s Organizational Elements Model (1988). Although Frederick Taylor and Thomas Gilbert worked many years apart, there are astounding similarities between their work in terms of the focus on systematically analyzing and systematically engineering human behavior to produce desirable performance outcomes.

This article provides an overview of the contributions of Frederick Taylor and Thomas Gilbert to the development of the major performance improvement principles and discusses several similarities and differences between their work.

**Frederick Taylor: Scientific Management**

Frederick Winslow Taylor (1856–1915), known as the father of scientific management, worked as an engineer during the late 19th century. His best known work at the Bethlehem Steel Company is described in his book *The Principles of Scientific Management* (1911/1998). He explained how to engineer human behavior and improve efficiency through scientifically designed management methods, such as appropriate selection, incentives, and training. Taylor asserted that “the principal object of management should be to secure the maximum prosperity for the employer, coupled with the maximum prosperity for each employee” (1998, p. 1). Scientific management is about producing a win-win situation wherein the performers as well as the organization benefit from improved performance.
Taylor described the principles of scientific management with the following four duties of management, emphasizing the use of task analysis, selection, training, as well as managerial responsibilities:

First. They develop a science for each element of a man’s work, which replaces the old rule-of-thumb method.

Second. They scientifically select and then train, teach, and develop the workman, whereas in the past he chose his own work and trained himself as best he could.

Third. They heartily cooperate with the men so as to insure all of the work [is] being done in accordance with the principles of the science which has been developed.

Fourth. There is an almost equal division of the work and the responsibility between the management and the workmen. The management takes over all work for which they are better fitted than the workmen, while in the past almost all of the work and the greater part of the responsibility were thrown upon the men. It is this combination of the initiative of the workmen, coupled with the new types of work done by the management, that makes Scientific Management so much more efficient than the old plan. (1998, p. 15)

The Principles of Scientific Management

Taylor held that the use of incentives was the common element in both the previous management of “initiative and incentives” and his Scientific Management, but he pointed out a fundamental difference in how incentives were provided. With the management of initiative and incentives, workers would have to put out their best initiative and then they could receive an incentive from their employer.

Managers under scientific management would use incentives differently. Managers under the previous management of initiative and incentives would wait until workers initiate desired performance, but managers under scientific management would promise incentives to workers to motivate them, and would help them produce better performance. Figure 1 compares the two management methods.

Compared to the management of initiative and incentives, Taylor’s Scientific Management is much more systematic in that it applies a fundamental principle of human behavior psychology for improving performance, which is now known as a stimulus-response-reward association. Under the management of initiative and incentive, workers are responsible for analyzing their own performance problems and improving their performance levels. Scientific management uses a more systemic approach, as the management takes at least half of the responsibility for improving performance by using various interventions such as employee selection, training, incentive plans, systematic feedback, or tool enhancement.

Thomas Gilbert: Worthy Performance Engineering

Thomas Gilbert (1927–1995) was one of the pioneers in the field of HPT. He is known as the father of performance improvement and published his book Human Competence: Engineering Worthy Performance in 1978, in which he described the Behavior Engineering Model.

Three Leisurely Theorems

In his book, Gilbert explained three leisurely theorems. He used the word leisurely to indicate not only time but also opportunity for doing something different that leads to a better outcome. In explaining his first leisurely theorem about producing worthy performance, Gilbert clearly differentiated between a behavior and an accomplishment that is an outcome of the behavior. He explained that accomplishment...
and behavior are two aspects of human performance, that is, “in performance, behavior is a means; its consequence is the end” (Gilbert, 1988, p. 49).

In his second leisurely theorem, Gilbert conceptualized the gap between the desired level of performance (i.e., the exemplary performance) and the actual level of performance (i.e., the typical performance) as the potential for improving performance (PIP). That is, a PIP is a measurement of the potential that a typical performer has for improvement. For this reason, Gilbert called his second leisurely theorem the measurement theorem.

A way to help typical performers reduce their PIP (in other words, to help them improve their performance level to the level of exemplary performance) is to conduct a diagnostic analysis to find out the areas that caused the performance deficiencies and to implement appropriate interventions. Gilbert listed six areas where causes of the performance deficiencies might be found: data, instruments, incentives, knowledge, capacity, and motives. The first three categories are environmental supports, and the last three categories are the performer’s personal factors (see Figure 2).

The process of diagnosing and engineering human behavior to produce worthy performance is Gilbert’s third leisurely theorem, better known as the Behavior Engineering Model. Gilbert also called this model the management theorem, because from the management viewpoint, it helps managers identify causes of human competence or incompetence, and it emphasizes that poor management of any of the six elements could actually cause human incompetence. Gilbert explained—

> For any given accomplishment, a deficiency in performance always has as its immediate cause a deficiency in a behavior repertory (P), or in the environment that supports the repertory (E), or in both. But its ultimate cause will be found in a deficiency of the management system (M). (1978, p. 76)

To make performance worthy to the organization as well as the performers, Gilbert emphasized the importance of finding interventions that would help eliminate the causes of a performance problem at the least cost, producing a win-win situation. He suggested that a systematic approach for finding greater leverage is to follow the sequence from data to instruments and incentives to knowledge, capacity, and motives. He believed that more often than not, human incompetence resulted from a lack of simple environmental supports and that personal factors, especially human motives, would be very difficult to observe and understand—and thus costly to change.

**Diffusion of Effect**

Although Gilbert’s model has been frequently introduced in the literature (e.g., Dean, 1997; Fuller & Farrington, 1999), his idea of “diffusion of effect” seems less frequently discussed in the literature. In his book, Gilbert explained the important principle about the diffusion of effect:

> Whenever I change some condition of behavior, I may indeed—and often will—have a significant effect on some other aspect of behavior. So, if I improve the incentives for performance, people may learn more, even though I have made no effort to teach them better. And when we give people better information about their successes, we may have also improved their incentives to perform well.... There is no way to alter one condition of behavior without having at least some effect on another aspect—often, a considerable effect. And usually it is difficult, if not impossible, to determine the degree of the diffusion of the effects. (1978, p. 94)

HPT practitioners should use this principle to maximize the overall effect of a selected intervention. For example, in a hypothetical situation, promising a proper level of compensation (incentives) may reduce equity tension in workers and help them feel appreciated and motivated (motives), which in turn may encourage them to pay more attention to the information required for the work (data) and become self-directed to teach themselves to be more competent performers (knowledge) (see Figure 3).
In another hypothetical situation, providing an enhanced tool and institutional support may not only increase performers’ capacity, but may also be viewed as an incentive and may change the level of motivation, encouraging performers to become more self-directed and to seek the knowledge and skills necessary to accomplish their job tasks (see Figure 4).

This is a systemic view of engineering human performance. Rothwell eloquently illustrates the need for acknowledging the side effects of human performance engineering: “Making changes in human systems is akin to bumping a single strand of a spider web. The result is that the whole web vibrates, not just the strand you touched” (1995, p. 4). With this “big picture” of the entire system in mind, HPT practitioners are better able to avoid providing piece-meal, redundant approaches.

From Scientific Management to Engineering Human Behavior

Despite the fact that Taylor and Gilbert worked about 70 years apart, there are many similarities in their work. Especially when Taylor’s theory is compared to Gilbert’s three leisurely theorems, some interesting differences as well as similarities between the two men’s work are revealed.

Performance Improvement Opportunities

First, it is interesting to note that Gilbert has included the word leisurely in referring to his theorems, indicating time and opportunity:

Alas, the notion of opportunity has slipped away from our use of leisure. Most of us now, when we hear the word, think only of the time component—a lot of time with no special opportunities at all. But the concept “the duration of opportunity” remains a marvelous one, because what could people value more than both time and opportunity? If (old-style) leisure is the product of time and opportunity, it is, indeed, the worthy aim of a system of performance engineering, and the one I consider to be its true purpose. (1978, p. 11)

Interesting enough, Taylor also used the word opportunity in describing a managerial duty:

What we are all looking for, however, is the ready-made, competent man whom someone else has trained. It is only when we fully realize that our duty, as well as our opportunity [italic added], lies in systematically cooperating to train and to make this competent man, instead of in hunting for a man who some one else has trained, that we shall be on the road to national efficiency. (1998, p. iii)

The 1st Leisurely Theorem: Defining Worthy Performance

Both Taylor and Gilbert clearly differentiated means from ends. One of Taylor’s concerns was low productivity resulting from workers’ soldiering behavior tendencies, especially when they were managed under the initiative and incentives management practice. His goal was to alter the managerial practice in order to make changes to workers’ behavior and ultimately to improve productivity.
This notion of ends-oriented practice is also found in Gilbert’s work. According to Gilbert (1978), the end is to produce worthy performance, which is a ratio between the value of an accomplishment and the cost of changing behavior to produce that accomplishment. This consideration of an economic value of changing human behavior to accomplish a task is what distinguishes Gilbert from Taylor.

The 2nd Leisurely Theorem: Establishing a High-Priced Man or an Exemplary Performer

Gilbert defined an exemplary performance as “the worth of the historically best instance of the performance” (1978, p. 49) and measured the gap between the exemplary performance level and a typical performance level as the PIP.

The use of an exemplary performance level as the benchmark for measuring and improving typical performance levels is also found in Taylor’s work. When Taylor introduced Scientific Management to Bethlehem Steel, one of the first steps was to find the proper worker for the job of handling pig iron. He carefully observed and studied 75 pig-iron handlers for several days. Then he selected four semifinalists, from whom he finally chose one based on not only his physical strength but also his personal characteristics, habits, and ambition. In his book, Taylor describes how he was able to motivate the finalist, named Schmidt, to be willing to become a high-priced man who produced 360% increased workload (from 12.5 tons to 47 tons per day) at a 60% higher wage (from $1.15 to $1.85 a day). Schmidt’s high-performance level became the exemplary performance level to which other typical pig-iron handlers’ performance levels were compared. Taylor’s effort to engineer an exemplary performance level through scientifically designed methods is what distinguishes Taylor’s work from Gilbert’s.

The 3rd Leisurely Theorem: Producing Worthy Performance by Engineering Behavior

Both Gilbert and Taylor focused on producing competent human behavior. Both believed that human incompetence was management’s fault. Taylor criticized the poor managerial practice used in the initiative and incentives management and encouraged close cooperation between management and workers in scientific management. Similarly, in his Behavior Engineering Model Gilbert suggested that deficiencies in management are the ultimate cause of deficiencies in employees’ performance. That is, both Taylor and Gilbert emphasized that management plays a crucial role in successfully analyzing, designing, and implementing performance improvement interventions.

Taylor explained that the four principles of Scientific Management were exercised at Bethlehem Steel: scientific selection of workers; conducting a task analysis and training workers according to the scientific method; and the managerial responsibility to work with workers to produce improved performance outcomes. More specifically, an interesting comparison is illustrated when Taylor’s management strategies used at Bethlehem Steel are described based on each of the six categories of Gilbert’s model:

- **Data**: Taylor provided clear expectations on desired performance and its consequence to workers. He used yellow and white papers to provide feedback on performance each day. A yellow paper indicated that the worker had failed to complete the assigned amount of work and had not earned $1.85 the day before, risking a transfer to another job. A white paper meant that the worker had accomplished the expected amount of work and had earned the promised incentive.

- **Instruments**: Taylor did not allow shovellers to select and use their own shovels. Instead, he provided 8–10 newly designed and improved shovels, designed for handling a specific type of material.

- **Incentives**: Taylor promised Schmidt (a high-priced man) that he could receive a 60% income increase for improving his performance outcome. Taylor also emphasized the use of different types of incentives, such as possibility of promotion, shorter working hours, and better work conditions.

- **Knowledge**: Taylor provided pig-iron handlers with step-by-step training that was designed based on a carefully conducted task analysis. In many cases, workers received written directions that explained the types of work they were supposed to complete and the methods they needed to complete the work.

- **Capacity**: Taylor developed criteria for selecting pig-iron handlers and carefully selected the best-suited workers based on those criteria. When selecting workers, Taylor also examined the level of their ambition as well as personal character and habits. Workers who were not able to handle the assigned workload were removed from the pig-iron handling job and were assigned to other jobs.

- **Motives**: Taylor believed that it would be more effective to work with individuals and address their motives than to deal with them in groups due to the systematic soldiering behavior that often occurred in group environments. He had an assumption that monetary rewards would appeal to the workers; thus, he offered them additional pay for improved performance. He also tried to appeal to their self-respect by referring to them as high-priced men or first-class men.

In Summary

Taylor documented systematic and systemic processes for improving human performance with his Scientific Manage-
ment nearly 100 years ago. From a historical perspective, it is evident that Scientific Management—preceding the birth of the field of HPT, provided a solid foundation for the future work in the HPT field, such as Gilbert’s Behavior Engineering Model. While we do not know whether Gilbert himself was actually influenced by Taylor’s work, in retrospect it seems that many of Taylor’s methods of performance improvement are reflected in Gilbert’s model.

However, an interesting aspect that distinguishes Taylor’s work from Gilbert’s is that Taylor claimed his Scientific Management to be based on a science (for example, scientific selection of workers and scientific analysis and development of tasks); Gilbert did not claim his model was a science: “We are not looking for ‘scientific’ explanations of behavior, but only for an orderly guide to asking questions an engineer must ask” (1978, p. 79). Gilbert proposed following the six categories in an orderly sequence and asserted that, while all six categories are equally important, greater leverage may be found in certain categories and it is management’s responsibility to anticipate possible diffusion of effect and to find the most cost-effective interventions. Taylor did not address such particular strategies or specific consideration of designing interventions with the diffusion of effect in mind. Taylor clearly recognized important managerial principles and exercised various scientific methods to improve human performance, but it was Gilbert who put them into a structured framework and developed a model for engineering human competence.

References


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