The Tragedy of Best Efforts

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Abstract

In any enterprise, it is desirable for everyone to put forth his or her best efforts. However, if those efforts are directed improperly they will be wasted; they may even be counter-productive to the goals of the enterprise. Yet, every day, the best efforts of countless people are unwittingly misdirected in organizations around the world.

This paper follows the exploits of a production team eagerly and energetically doing all the "right" things. Unfortunately, the team is greeted by one failure after another, despite the best efforts of everyone involved, from the workers up through multiple levels of management. The paper explains why and how the team's well-intentioned best efforts were tragically misguided.

Narrative

In the first half of the 21st century, a mid-sized manufacturing company created a new department. The specifics of the company, such as its line of business and its location, are not relevant to the story.

George (all names in this story are fictitious) was still relatively young when the new department he was to lead was formed, but he was not inexperienced. He had managed two small groups before, and prior to that had completed a program of rigorous management training, which included an innovative program that enabled him to intern with a veteran manager. He had begun his working career at the company, fresh from obtaining his MBA at an internationally renowned business school, and had earned this plum position by demonstrating his worth over a number of years in the company's merit-based system. Throughout his brief but successful tenure, George had continued to keep abreast of developments in the art, craft, and science of management.

George's respect for the professional practice of management was deep and abiding, and his adherence to its principles was a matter of pride. He believed strongly in sharing information with the people who worked for him, to increase their level of involvement. As he explained to the six handpicked members of his new group, they would be faced with high expectations, because their success was crucial to the company's aggressive revenue and profitability targets as it entered a new line of business; but along with the high visibility would come the possibility of high reward for everyone involved. The careers of all those in the department would rise and fall entirely on the basis of their own performance, measured by the company's established and respected (and much-copied) performance evaluation process and pay-for-performance plan.

In that respect, George pointed out, the group enjoyed several advantages over many of the other groups in the company. First, their work could be evaluated completely objectively, based on production numbers, rather than getting sidetracked by the personal and political issues so prevalent in areas where evaluations were necessarily subjective. Further, their production could be precisely measured on an individual level, whereas in so many other groups the true

picture of individual contribution was muddled by the collaborative nature of the work being done. If George's group could achieve its goals, it would be obvious to everyone up and down the chain of command – and the better performers would be able to write their own tickets when the time came to move on.

The goals were simple. In order to achieve the revenue and profitability targets that would make the company's new venture a success, the group would have to produce 480 units per month with no more than five percent of the units being found defective upon inspection by the company's independent testing group. That meant each of George's six employees would need to produce 80 units each month, with no more than four defective units.

So that the evaluations would be more than just occasional events divorced from the group's regular work life, George set the performance evaluation period at one month, thereby tying the evaluations to the production schedule and also ensuring that, by their frequency, they could contribute to an ongoing personnel development process.

A rigorous production process was defined, to ensure consistent performance among all members of the department, and all six were meticulously trained and tested, both in the process and in the use of their state-of-the-art equipment. Fortunately, they would all have identical tasks, which George recognized as an extremely rare opportunity for him to build a completely level playing field for his people.

The day before production was to begin, George threw a kickoff party for his team to celebrate their new beginning. At the party, he surprised them by awarding them each with 100 shares of stock in the company - something he had insisted upon to his superiors when they first asked him to take on this new task. He understood that a stock award would help to enlist them all in the greater cause, spur them on to greater levels of achievement (with the promise of greater reward), and instill a deeper sense of ownership. Later that evening, George roamed the production floor alone, making spot checks and reassuring himself that all was ready.

George was understandably eager for it all to begin. The new machine gleamed in the bright lights, its image reflecting in the sheen of the many multicolored motivational posters he had selected himself and hung on the walls with his own hands. In his heart of hearts, he believed his handpicked team would be able to exceed their quality goal, which he privately felt was modest. He'd already seen some of his people produce no more than three or four defects during the test runs. Once they had established themselves, he thought, the goal of no more than four defects would be met easily; at that point he might challenge them with a goal of zero defects. But that was for another day. No reason to get ahead of himself. He'd been around long enough to know he had to focus on first things first. He went home and did his best to get a good night's sleep.

The first month seemed to go well. As George made his daily rounds, it looked to him as though the team was generating more defects than he had hoped, but it was the first month and he knew that even the best training needed to be supplemented with real life hands-on experience

before his people could do their best. He remained positive in his dealings with the group, and morale stayed high. No one missed a single day of work that month, everyone got along together well and followed the production process scrupulously, and the new machinery operated smoothly. At the end of the month, on a Friday afternoon, George received his first report from the independent test group and eagerly retired to his office to study it.

The results did not match his aspirations. While the group had indeed produced the required 480 units, a startling 53 of them were found to be defective – more than eleven percent. George had expected the first month's number of defects to be a bit high, as his people acquired a feel for their new jobs, but he hadn't expected to see a defect rate of eleven percent.

For a moment, George allowed negative thoughts to flash past him – *Do these people not understand what's at stake? Did I let them get too comfortable with the job, or with me? Did I make it seem like it would be easy?* – but then he gathered himself and got down to the hard work of managing. He turned to the section of the report where performance was broken down on an individual basis and saw the following:

	1	2	3	4	5	6	7	8	9	10	11	12
Adam	9											
Barbara	8											
Carol	9											
Don	15											
Ellie	10											
Frank	2											
Total	**53**											

When George saw this page of the report, with its level of detail, the situation became a little easier to understand. Don was clearly struggling with his new task; 15 of his 80 units (18.75%) were found to be defective. Adam (11.25%), Barbara (10%), and Carol (11.25%) weren't doing very well, either. Ellie (12.5%) was a bit worse. In fact, Frank, at 2.5% defects, seemed to be the only one of the six who had come in ready to hit the ground running.

Knowing that it's best to criticize in private and to praise in public, George called Don into his office for a little heart-to-heart talk. He pointed out, as delicately as he could, that Don's total defects were almost four times the target level and asked if there were anything he could do to help Don perform better. Unfortunately, Don didn't seem to have anything to say as to why he had performed so poorly, which George found to be a discomfiting lack of self-awareness. He realized, of course, that Don's reticence could have been due to something more sinister than a simple lack of self-awareness (he could be hiding something), but George felt confident there was no need to concern himself as yet over such possibilities, especially given that he had handpicked all six members of his team, Don included. He decided to give Don the benefit of the doubt. Nonetheless, under the circumstances George felt he had no choice but to warn Don that his performance would need to improve drastically if he wanted to remain in the group. After

all, everyone's eyes were on the project. George could not be expected to put up with that kind of performance without holding Don accountable.

Later, George spoke privately with Adam, Barbara, Carol, and Ellie as well, pointing out that their defects were double the target number (or more) and that they would be expected to improve quickly as they became better acquainted with their new jobs.

At the team's next status review, George named Frank the team's Employee of the Month and awarded him a certificate for a free lunch at the local delicatessen where the team often went for lunch. He knew that rewarding good performance publicly would send the best possible message to everyone on the team. Later, he also congratulated Frank privately and told him he would be expecting him to set the pace for the others in the future.

As the second month passed, George's training and experience enabled him to perceive a subtle change in the atmosphere. The team seemed to be going about their work a bit more soberly than before. He considered the possible reasons. Perhaps they had indeed been overconfident and taking the job too lightly before; perhaps the initial excitement of the new job was beginning to wane; perhaps they were feeling some pressure to make up for the previous month's unexpectedly high number of defects. Whatever it was, morale still appeared high and the team continued to produce the required number of units while diligently following the production process. George kept a close eye on Don, of course, and Don did seem to be doing better.

The second month's report arrived at last. George flipped immediately to the detail page and saw the numbers:

	1	2	3	4	5	6	7	8	9	10	11	12
Adam	9	6										
Barbara	8	5										
Carol	9	10										
Don	15	5										
Ellie	10	7										
Frank	2	14										
Total	**53**	**47**										

Apart from the decline in defects, two pieces of information immediately drew George's attention. His pleasure at Don's dramatic reduction of his number of defective units was tempered by his disappointment – indeed, his anger – at the even more dramatic *increase* in Frank's number of defects. This was a phenomenon George had seen many times before in his career, and he chided himself for allowing it to happen. He knew he had dropped the ball in not keeping a closer watch on Frank, to be sure he stayed on track and did not become lackadaisical following his previous success. On the other hand, Don had responded admirably to George's stern warning and increased supervision.

George called Frank into his office and explained to him that he had seen the familiar post-award let-down pattern many times before, and that he wouldn't hold it against him this time because of his previous level of performance. He also gently but firmly made it clear that Frank could expect no further breaks. Frank's reaction was subdued – almost sullen, it seemed to George – exactly the reaction he would have expected from someone who had been caught slacking off. George also spoke privately with Carol, who had done a bit more poorly than before, and reminded her of what the expectations were.

George named Don the team's Employee of the Month, thanks to his remarkable improvement, and gave him the free lunch certificate. He also made it a point to compliment Adam, Barbara, and Ellie for improving their performance. He also pointed out that the team's overall performance had improved slightly. In doing so, he was trying to put as positive a spin as possible on the situation, but he could not in good conscience refrain from also reminding the team that the total number of defects should not be more than 24 in any given month - and that the actual number still hovered at nearly twice that, even in their second month on the job. The team couldn't continue to rely on the "starting a new job" excuse. If revenue and profitability targets were to be met, they had to start producing higher quality products soon.

The third month passed quickly. Each member of the team continued to follow the production process faithfully and consistently. George knew this for a fact because he had begun to monitor them all closely. Tension levels among the team members seemed to rise a bit more, but George understood that they were feeling pressure to overcome their previous failures. He made sure he was a constant reassuring and inspirational presence on the floor. He was feeling pressure, too. His team's failure to achieve its goals had not gone unnoticed by his superiors, and at the end of the second month he had endured a long, uncomfortable performance review of his own with John, his boss. George had accepted full responsibility for the team's problems, as he knew a true leader should, and vowed to turn things around.

The end of the third month finally arrived, and everyone on the team kept one eye on George as he retreated to his office to review the latest report. He couldn't believe what he saw:

	1	2	3	4	5	6	7	8	9	10	11	12
Adam	9	6	11									
Barbara	8	5	4									
Carol	9	10	14									
Don	15	5	12									
Ellie	10	7	5									
Frank	2	14	6									
Total	**53**	**47**	**52**									

To be fair, there was some good news. Ellie had improved slightly. Frank, having been properly chastened following the previous month's letdown, was well on his way back to his earlier level

of performance. Like Ellie, Barbara was showing steady improvement she had even achieved the four-defect goal for the month.

But Adam's, Carol's, and Don's defects were off the charts – those three alone accounted for 37 defects, when the total for the entire team should have been only 24. Adam and Carol were disappointments, of course, but it was Don's performance that really galled George. Don had responded when George brought some extra pressure to bear on him, but as soon as there was a letup he slacked off again. George cursed himself for not staying on top of things after the previous month's improvement the way he knew he should have. He had promised John greater improvement this month, and now he'd have to explain away an eleven percent *increase* in defects. Clearly this group was not the type to respond to the kid-glove treatment; he needed to stop trying so hard to be their friend and just be their manager. Of course he knew he had to maintain a good relationship with them to be an effective leader, but he also knew he couldn't allow their familiarity with him to get to the point where they took advantage of him and no longer respected his authority.

That’s just what he told John when he was called in after the word got around about the numbers. He apologized to John for not taking his job seriously enough and pledged to read the riot act to his team.

And he did. He called the team together for pizza (on the department) and reminded them of how crucial their success was to the company. George had handpicked each of them himself for the department. The opportunity of a lifetime was theirs for the taking. They had been given company stock so they could share more richly in the fruits of their labors. The eyes of the company's leadership were upon them. It had been shown clearly that the target was eminently achievable – Frank had only two defects in the first month; Barbara's steady improvement had gotten her down to four this month; three of the other four had come within one or two of the target number of defects at least once. He named Barbara the team's Employee of the Month, and awarded her the free lunch certificate.

George found it a bit strange that, for the most part, the team looked detached during his impassioned speech – except for Ellie, who reacted quite positively and seemed energized by it. The rest of the team actually appeared a bit put off by her positive response, however. Even Barbara, the Employee of the Month award winner, didn't look as happy as she should have.

George realized that he had waited long enough (perhaps too long) before reaching out for help. He had been hesitant to approach his peer managers for advice. Some of them, whenever he brought up the issues he was dealing with in his group, seemed to be just a bit too happy to see the “golden boy” squirming in the spotlight shining so brightly on his team. At any rate, none of them had been able to give him any ideas that he hadn't already come up with himself. And they had plenty of problems of their own to deal with. But he hadn't spoken with Helen yet.

Helen had been George's first manager at the company, and had immediately become his mentor and role model. She was experienced, competent, efficient, and approachable. She was

well liked and respected throughout the company, and always eager to learn and grow. While she and George were technically now peers, he still thought of her as an invaluable confidant and advisor.

Helen had already heard some details through the grapevine, but George laid out the entire situation for her. On the surface, it was a puzzler. Here was a group of handpicked employees, with brand new state-of-the-art equipment, a well-defined process being used consistently by each of them, lots of positive incentives and great opportunity, a growth-oriented environment, world-class training, and an energetic manager with a proven track record – and yet, month after month, they failed to meet a target that George felt (as he confided to her) was modest and knew was achievable.

Helen pulled out a piece of paper and drew an Ishikawa (sometimes called “fishbone”) diagram. She labeled the head "Low Quality Production," then drew four bones and labeled them "Methods," "Machines," "Materials," and "Manpower."

Helen and George discussed each of the four areas at length. They reviewed the defined production process and found no significant flaws. That, and George's observation that everyone appeared to be following the process diligently, led them both to dismiss Methods as a likely source of the problem. The Machinery was brand new, utilizing cutting edge technology, and frequently maintained. The Materials being used came from the usual suppliers, and met the same specifications as materials used in other departments.

Finally, the discussion turned to the question of Manpower. When George mentioned Ellie's enthusiastic response compared to the rest of the team's detachedness, Helen's eyes lit up as she wondered aloud about what could have been the reason for the intriguing difference in reactions. George had made the best motivational speech he could summon up, and only one person reacted the way he had hoped they all would. Then it hit her: they had reacted differently simply because some of them had found his speech motivational and others hadn't. As she reminded George, different people are motivated in different ways. George found himself blushing with embarrassment, because he knew that as well as anyone – but he had neglected to put that knowledge to work for him. Helen was gracious as he expressed his deepest gratitude and left her office.

The fourth month was a difficult one for George. He realized he needed to get to know his people well enough to understand their individual motivations, while at the same time maintaining a certain authoritative distance. It was a fine line to walk, but he understood that the challenges of management were the reason he took home a bigger paycheck than the people who worked for him. The job of manager was not easy, but it was his chosen path and he would do whatever it took.

He interviewed every member of his team several times, determined to find out how each of them ticked, what things mattered most to them – the goal being to discover some source of intrinsic motivation for each of them. Of course George recognized the folly of relying solely on

extrinsic motivators – and he realized, ruefully, that was exactly what he had been doing in the earlier months. Still, it was a struggle trying to find ways of establishing even tenuous connections between their intrinsic drivers and the job at hand.

At last the next monthly report arrived. George drew a deep breath as he closed the door to his office. What he saw, when he turned to the detail page, was deflating:

	1	2	3	4	5	6	7	8	9	10	11	12
Adam	9	6	11	14								
Barbara	8	5	4	7								
Carol	9	10	14	10								
Don	15	5	12	13								
Ellie	10	7	5	9								
Frank	2	14	6	6								
Total	**53**	**47**	**52**	**59**								

Incredibly, four of the six team members did worse than the previous month. Adam and Don were clearly becoming problems. The only team member who improved, Carol, still had ten defective units – two and a half times the maximum allowed. Not one of them had fewer than six defective units. The total number of defective units reached 59, more than 13 percent higher than the previous month.

Clearly things were going south, and quickly. George knew he was going to have to think fast if he was going to save his job. His team's product was a crucial component of the company's new venture, and failure of the venture would mean financial disaster for the company.

Not surprisingly, John had been thinking the same things, and told him so – in creatively colorful terms that George, before now, had never heard from anyone he had reported to. The company had staked its future on the new line of business, and the shortage of good units from George's group meant that final assembly of the new products had to wait – and they couldn't ship what they didn't have.

Desperate, George suggested that the team could work overtime to build more units, so there would be enough good units to meet customer orders. John dismissed the idea out of hand. The cost of the extra materials alone would be prohibitive, and he certainly didn't want an inventory of defective (and expensive) units piling up. The prospect of reworking defective units was also out of the question, for technical and financial reasons.

A few moments of awkward silence passed; then John answered the question George had been silently wondering about. There had been a discussion among upper management, and it had been decided that George had to be replaced. He wouldn't be fired, of course – just given a job managing somewhere with a bit less pressure. John stressed that there was no shame in this; it wasn't the first time he had seen this kind of thing had happen. Of course, it was regrettable. But something was clearly wrong – and, as George's manager, John couldn't wait any longer to act.

George was devastated, as anyone would have been. Still, he was glad to hear that Helen had been picked as his successor. If anyone could turn things around in that group, she could. Even better, he knew she already had some background on the situation from the time he had gone to her for advice.

For her part, Helen had agreed to take over the group somewhat reluctantly. She liked the job she already had. But the company had been good to her, and where she was needed, she would go.

Helen understood that business is built on relationships; replacing the likeable George and quickly establishing rapport with the team would be a challenge. She immediately scheduled a meeting with her new group and explained the situation. She took great pains to absolve George of any personal blame; it was just a business decision, made for the benefit of everyone involved. She interviewed the group at length and in detail, learning as much as she could about every aspect of their situation and routine. She was a bit surprised to learn that George had been naming an Employee of the Month. She had decided long ago that such practices only created competition among team members. Although this team's members all worked independently of one another, she knew it was still important that they pull together and support one another - especially now, when the stakes were so high. The meeting went on for a very long time, but when it ended she felt it had gone well enough. She had gotten good feedback from the team. Surprisingly, no one had held back; everyone had participated. It seemed that they all understood the seriousness of the situation and they were willing to do whatever it would take to get things back on track.

After the meeting, Helen went to John and suggested a team-building retreat for the team, to build a greater sense of unity. She suspected that, because they did work independently from one another, perhaps they had not built up the sense of family they would need to overcome the challenge ahead. He resisted, as she knew he would. He had never thought much of that "touchy-feely stuff," as he called it. But this team's success was vital, and Helen was persistent; the retreat could be done on a weekend, not impacting the production schedule. At last she went out on a limb and volunteered to personally foot the bill for the retreat. John finally agreed, but told Helen to keep her money; he trusted her judgement, and her willingness to part with her own money impressed him and convinced him he should give her (and the retreat) a chance.

Later, in her office, Helen took a closer look at the numbers. They weren't pretty. But something about them struck her as quite odd; aside from the monthly reports from the independent testing group, there were no other numbers. It didn't appear that George had been tracking defects internally at all. A quick phone call to George confirmed that, and left George kicking himself. Of course! Waiting a whole month to find out how the team was doing was insanity! There was a wealth of information surrounding each defective unit, and that information was being ignored and lost forever.

Helen had always liked George. Still, as she hung up the phone she couldn't help but wonder about him a bit. The Employee of the Month thing was understandable; many managers considered that sort of practice perfectly appropriate, even if she did not. But not keeping a closer eye on defects, especially given the large numbers of them, was inexplicable. She wondered if perhaps success had come a bit too quickly and easily to him. Maybe he had never really been tested, and his luck had finally run out. It wouldn't be the first time she had seen it happen. It was worse for some other managers she had known, who were older, with families and lifestyles to support. When they fell, they fell hard.

She was reminded of Ken, who had been her own mentor at the company. Ken had enjoyed a brilliant career that lasted many years, until he was given a job that, for some reason, he just couldn't handle. The failure (which, Helen mused, was eerily similar to George's in many ways) had devastated him personally and professionally, and he was never the same. He and his wife had separated not long after. When he was offered early retirement, he took it. Helen had heard recently from an old friend that Ken had reconciled with his wife and was working part time in a hobby shop.

Compared to Ken, George was lucky; at least he was still young. If he kept his head down, took the assignments he was given, and played the good soldier for a few years, he might get another shot at an important role in the company one day. It wasn't likely to happen any time soon, but at least he still had time to recover.

It was a shame, she thought, that George's problems couldn't have been prevented. If his weaknesses could have been identified earlier and dealt with appropriately, things might have turned out very differently. Helen made a note to talk to John about a possible improvement in the company's management training; it occurred to her that there might be a test that would challenge management candidates with an unusually difficult, comprehensive situation – perhaps an advanced simulation. She smiled to herself as she spelled out the words "Kobayashi Maru." She knew that John, who was as big a fan of *Star Trek* as she was, would recognize the name of the no-win scenario that all Star Fleet cadets were required to face as a test of character before graduating as officers. At the very least, such a test could help weed out those who weren't really cut out for the tough challenges of management before they got into a position to harm the company and embarrass themselves.

But the "Kobayashi Maru" would have to wait. There was no time to lose. Helen called the team together and filled them in on her new expectations. They would be responsible for measuring each unit they manufactured, and if it fell outside specifications they should track down the cause of the defect before proceeding. They would regularly share the knowledge gained from this activity with one another, looking for patterns that might help them identify areas for process improvement.

Helen also told the group about the retreat, which she had miraculously scheduled for the following weekend by calling in a favor with the head of the institute, an old friend of Helen's

since the time she herself had first attended the retreat. The immediate reaction among her new team was tepid – as any manager knows, it often is. Barbara and Don had each already made plans with their families for the weekend in question, and were understandably a bit agitated at the prospect of changing those long-standing plans on short notice. The others were available that weekend, if not particularly enthusiastic about the idea. Helen pleaded her case – the situation was dire, and if they were to have any hope of success, they would all have to work together. The retreat could help them to become a better team. She had seen it happen before, with other groups.

That evening, both Barbara and Don spoke with their families and shared everything that had happened. Both families, fortunately, were extremely supportive, and they understood the seriousness of the situation. The plans would be canceled. There would be plenty of other weekends to enjoy family plans, but they both needed a regular paycheck coming in if they were going to be able to afford that kind of thing.

The retreat, as it turned out, was a positive experience for everyone. It took a while for most of the team to open up, but by Sunday afternoon they all agreed that they felt closer and more supportive of each other than they ever had before. When they returned to work on Monday they threw themselves into their work with a fresh enthusiasm that recalled their first days on the job. They were diligent and eager in tracking down the suspected cause of every defective unit, and met frequently to share notes. Helen joined in those meetings as well, and was pleased to see that the effects of the retreat did not seem to be fading as the days and weeks passed.

Most of the observations that the team members were making regarding the causes of defects were trivial, and no obvious process changes presented themselves, but Helen's biggest concern was that the actual number of defects did not appear to be diminishing, despite the enthusiastic efforts of the team. The days passed by almost in a blur. When the monthly report arrived, Helen didn't have to open it. She already knew the numbers, and she knew they weren't good. But she did open it, and sure enough the numbers matched her own exactly:

	1	2	3	4	5	6	7	8	9	10	11	12
Adam	9	6	11	14	14							
Barbara	8	5	4	7	8							
Carol	9	10	14	10	9							
Don	15	5	12	13	8							
Ellie	10	7	5	9	10							
Frank	2	14	6	6	12							
Total	**53**	**47**	**52**	**59**	**61**							

The team had had its worst month of all. The only improvements came from Carol, who reduced her number of defective units from ten to nine, and Don, who went from 13 to eight – hardly a praiseworthy effort, when the target was a maximum of four. Adam's performance stayed exactly the same as the previous month – a miserable 14 defects. Everyone else's performance

had gone from bad to worse. Frank had been doing relatively well, but this month his defects had doubled. Helen was beginning to acquire an appreciation for the difficulties George had faced with these people.

Word of the results got around the company, of course. When George heard, he tried to suppress (but couldn't) a small twinge of satisfaction. Helen's troubles validated him, if ever so slightly. There was something going on over there in that group, and even his vaunted mentor couldn't fix it, at least not as quickly as everyone had hoped.

Helen, meanwhile, was dancing as fast as she could, trying to explain herself to John. She hastened to tell him she was certain that the retreat had had a positive effect that was both visible and lasting. The only explanation she could offer was that the new demands of tracking individual defects might have distracted the team from its core tasks. Maybe it had caused them to lose focus.

Helen and John both knew that identifying defects and their causes would be vital to improving the team's output quality, and there was no way they were going to simply stop doing it. They agreed that Helen would just have to figure out some way to help her new team stay focused on production despite their added responsibilities. And she really had to start mining some value from those observations of individual defects, to prove the effort worthwhile. And she still had a difficult meeting ahead of her with her team.

The thought occurred to her, as it had to George a few months earlier, that there were good reasons managers took home bigger paychecks than the people they managed. The challenges were so much greater, and the levels of responsibility and accountability were so much higher, in this life she had chosen.

As she had expected it would be, her team meeting was uncomfortable. The numbers were no surprise to the team either. Each of them had quietly begun, long ago, keeping a private tally of defects, and they all knew they had performed poorly.

Despite her many talents, Helen was no clairvoyant; she was not privy to the team members' deepest thoughts. It didn't take a mind reader, though, to see that the group was suffering. She called upon all her training and background in counseling to probe for a deeper understanding of the situation. As reluctant as they all were, they could tell that Helen was sincere, so they gradually came to share as much as they were comfortable revealing. She was not greatly surprised by their hesitant intimations of resentment, and their frustration was palpable. But most of all, they were confused and uncertain. They did not seem to know what to do about the problems they faced, and they truly appeared to believe they were not giving anything less than their best efforts.

If Helen had ever seen a situation in her career that cried out for strong leadership, this was it. These people were floundering, and didn't have any idea what they were doing wrong or what to do about it. Now that this had been brought out in the open and acknowledged, she knew that

they would be ready to accept the need for forceful direction. Fortunately, she was prepared - she and John had already devised a plan, and she laid it out for them.

First, the team would participate in daily quality circle meetings to identify problems and develop problem fixes in as timely a manner as possible. Next, because of her concerns over a possible lack of focus due to these additional responsibilities, she requested that the team keep her apprised of anything she could do to support them in completing their core tasks. She would be a full participant in the daily quality circles. Finally, she told them she had already requested, and received approval for, an additional team member to go over the defect information they had gathered, dig up whatever was hiding inside, and coordinate the defect tracking and cause identification efforts.

That last item had not been easy to accomplish by any means. John had been understandably loath to add any expense at all to the struggling department's budget, but Helen was as respected a manager as there was in the company, and she was also very persuasive.

The reasoning was straightforward. It was a solution that addressed both of the objectives Helen and John had identified: putting the defect information to work, and protecting the rest of the team from distractions. The company had already invested a great deal of money in the group, and was banking on its success; to put it bluntly, they could not afford to allow the group to fail.

Larry arrived the next morning, eager to take on the challenges awaiting him. By the end of the first day, he had met all the team members and developed a simple, effective defect reporting process that would not unduly burden the team members or distract them from their production work.

As the weeks passed, Larry continued to search for clues hidden in the defects, but found little. Still, his efforts did encourage the team members that something was being done. Helen wanted to believe that things were getting better, but she had an uneasy sense that nothing substantial had changed. The numbers for the month confirmed her suspicion that there was still work to be done, but at least there was some improvement:

	1	2	3	4	5	6	7	8	9	10	11	12
Adam	9	6	11	14	14	15						
Barbara	8	5	4	7	8	4						
Carol	9	10	14	10	9	7						
Don	15	5	12	13	8	9						
Ellie	10	7	5	9	10	10						
Frank	2	14	6	6	12	9						
Total	**53**	**47**	**52**	**59**	**61**	**54**						

Adam continued his trend to poorer performance. Barbara continued her solid, if not spectacular, performance by becoming the only team member to ever achieve the target twice.

Don did worse than the month before. Frank, the only team member ever to exceed the goal, did not do well this month, but did improve. Carol was definitely showing a trend of improvement. And Ellie stayed just as bad as the previous month.

The total number of defective units had decreased, and Helen breathed a sigh of relief that the measures she had taken did have a positive effect. The problem was, she knew, the improvement was not enough. Every defective unit beyond 24 per month was costing the company money and future business, and the number was still up at 54. If things didn't improve significantly and quickly, it would mean disaster for the company.

John called Helen into his office. She could tell by his face that something big was up. Most of upper management was talking about layoffs, and about canceling the project. John had fought hard in opposition, but the die was cast. Helen wondered aloud how much longer they had to turn things around, and the answer was not encouraging. John's persuasive arguments had bought the team two months to make the necessary improvements. If they couldn't, then half of them would lose their jobs. It wasn't anything personal, just a prudent business decision by people who wanted to protect the company. Costs were overrunning revenue; drastic steps would have to be taken if that trend was not reversed in a big way, and soon.

Helen's group did not take the news well. No one could have expected they would. But Helen was a truly skilled leader, and she knew that her primary goal at that point was getting the group focused on matters they could control. It seemed as good a time as any to enlist the team's aid once again in deciding what could be done. Helen, Larry, and the whole team stayed and talked for hours, hashing over the defect information and reviewing the production process in detail.

Many ideas were floated, but only one inspired hope in the hearts of the team. In the course of collecting defect information, Larry had noticed that the machine was manually calibrated. The measurements they were already taking told them how far from the specification each unit was. After completing each unit, the team members could, after measuring how far out of spec the unit was, adjust the machine accordingly. Don remembered having read somewhere that the Army calibrated its big guns in just the same way: take a shot, observe how far off target the shell was delivered, and adjust the gun sight in the opposite direction to compensate.

It was such a simple idea, and basic common sense. If your machine is off in one direction, you adjust it in the other direction. The group felt empowered by their discovery. At last, here was something they themselves could do to take control of their situation.

The days passed, and the team worked long hours. The frequent machine adjustments meant that everything took much longer than before. But there was hope, and morale was higher than it had been in quite a while. Helen was looking at the numbers daily, and after a few weeks it became clear that something intriguing was happening. Frank had only one defective unit, and Carol had only three.

The others, unfortunately, were not doing nearly as well. But if Helen could bring the others' performance in line with theirs, there was real hope. She asked Frank and Carol to compare notes and document what they did, how they did it, in what order, and so on, in great detail. When they had finished, she had them share their successful practices with the others in a special training session. With only two days left before the end of the month, she knew the session probably wouldn't have a huge impact on that month's numbers, but at least the improvement should carry through to the next month and make a real difference.

Given the attention to the numbers, the month's numbers were disappointing, but no surprise:

	1	2	3	4	5	6	7	8	9	10	11	12
Adam	9	6	11	14	14	15	17					
Barbara	8	5	4	7	8	4	15					
Carol	9	10	14	10	9	7	3					
Don	15	5	12	13	8	9	12					
Ellie	10	7	5	9	10	10	17					
Frank	2	14	6	6	12	9	2					
Total	**53**	**47**	**52**	**59**	**61**	**54**	**66**					

The total number of defective units was at an all-time high. That was certainly nothing to cheer about, of course, but at least Carol and Frank had only five defects between them, and had just taught everyone else their best practices in machine adjustments. Helen and the team felt they had some reason to be cautiously optimistic for the next month.

John's reaction was understandably more reserved. Yes, it was great that Carol and Frank had had breakthroughs, but the question of what could be expected from the others was still open, and there was no room for error. And even with the stellar performances from Carol and Frank, the total number of defective units for the month was higher than it had ever been.

As the eighth month progressed, the team's cautious optimism evaporated. Despite everyone's best efforts, the numbers were not good. Even Carol and Frank regressed. After only two weeks they had eight and four defects, respectively; after three weeks, it was up to 13 and seven. The entire team was already expecting the worst by the time the final results were reported:

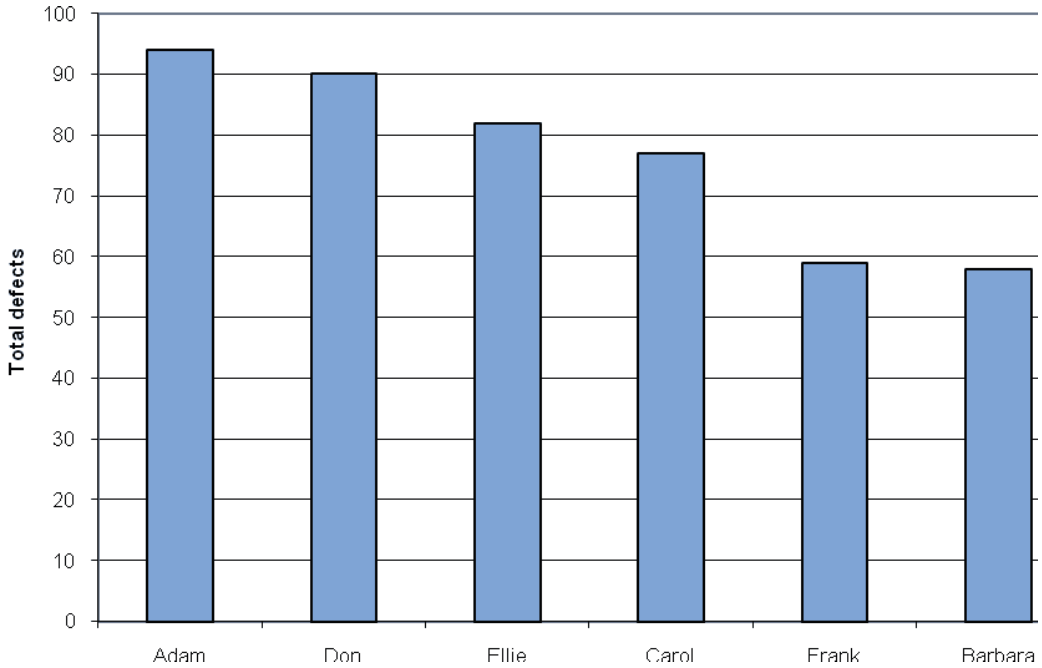
	1	2	3	4	5	6	7	8	9	10	11	12
Adam	9	6	11	14	14	15	17	8				
Barbara	8	5	4	7	8	4	15	7				
Carol	9	10	14	10	9	7	3	15				
Don	15	5	12	13	8	9	12	16				
Ellie	10	7	5	9	10	10	17	14				
Frank	2	14	6	6	12	9	2	8				
Total	**53**	**47**	**52**	**59**	**61**	**54**	**66**	**68**				

The report could not have been more devastating to everyone's hopes. The truth is, however, that no one was caught unawares. The numbers had been watched daily – sometimes hourly – by everyone on Helen's team, by Helen, by John, and by everyone else in management who understood the stakes.

Customers who felt they had waited long enough were calling to cancel their advance orders. With customers and deadlines of their own, how much longer could they be expected to wait? The future of the entire company was at risk.

The consequences were swift and unsparing. Helen was told to pick the best three of her six team members to keep; they would be working double shifts to keep up production. The other three would be laid off. Larry would have to go as well. And the damage wasn't confined to a single group; layoffs hit every area of the company, some harder than others. George's department was evaluated as non-essential (after all, the reason he was sent there in the first place was because it was somewhere he couldn't do much harm), and everyone in it, including George, was let go.

Helen had some difficult decisions to make. Dipping into her manager's tool box again, she drew a Pareto diagram showing the performance of the six team members:



The Pareto diagram helped Helen rank the team members in a purely objective way. Over the eight-month period, Adam and Don clearly had been the worst performers. Those two would have to go. On the other end, Barbara and Frank were clearly head and shoulders above the rest in terms of pure performance. Looking back at the raw numbers, Helen could see that Barbara had been a fairly steady and consistent performer, except for during the first month of

adjusting the machine, which skewed her defect total much higher than it would have been otherwise. Frank had been more mercurial, with monthly performances ranging all the way from two defects up to 14. He was also the only one who had ever gotten down as low as two defects, and he had done it twice. Barbara and Frank would stay.

At first, Helen felt the toughest call was between Carol and Ellie. Their total defects were only six percent apart, and Helen searched for additional criteria so she could be sure to decide as fairly as possible which one would stay and which one would go. Both were dedicated, reliable, and good-natured. Helen remembered how George had told her about Ellie's enthusiasm at a time when the rest of the team was unresponsive; that kind of attitude would be good to have on the team going forward. Prior to beginning machine adjustments, she had also outperformed Carol, with 51 defects to Carol's 59. On the other hand, Carol had only 18 defects since the machine adjustments had begun; Ellie had 31.

Helen carefully weighed which factors would likely have the most positive impact going forward. The thought of just flipping a coin did flash through her mind, but she never seriously considered it. She knew that it would be unfair and callous to determine the fates of two people by mere chance. They deserved better from her. In the end, she decided that she needed quality production. Carol was one of Helen's best-practices mentors; she had also proven herself to be the superior performer under the prevailing circumstances, and by a much greater margin than Ellie had outperformed her before the machine adjustments began. It wasn't really as tough a call as Helen had first thought. If the team needed a cheerleader, Helen could fill that role herself. Ellie would go; Carol would stay.

The next month was not pleasant. Double shifts, and long shifts at that, took a toll on everyone's health and personal relationships. Morale was predictably low; desperation is a poor colleague. Fear and tension ran rampant. Worst of all, even with only the best workers on the job, the numbers were not good enough, as the three best workers combined to produce results only marginally better than the worst month ever:

	1	2	3	4	5	6	7	8	9 (1st)	9 (2nd)	10 (1st)	10 (2nd)
Adam	9	6	11	14	14	15	17	8	-	-	-	-
Barbara	8	5	4	7	8	4	15	7	15	17		
Carol	9	10	14	10	9	7	3	15	16	5		
Don	15	5	12	13	8	9	12	16	-	-	-	-
Ellie	10	7	5	9	10	10	17	14	-	-	-	-
Frank	2	14	6	6	12	9	2	8	6	6		
Total	**53**	**47**	**52**	**59**	**61**	**54**	**66**	**68**	**65**			

Behind the doors of conference rooms, conversations turned bitter and questions and accusations flew. Why had upper management decided to take this gamble? What was the board of directors doing when the decision was made? Why hadn't anyone mitigated the risk of the new enterprise? Why did such a young manager get this job to begin with? Why wasn't

Helen able to turn it around? Should the marketing group have waited until sufficient inventory had been built to handle initial orders? What was going on with those workers, anyway? At least Frank seemed to be getting it, but why was Carol so inconsistent? And what on earth had happened to best-practices mentor Barbara?

The atmosphere during the tenth month was even more unpleasant than it had been during the ninth, but finally there was some real improvement in the numbers:

	1	2	3	4	5	6	7	8	9 (1st)	9 (2nd)	10 (1st)	10 (2nd)
Adam	9	6	11	14	14	15	17	8	-	-	-	-
Barbara	8	5	4	7	8	4	15	7	15	17	11	6
Carol	9	10	14	10	9	7	3	15	16	5	2	13
Don	15	5	12	13	8	9	12	16	-	-	-	-
Ellie	10	7	5	9	10	10	17	14	-	-	-	-
Frank	2	14	6	6	12	9	2	8	6	6	3	9
Total	**53**	**47**	**52**	**59**	**61**	**54**	**66**	**68**	**65**		**44**	

The total number of defects was the lowest it had ever been in the history of the project. Frank, in particular, seemed to be getting the hang of the process and understanding the stakes. His defect total over the two months of double shifts was only 24. Carol had 36 but, notably, had only two defects on first shift during the second month. For some reason, the increased workload seemed to have affected Barbara the most. Once the team's top performer before going to double shifts, she was now the worst performer of the three by far, with a total of 49 defects over the two months.

John and Helen tried to make the case to upper management that the group had finally turned a corner; if they made the same improvement the next month that they had made this month, they would achieve the target at last.

Unfortunately, it was just too late. The entire project was scrapped. The facility was sold off – machine, inventory, fraying motivational posters, and all. A drastic reduction in headcount left Barbara, Carol, and Frank unemployed, like their colleagues before them. Desperate measures, the details of which it is unnecessary to discuss here, were taken to salvage what was left of the company's resources and reputation. John and Helen took other jobs within the company, but within a year both had left for jobs elsewhere. The company continued to struggle for three more years before finally stabilizing as a small specialty manufacturer.

Why Do You Speak in Parables?

This paper tells the story of a group of people diligently putting forth their best efforts, ending in tragedy. Although the story is fictional, similar scenarios play out every day, and an understanding of our parable can be instructive.

The workers were handpicked and highly trained. They were provided with well-defined goals, and given regular monthly reviews of their performance based on purely objective measures. Their work environments and working conditions were identical, so they all had an equal chance to succeed or fail. They were given a number of desirable incentives, such as a company stock award and (for a while) a free lunch for the Employee of the Month.

The managers were constantly present and involved in the process, sponsored a team-building retreat, allowed the workers to make process improvements, captured and disseminated best practices, instituted a process for defect tracking and cause identification (and even hired someone to "mine" the data gathered), established and participated in quality circles, worked to identify and employ individual intrinsic motivators unique to each team member, consulted with other managers, prepared and delivered the monthly performance reviews and appropriate counseling, and even went so far as to hold an inspirational project kickoff meeting and personally hang motivational posters in the workplace. Further, the managers didn't rely on instinct alone, but used tools like the Ishikawa and Pareto diagrams to help them understand their situation and make decisions. And when desperate measures were called for, they made the tough choices and fired their worst performers and kept only the best.

It would seem that everything was primed for success, yet they were met with utter failure. Why? What went wrong?

The simple truth is that the project was doomed from the very beginning, despite all those best efforts. The evidence appears plainly on the page, over and over, throughout the narrative; yet *it is completely invisible to those who do not know how to see it.*

This phenomenon, labeled "paradigm paralysis" by futurist Joel Barker, occurs when a person's expectations and assumptions prevent that person from processing, or even perceiving, reality when it is contrary to those expectations and assumptions. Paradigms are a necessary part of our brain's functioning, because they allow us to develop shorthand models of the world instead of having to process every moment or experience as if we were encountering it for the first time. For example, once you've learned the paradigm "chair," you can recognize chairs of many different types, and are not mystified when confronted with a swivel chair if you've previously only encountered straight-back chairs and rocking chairs.

But paradigms are powerful enough that they also can prevent us from understanding – worse, they literally can prevent us from even *seeing* – things that do not conform to them.

To see the evidence on the pages requires a new paradigm. Specifically, it requires the use of statistical methods pioneered in the 1920s by Dr. Walter A. Shewhart at Bell Laboratories, taught in Japan as part of the successful rebuilding effort following World War II, and taught throughout the United States during the 1980s and 1990s by Dr. W. Edwards Deming in his famous 4-day course for managers.

Revealing Variation

Dr. Shewhart, studying variation as it affected the process of manufacturing telephones, identified two kinds of variation: common random variation that is inherent to the system being studied; and special cause variation. By way of illustrating the difference between the two types of variation, consider a rifle, locked in a firing stand, fired at a distant target repeatedly by remote control. The bullets will not all pass directly through a single small bullet-sized hole; rather, the bullet holes from that rifle will describe a pattern on the target due to the inherent variation of the system. A host of possible sources of variation exist in the system: tiny variations in the sizes, weights, shapes, and balance of the bullets; slight variations in the scoring and temperature of the rifle barrel; the normal air currents in the room; the positioning of the bullet in the chamber; and so on. The effect of all these sources of variation is a random distribution of bullet holes in a group on the target. The less variation there is in the system, the tighter the pattern will be. This variation is known as *common* variation.

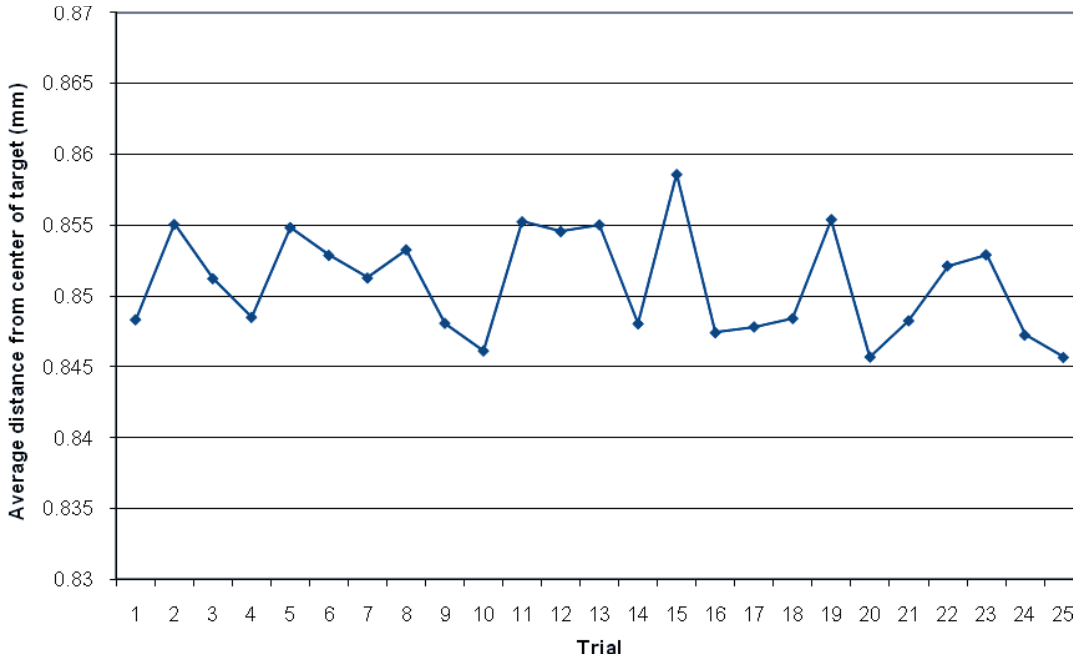
Now, imagine the system being disturbed by some special event. A test technician might have bumped into the firing stand and slightly displaced it just before a test is conducted, or the test technician might have loaded the rifle with a batch of bullets made from a much heavier metal alloy than all the others. Either of these events would likely result in a group of bullet holes set apart from the others, which would indicate that something out of the ordinary had happened to disturb our system. The "something out of the ordinary" is *special cause* variation.

Dr. Shewhart also identified two costly mistakes that could be made in dealing with variation. The first mistake (called "Type I") is treating common variation as something out of the ordinary and trying to "fix" the system. Dr. Shewhart discovered that making this mistake actually leads to increased variation in the system.

The second mistake (called "Type II") is ignoring variation due to special causes, believing it to be common variation. Making this mistake means missing two kinds of opportunities: the opportunity to fix something in the system that actually needs to be fixed; and the opportunity to learn and benefit from something that went better than could have been expected.

Making either mistake leads to loss. Type I mistakes lead to wider variation in the system, making it more difficult to identify and remove special cause variation or to identify changes in the system's capability. On the other hand, Type II mistakes lead to missed opportunities for fixing or improving the system. Dr. Shewhart developed a statistical tool, known as a *control chart*, to help minimize loss from the two mistakes.

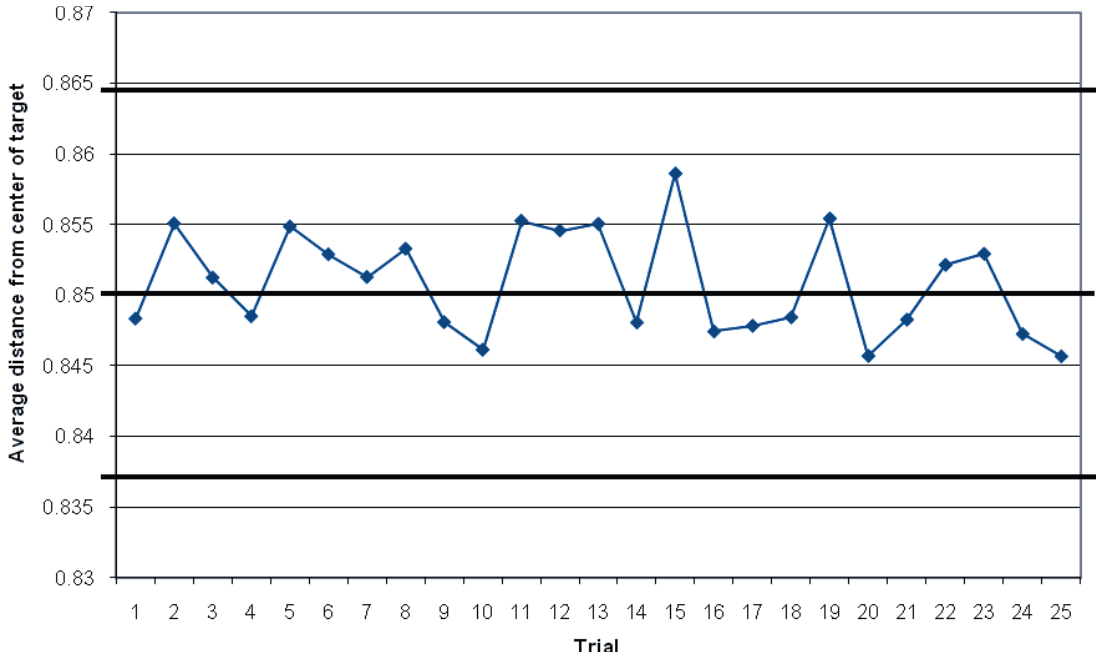
Let's say that we conduct an experiment by firing 20 bullets from our rifle and measuring the distance from each bullet hole to the exact center of the target. If we do this 25 times and sample the results of each trial, we can draw a simple run chart as follows:



To make this run chart into a control chart, we must add what Dr. Shewhart called *control limits*. He determined, empirically, that loss from the two types of mistakes could be minimized by drawing boundaries at three standard deviations above and below the mean. The *upper control limit* (UCL) is located at the mean plus three standard deviations, and the *lower control limit* (LCL) is at the mean minus three standard deviations.

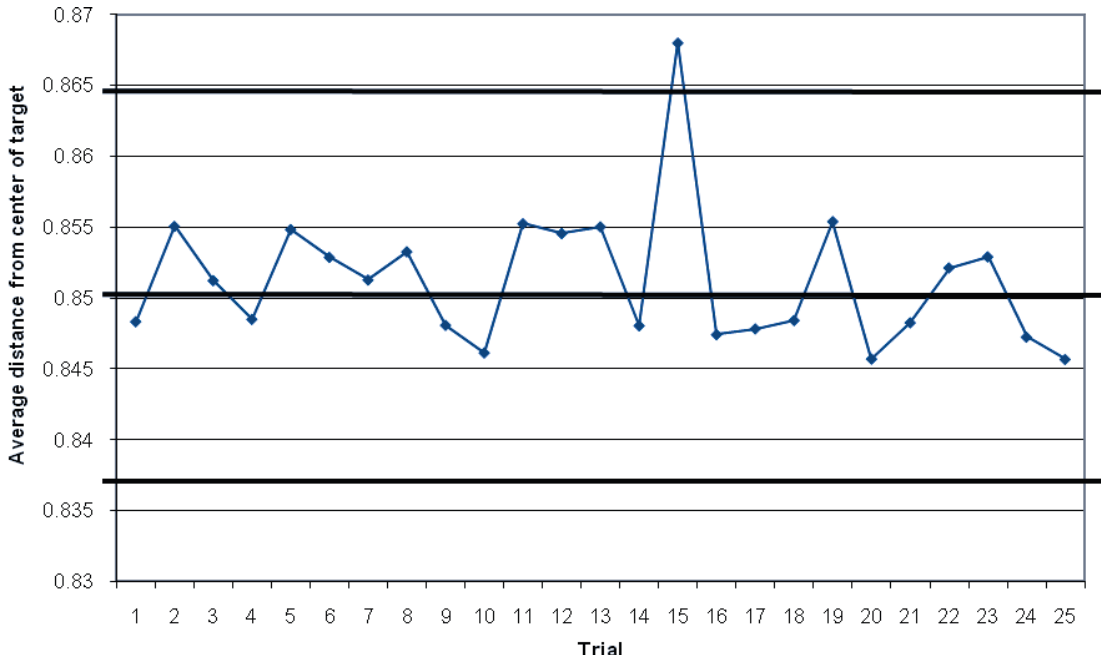
Dr. Shewhart's research showed that if all the data points on a control chart fall within the control limits, the system is almost certainly *stable* – only common variation is present – but if data points fall outside the control limits, the system is almost certainly *unstable*, meaning that it includes special cause variation. Stability in a system means we can predict that, if the system is not disturbed or modified, it will continue to behave in much the same manner for the near future, with all data points falling within the existing control limits. Instability means that no prediction from the data is possible.

The appropriate methods for calculating control limits under various circumstances are well documented elsewhere and beyond the scope of this paper, but here's our rifle chart with mean control limits added:



We can see that all data points fall within the control limits. This means that all the variation observed is almost certainly common variation that is inherent to the system. The system is stable.

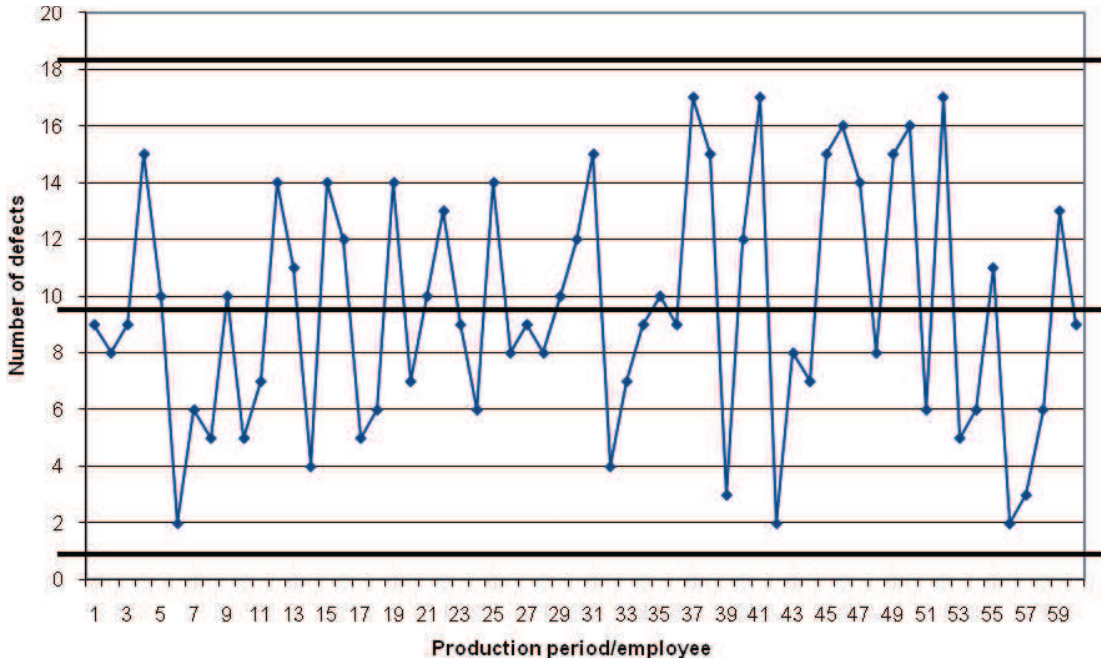
But the chart might have looked as follows:



In this case, there is a data point outside the control limits, indicating an event that was most likely not due to common variation inherent in the system. If many more data points were outside the control limits, we might declare the system unstable, and no reliable prediction could be made about the system's near-term future performance. But the presence of just a single data point outside the control limits over a good-sized sample indicates the likelihood of a special event having occurred within an otherwise stable system. As discussed above, perhaps for this trial the rifle was not aligned the same way as for the others, or perhaps a batch of bullets made from a different metal was used.

The key to remember is that the control limits – *which are calculated from the actual data, not imposed by any specification, goal, quota, or other form of wishful thinking* – act as a guide, enabling us to minimize our chances of making either of the two costly mistakes.

Now, let's draw a control chart to analyze the performance of our fictional employees in our fictional department in our fictional company. Here is the data we've already seen, expanded into a sequence of each production period for each employee, and with mean and control limits calculated appropriately and added to the chart:



This control chart reveals a stable system. That is, all the variation in the number of defects can be ascribed to common variation intrinsic to the existing system. Let's say that again, because it bears repeating: *statistical analysis shows that the variation in the number of defects was common variation intrinsic to the system, and cannot be ascribed to the individual efforts of the six workers. There is no statistically defensible distinction to be made among the six employees with regard to their performance*.

Actions and Effects

An understanding of these concepts demands the adoption of a radically different paradigm; to be blunt, the lives and well-being of people are at stake.

Replacing George with Helen had no apparent effect, because there was no change to the production system; in real life, the added workload of tracking defects very likely would have had an adverse impact on productivity. The layoff and double shifts did not affect production either in our story, but it is no stretch to imagine that in real life they would have had a negative effect.

The revelation that this is a stable system also means, for example, that Don required no counseling regarding his "poor performance" the first month, because his performance was not poor. Neither was his “improvement” the next month deserving of any special awards. Both months’ numbers were right in line with what might have been expected from any of the six employees working in our stable system. Neither Frank's two defects in the first month nor his two defects in the seventh month were data points outside the control limits, and therefore deserved no special response either.

An unenlightened manager might punish Adam for producing 54 defects from the third month through the sixth month, and reward Barbara for producing only 23 over the same four months, despite the fact that both are putting forth their best efforts and there is no justifiable distinction to be made between their performances. Adam might feel confusion; he knows, intuitively, that he is doing just as good a job as Barbara, yet somehow he does not get the results she does. Resentment against her and against his management team begins to build.

The conventional manager might install an incentive program to reward individuals for doing better than their colleagues, hoping to improve overall quality and productivity, when in fact all their performances were being determined solely by the laws of chance – and, if one employee did actually discover a way to improve performance by changing the system, such an incentive program would discourage that employee from sharing the secret with the others. The result is that most opportunities for improvement across the board are squandered.

All the rewards and threats, all the career counseling, all the judgements made concerning the workers' motivations, attitudes, and abilities – all these futile, destructive best efforts were the result of nothing more than repeating Type I mistakes over and over again due to a lack of understanding of statistical methods that have existed since the 1920s.

In fact, ascribing the workers' results to personal characteristics – laziness, incompetence, genius, diligence, response to reward or disciplining, and so on – in the absence of situational or contextual understanding is a phenomenon well known to psychologists as the *fundamental attribution error*. The control chart provides us with the necessary context to see that the workers' performances were statistically indistinguishable, despite our "common sense" reflexive interpretation of the numbers.

It should be obvious by now that selecting the three "best workers" from among the six employees was a fool's errand. Three people lost their jobs and three others were thrown into a difficult double-shift operation that strained their health and their personal relationships – all based on the misapprehension that it was possible (and fair) to make distinctions among their performances based on the hard black-and-white numbers found in the defect reports.

The decision that costs had to be cut, and three employees had to go, is certainly defensible as a financial and business decision made in desperate circumstances; but there was no justification whatsoever for deciding who would be let go and who would stay using the observed performance of the individuals in the system. Given that the system was demonstrably stable, and the individual performances were indistinguishable, labeling some workers “best” and others “worst” did a grave disservice to everyone involved. In essence, the selection process was no more than a lottery, as the rankings were determined based on numbers produced solely by common variation. Drawing straws would have been every bit as “fair,” and would have had the advantage of everyone's being fully aware of the random nature of the selection process.

It should also be clear that asking Carol and Frank to share their "best practices" in making machine adjustments was misguided, as there was no justification for the belief that their performance had been (or would be) superior to that of the others on the team. In fact, any copying of "best practices" without first establishing a causal relationship between the practice(s) and the desired effect(s), and without a sober and reasoned consideration of the differences between environments, is simply tampering with the system – a guarantee to make things worse because, as Dr. Shewhart’s work also showed, such tampering actually increases the variation in the system.

When, in the seventh month, the workers began adjusting the machine, trying to compensate for previous production "errors," they were tampering as well. If we were to take a closer look at the numbers, armed with the knowledge that the system had changed in a significant way at that time, we could draw a new control chart, separately calculating control limits for the six months before the production process changed and for the four months after the process changed.

Space constraints prevent us from presenting that work on these pages; but the resulting control chart shows that, following the machine adjustments, the mean number of defects per month increased by more than a full defect, and the spread between control limits also increased (due to greater standard deviation), by almost a full defect. The workers' best efforts, well intentioned though they were, actually made the system perform worse than before. And we should not forget that making the adjustments led to more work and longer hours, in addition to reducing yield. *The employees were working longer and harder to produce worse results.*

By now the reader may have begun looking elsewhere in the system for blame ("If it wasn't the workers, the problem must have been that machine!"), but that would be missing the point. The employees are just one component of the system (Manpower), as is the production process

(Methods), the machine (Machines), and the raw materials (Materials). As Dr. Deming used to put it in his seminars, the formula can be expressed as $x + y + xy = 8$, where x is the contribution of an individual and y is the contribution of the rest of the system. Even with a measurable result (“8”), the equation cannot be solved for either x or y.

The simple truth is that the system in our story – as originally constructed, and barring special events – could be expected to produce an average of somewhere around nine defective units per 80 units produced. If the business requirement to make a profit was a maximum of four defective units per 80 units produced, the project was doomed to failure even before it began. Had they performed the statistical analysis demonstrated in this paper, the management of our company would have had sufficient data points after the first few months that they could have strongly suspected this was the case. Even better, they might have learned the same during the training and testing period. At that time they could have decided to scrap the project, or they could have begun experimenting rationally with modifications to the components of the production system.

Is it necessary to explicitly discuss the impact of the motivational posters on the walls? Their only possible impact was negative – to continually remind the workers of their failure to achieve the goals emblazoned on them, and the futility of trying to achieve them.

Real Life Is Different

In real life, the situation is often far worse than in our little story. Consider that conditions are strictly established in the story such that a stable system with meaningful objective measures exists, making it simple for us to use control charts to minimize loss from Type I and Type II mistakes. In real life, few systems are so neatly constructed.

Yet the people in our system are still prone to such known errors as the fundamental attribution error and the seeing of patterns where none exist – such as Barbara's "steady improvement" over the first three months, or Adam's "declining performance" from the second month through the seventh – to say nothing of the errors introduced by personal bias, the tricks of memory and perception, rationalization, and the traps of logical fallacies.

But at least in a stable system of objective measures it is possible to detect performance that is outstanding (in either direction) – not necessarily possible to ascribe it to an individual’s attitude or aptitude, but at least possible to identify it and begin to investigate potential causes.

Many real life systems are not stable, and do not have clear and meaningful objective measures, relying in large part on subjective evaluation (“meets expectations”) of peripheral measures. Lacking a stable system based on relevant objective measures makes the problems mentioned above inevitable. It means we have no guide to help us avoid making Type I and Type II mistakes or falling into psychological traps such as bias and the fundamental attribution error – and it also means we have no rational foundation for improving the system.

In real life systems, do we sometimes encounter employees who, unlike those in our story, are not motivated to perform the jobs to which they have been assigned, or are not capable of doing so? Of course. Should they be fired? Perhaps. If a worker has been appropriately trained to do the job, and there are no extenuating circumstances (such as a need for eyeglasses), and still does not perform as he or she should, then that worker probably should be doing a different job in (or outside) the company.

But while we debate how best to hold this unfortunate worker accountable, we should also remember that others are responsible for the systems that led to the decision to hire that worker, and the decision to assign that worker to that job. Have those systems been examined? Are they stable? What are their "failure rates?" What is being done to improve them? As management consultant Peter Scholtes has said regarding layoffs, “You say you’re getting rid of deadwood? Why do you hire deadwood? Or, why do you hire live wood and kill it?”

Improving the System

The improvement goals that proceed from this perspective are:

1. Identify and eliminate special causes, to achieve a stable system
2. Reduce variation within the stable system, by experimentation with the various components of the system

Consider the benefits of a stable system of relevant objective measures when pursuing system improvement. Suppose that the measurements in our story continued for some time, all data points remaining within the established control limits. Then, after many months, Adam produced 22 defective units in a single month. This data point, being outside the control limits, would deserve special investigation. The investigation might have led to the discovery that Adam's two-year-old daughter was ill for much of that month; or that squirrels in the attic of his home had kept him from getting a normal amount of rest that month; or that he had injured his hand repairing his front porch early in the month, and had temporarily lost some manual dexterity as a result; or perhaps that he alone, that month, had been given a batch of raw material to work with that had been obtained from someone other than the regular supplier. The possibilities are endless. There is, of course, even a non-zero probability that the data point was not due to any special cause. The only way to completely eliminate making either one of the two mistakes is to consistently fall prey to the other – to treat every sign of variation as random, or to treat every sign of variation as special. To repeat: the value of control limits is that they serve to minimize the probability of making either of the two mistakes.

But achieving stability by eliminating any special causes that may exist is only the first step in improving a system. Once the system is stable, rational experiments can be carried out and their impact evaluated. For example, the machine adjustments that were added to the production process represent an experiment in changing the system. The results of this particular experiment were negative (as could have been predicted by any student of Shewhart

or Deming), but they were visible in the numbers (to those who can see them). Many other experiments could be attempted, and some might show improvement. Trying raw materials from a different supplier would constitute an experiment; replacing the cutters on the machine with cutters made from a different alloy might be another; changes to the work procedure might produce some benefit (or loss). Everyone working *within* a system must also consider possibilities for working *on* the system to improve it – and those who are responsible for managing the system are also responsible for ensuring that such experiments are conducted, in the name of continuous improvement.

The goal, in conducting experiments and evaluating their effects on a system once special causes are identified and eliminated and stability is achieved, is to reduce variation (and perhaps to shift the mean). Reduced variation makes it easier to spot shifts in the system, such as the one between the sixth and seventh month in our story; it is also easier to identify special events when there is less noise in the system due to broad variation.

Conclusion

The numbers of defects produced in our little story had nothing to do with the attitudes or aptitudes of the workers. In fact, there were no workers – the numbers were generated by a computer program to illustrate a stable system. Yet how easy it is to follow along with the narrative and accept the idea that these "objective measures" enable us to evaluate the "people responsible" and "hold them accountable." Easy, that is, until we recognize such behavior as misguided, based on nothing but the *illusion* of knowledge. A re-reading of the narrative at this point is highly recommended, as it will foster a deep appreciation for the power and pervasiveness of the illusion of knowledge.

Dr. Deming summarized and organized his teachings by using what he referred to as the *System of Profound Knowledge*, made up of four parts:

- Knowledge of Systems – having an understanding of systems and the relationships among their components (for example, recognizing that optimizations made in one part of the system may cause the overall system to suffer; or remembering the lessons of Dr. Deming's formula $x + y + xy = 8$)
- Knowledge of Variation – having an understanding of the vital difference between common variation and special cause variation, and using that understanding to minimize the loss from Type I and Type II mistakes
- Theory of Knowledge – having an understanding of how we learn (for example, that knowledge depends on theory, that experience teaches nothing without theory, and that copying examples does not lead to knowledge)
- Knowledge of Psychology – having an understanding of relevant psychological concepts, such as the nature of motivation and the fundamental attribution error

The governance of our businesses, schools, and all the other organizations we encounter and participate in every day of our lives is, almost universally, the responsibility of people who do not understand (or do not accept) the work of Drs. Shewhart and Deming. The result has been incalculable financial and social loss of which most people are completely unaware.

Squandered improvement opportunities, lowered morale, institutionalized selfishness, confusion and resentment, lower quality product, longer hours, increased expense, lower productivity – these are just a portion of the legacy of accepted management practice. How could it be otherwise, in the absence of profound knowledge?

Yet this wisdom has been readily available for many decades. Why has it not yet become the conventional wisdom? There are many contributing factors, including the aforementioned paradigm paralysis. Consider who, within an organization, has the power to change the way that organization is run; consider also that those same people are fully confident that they earned that power based on their own merits, thanks to the system of performance review that recognized their greatness and propelled them past their lesser colleagues – yet another instance of the fundamental attribution error in action. How difficult will it be for those people just to change *their own* paradigms?

The *Semmelweis effect* is a metaphor for the reflexive rejection of new knowledge that contradicts established and accepted paradigms. It is named for Ignaz Semmelweis, a Hungarian doctor who suggested in the 1840s (based on observations he made in an obstetric clinic in Vienna) that mortality rates could be reduced by 90% if doctors washed their hands in a chlorine solution before treating patients. His hand-washing suggestion was ridiculed and rejected by his contemporaries, who believed that the human body was filled with four basic substances, called the four humors (black bile, yellow bile, phlegm, and blood), which were in balance when a person was healthy; and all diseases and disabilities resulted from an excess or deficit of one or more of these four humors. Their confidence in this illusion remained unshaken even decades later, when Louis Pasteur provided a theoretical foundation (the germ theory of disease) for the practice of hand-washing. In fact, most of a century passed between the time Dr. Semmelweis made his observations and the time when doctors began washing their hands regularly as a matter of course. Countless people suffered needlessly in the interim, but thankfully that is in the past.

Almost a century has passed since Dr. Shewhart made his observations. Isn't it time we began washing our hands of the illusions of the past?

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