Strategies for Total Quality
A Physicist's Perspective

Sam S. Hancock, PhD

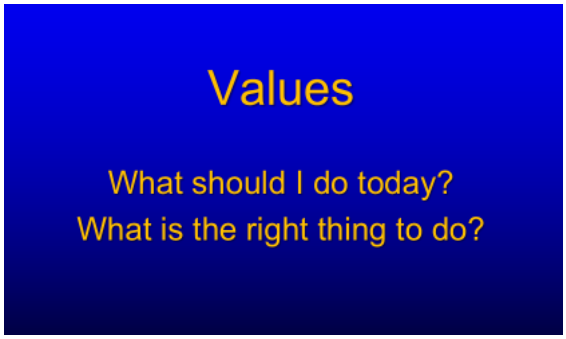
My initial training in medical physics was in 1970-71 at The University of Texas M.D. Anderson Hospital and Tumor Institute. That training taught me how to do a lot of things very well. In 1972, I took a position as the first and only physicist at 400-bed Oakwood Hospital in Dearborn, Michigan. My father, who was a career soldier, taught me that the way to get by was to "shut up; do what you're told; and don't ask questions." That had served me adequately through the education phase of my career. So, naturally, I implicitly assumed that I would show up at the job; someone would tell me what to do; and I would know how; and I would do it.

The problem is that no one really knew or understood what the physicist was supposed to do. So I was on my own. And that started me on my quest for the answers to the perennial question, "What am I supposed to do?" I have been asking myself that question, and seeking answers, for over 40 years. The answers that I have discovered have led to more questions, such as, "How am I supposed to get people to allow me to do those things, when they don't understand what I'm doing, or why?"

You may be surprised that my answers draw from the fields of philosophy, industrial engineering, behavioral science, mathematical biology, organizational psychology, the psychology of happiness, and neuroscience.

First of all, unless your strategy is to "shut up, do what you're told, and don't ask questions," you need to have some basis for deciding what you should do. You need to be purpose driven. When I walk in the door of the cancer center every day, my purpose is to contribute to quality of care.

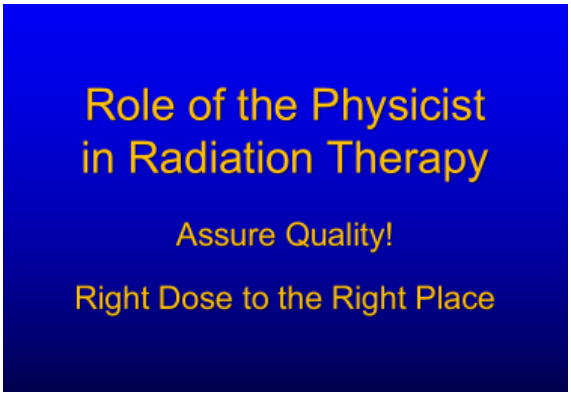
Ok! That sounds simple. Provide quality of care! But still, that leads to the question, "How do I do that?" How do I know what's the right thing to do now, next, today? The answer to that comes down to a question of values. Not moral values, but ethical values. By values, I mean how do you rank the various choices of what to do today?



In health care, the ultimate value is the quality of care of the patient. But what do we mean by "quality"?

W. Edwards Deming (Deming, 1982) taught us that quality means consistently providing the customer with what he needs, but not necessarily what he thinks he wants.

The role of the physicist in radiation therapy is to assure quality for the patient. The necessary condition for quality of care is to give the right dose to the right place – every time. We rely on the radiation oncologist to tell us what the right dose is, and what the right place is. Our responsibility is to assure that the patient receives that.



This is a broader responsibility than most people in radiation therapy grant to the physicist. And therein lies some of the challenges. I'm going to talk about some of those challenges and share the strategies that I have found to be effective in meeting the challenges.

Quality Assurance

I'll divide the topic of quality assurance into two categories: Facilities and Processes. Let's start with Facilities.

Facilities

QC of Equipment Performance is a necessary, but not sufficient, component of quality assurance.

Strategy: Tools – Not Rules

Let's consider first, the strategy: "Tools – Not rules!"

AAPM Task Group Reports are guidelines. They're not a recipe for assuring quality. The members of the task groups, astute as they are, cannot envision every possible combination, or application, of current technologies, much less the technologies that have not been developed. You have to exercise professional judgment. Your responsibility is to determine what must be done to ensure that anything that could go wrong doesn't adversely quality of care.

Radiation therapy technologies continue to become increasingly complex. We must have efficient ways to test this complex equipment, and that requires good tools. Not the tools of yesterday, but the tools of today that match the complexity of today's treatment technologies.

Health care costs are growing at an unsustainable rate, and physics staffing is expensive. If you can increase efficiency and avoid adding an additional physicist by spending $150,000 on good physics tools, then you could save about a million dollars over the seven year life of the equipment. This can be a compelling justification for a generous budget for physics tools.

Strategy: Delegate!

Now, let's consider the Delegate strategy

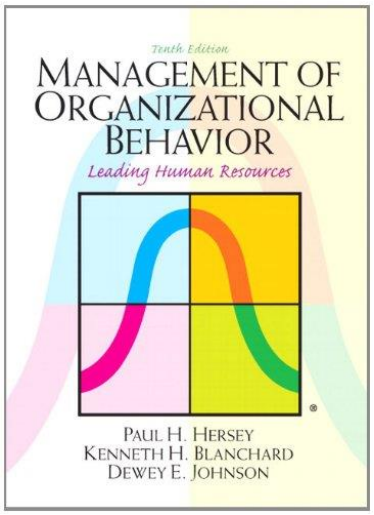
Put extra time into developing simple and efficient QA processes. And then delegate responsibility for the QA task to the lowest level employee capable of performing the task reliably. My rule of thumb is, if you can't get the right result by doing the procedure wrong, then you can delegate it.

The role of the physicist is to provide oversight and perform a timely review of the results and take corrective action. The physicist is responsible for quality assurance, but he doesn't have to personally perform the QA tasks.

Delegation is the right thing to do, because it lowers cost by shifting duties to lower paid staff.

Delegation increases the value of the delegate employees by giving them higher-level tasks to perform. It increases the value of the physicist by freeing him to focus on those problems for which he is uniquely suited and qualified.

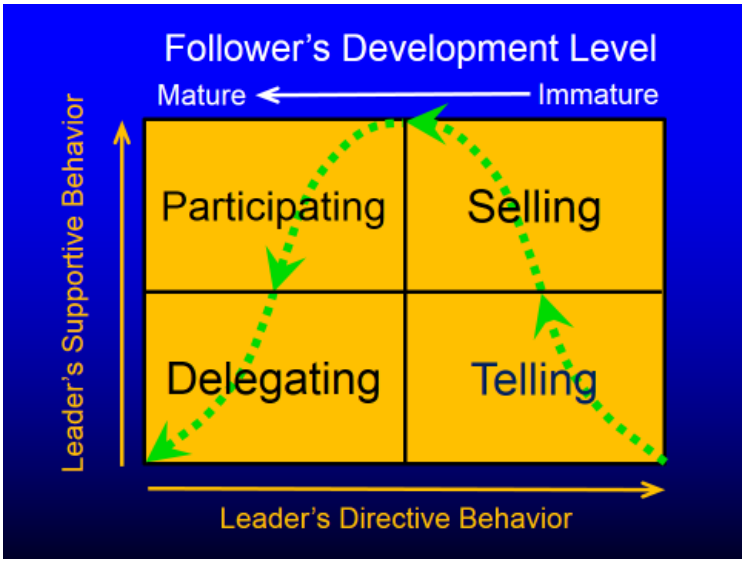
Situational Leadership – A model for effective delegation



Now, as you know, delegation involves managing people. In case you haven't recognized it, most of us didn't go into physics because of our aptitude for understanding interpersonal relationships. We have to work at it, and most of us work best with a simple model. Situational Leadership (Paul H. Hersey, 2012) is a model for effective delegation that has worked quite well for me for about 30 years

Situational Leadership is based on a simple model that was devised by Hersey and Blanchard. That model has developed into a large body of work, like in the 10th Edition of "Management of Organizational Behavior." Unless you are pursuing a Masters of Business Administration, I don't think you need everything in this book. But an understanding of the basic model has helped me many times over the years.

The concept and application of Situational Leadership can be illustrated with one figure. The horizontal axis is the leaders' directive behavior. The vertical axis is the leader's supportive behavior.



In this model, the leader's directive behavior depends on the follower's development level with respect to the particular task or responsibility to be assigned. As you can see at the top of the figure, the leader's directive behavior is in inverse proportion to the follower's maturity with respect to the specific task or responsibility.

For simplicity, the graph is divided into four quadrants, each representing a leader's mode of supervision. For a follower starting out with a new task assignment, we start in the lower right quadrant with the telling mode. We tell him simply what to do, how to do it, and when to do it.

As he demonstrates ability and willingness to do the task as assigned, follow the curve toward the upper right quadrant – the selling mode. We start reducing the directive behavior and increase the supportive behavior. In this mode, we start explaining why we do things the way we do. My most frequent error is to start out at selling, and the follower doesn't yet have a foundation to understand the reasons until he has experienced the performance of the task.

As the follower begins to gain understanding, we follow the curve to the upper left quadrant -- the participating mode -- continuing to decrease the directive behavior. In the participating mode, we take opportunities to ask the follower how he would propose to deal with a particular existent situation. That gives the leader the opportunity to test the follower's understanding and give him redirection where needed.

As the follower demonstrates an increasing grasp of the task or responsibility, we move toward the lower left quadrant – the delegating mode -- in which we assign primary responsibility to the follower but continue to monitor his performance. As he continues to demonstrate competence and maturity in the independent performance of the task or responsibility, we reach the ultimate goal of delegation.

Processes

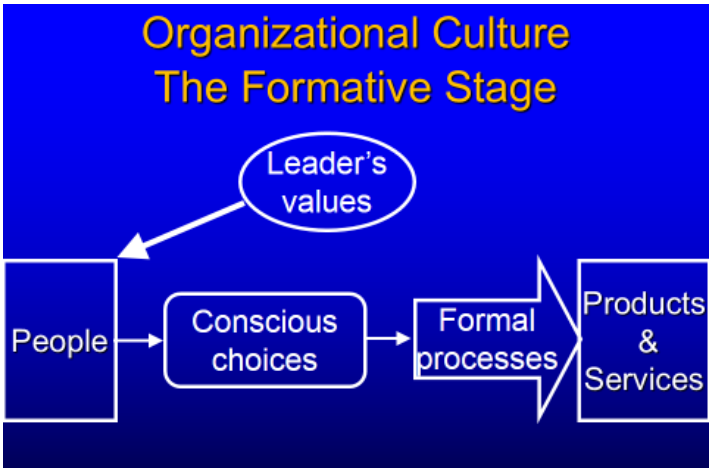
Let's consider now the topic of Processes.

QC of equipment performance is not enough if people are not following effective processes.

Assuring quality in radiation therapy requires a culture of process improvement. All the industrial engineering approaches to quality, like TQM, CQI, Lean, Six Sigma, and Lean Sigma, all started with W. Edwards Deming, the father of modern quality assurance who developed Total Quality Management. (Deming, 1982)

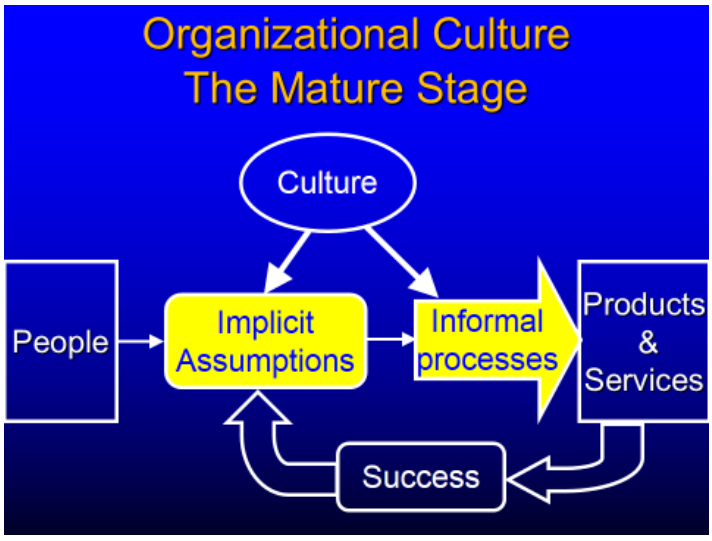
For Total Quality Management to work in radiation therapy, it can't be something that the Quality Management Department does. Or something that hospital management does. It must be a part of the culture of the organization, including the radiation therapy staff.

Let me explain what I mean by the culture of an organization.



A cohesive culture starts with a leader's ethical values. In the formative stage, people make conscious choices based on the leader's values. These choices lead to formal processes for the products and services of the organization.

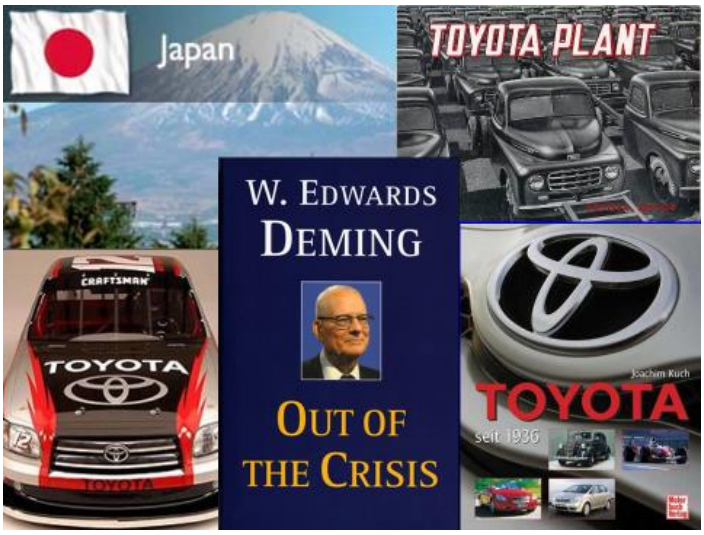
And then, if the people in the organization experience success, they feel encouraged to continue along that path. Over time decisions begin to be made based on implicit assumptions rather than conscious choices, and informal processes develop that are implicitly based on the leader's values.



And now we reach the mature stage where people can work autonomously while the leader goes fishing.

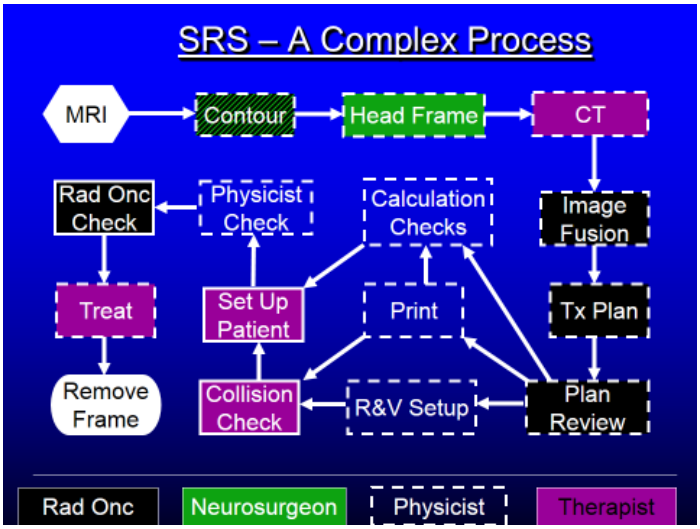
The combination of those implicit assumptions and informal processes is what I mean by culture. When you hear someone say, "I don't know about where you came from, but that's not the way we do things around here," it's all about the culture. Once established, an organization's culture tends to be self-perpetuating. And a culture is very hard to change.

Total Quality Management



Dr. W. Edwards Deming was an American physicist who developed Total Quality Management prior to World War II as a means of continuously improving quality while simultaneously reducing cost. After the war, General Douglas MacArthur, who was the U.S. commander of post-war Japan, invited Dr. Deming to introduce Japanese industrial leaders to Total Quality Management. Japan went on to become a global leader in many industries through the persistent application of Total Quality Management, while U.S. industries didn't begin to adopt TQM until the 1980's. Now, Total Quality Management has been widely adopted in U.S. health care, where it is known as CQI, or Continuing Quality Improvement.

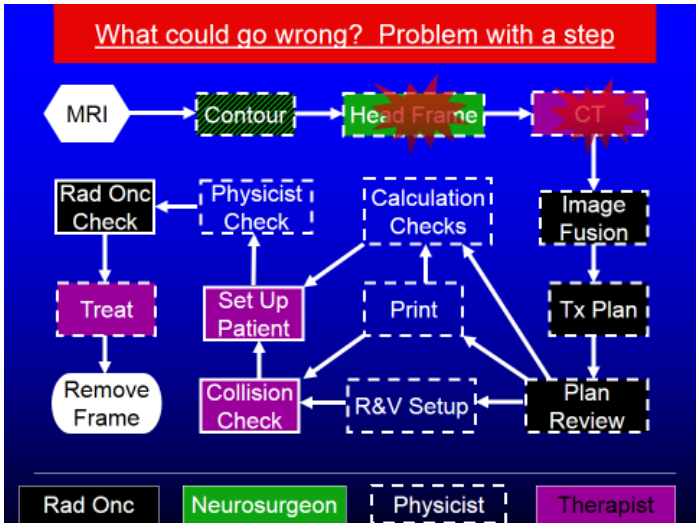
AAPM Task Group 100 has drafted a lengthy report that will set the standard for process improvement in radiation therapy. This report will represent a major paradigm shift for the physics of radiation therapy. The time has come for us to prepare ourselves for this paradigm shift and adopt a process-oriented focus.

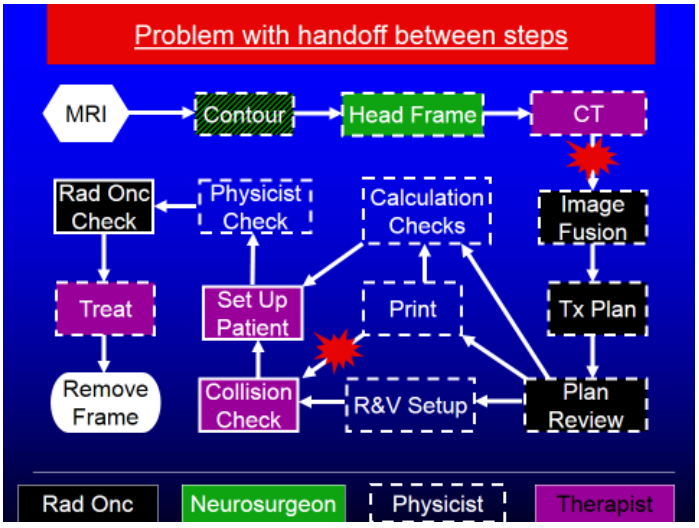


Here is a process flow chart for frame-based stereotactic radiosurgery to illustrate how processes in health care often involve many sequential and concurrent steps.

Consider the nature of errors in a process. We could have a problem with a step, such as placement of the head frame, or performance of the CT.

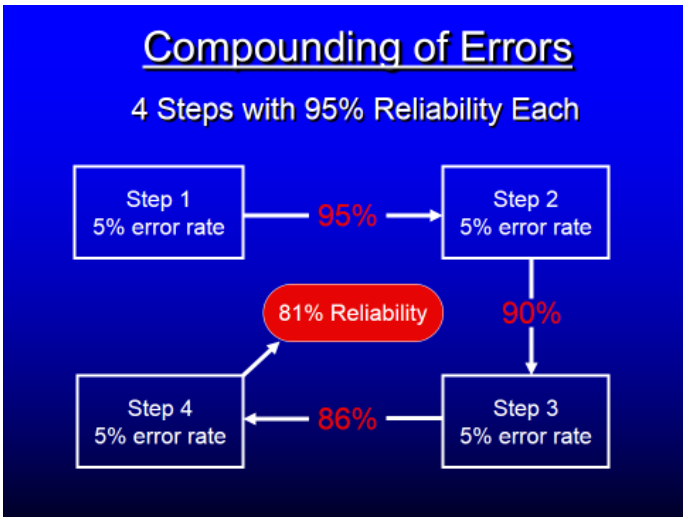
We could have a problem with a handoff between steps, such as getting the CT scan to the planning system, or getting the plan printout to the therapist for the operational check.





Compounding of Errors

To appreciate the importance of process improvement, one must understand compounding of errors in a multi-step process. Let's look at a process with four steps, each of which has a 95% rate of reliability.



The first step results in 95 % reliability.

The second step brings the combined reliability for the two step down to 90%.

The third step brings it down to 86%.

And the fourth step results in a combined error rate of only 81%.

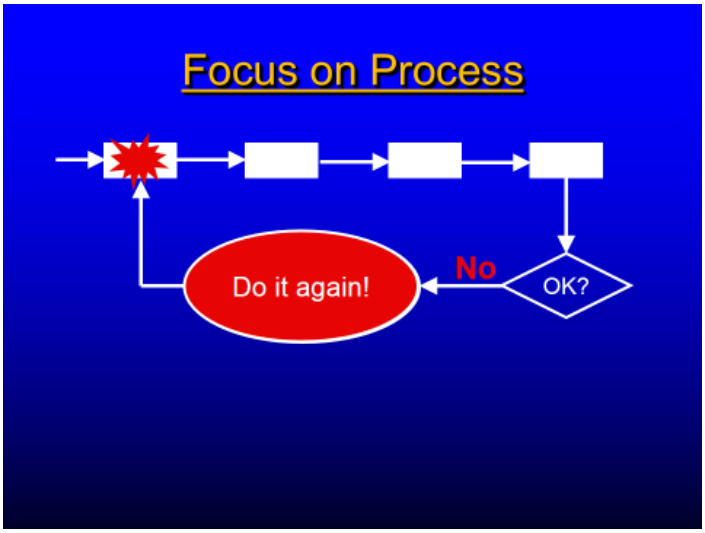
So with a multi-step process, a low rate of error per step can still result in a high rate of error for the process, because of compounding of errors.

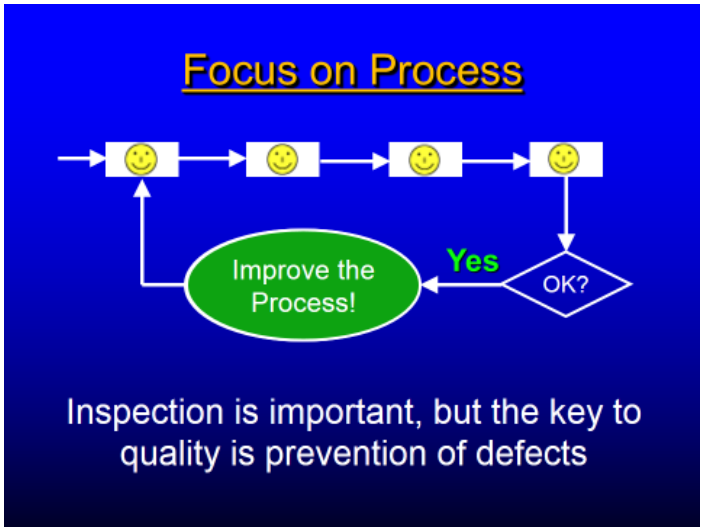
Focus on the Process

With TQM, the focus is on the process. When there is a defect in the end product, you have to go back and do it again, starting with the step where the error occurred.

But then, you have to work on improving the process and eliminating the cause of the error.

So, inspection is important, but the key to quality is prevention of defects.





Provide Leadership

Deming taught that TQM cannot be successful without leadership to create a culture of cooperation, collaboration, and teamwork. He said the leadership must be provided with a constancy of purpose. That means persistently and consistently.

In radiation therapy, the physicist shares responsibility for the leadership that's required for assurance of quality. He shouldn't wait for someone to tell him to do it. He should take the initiative. But success requires everyone's buy-in, and anyone can provide leadership, even without authority.

Drive out Fear

You have to drive out fear.

You want to work on improving the process. But when you try to give the appropriate feedback, fear can get in the way. You may hear, "It's not my fault! Or "Don't blame me. I'm just the messenger."

- Always attack the problem and not the person
- And don't shoot the messenger!

Don't Shoot the Messenger

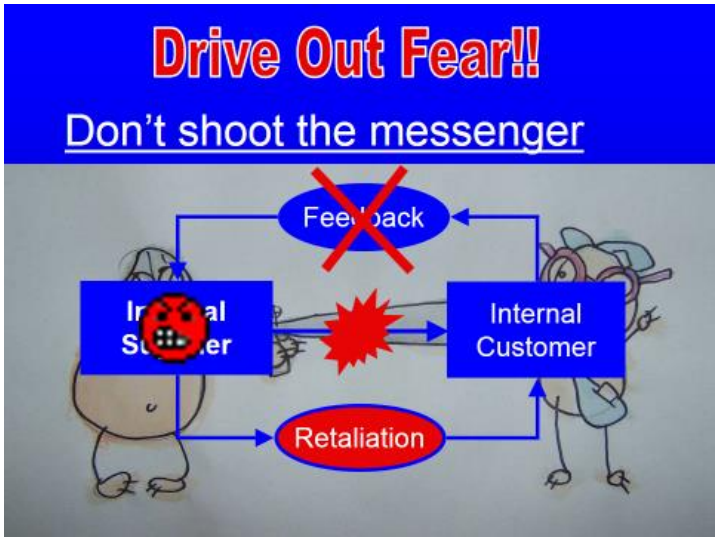
Here's what happens when you shoot the messenger.

You're not meeting the needs of an internal customer – another employee.

The employee gives you appropriate feedback.

You get angry and retaliate.

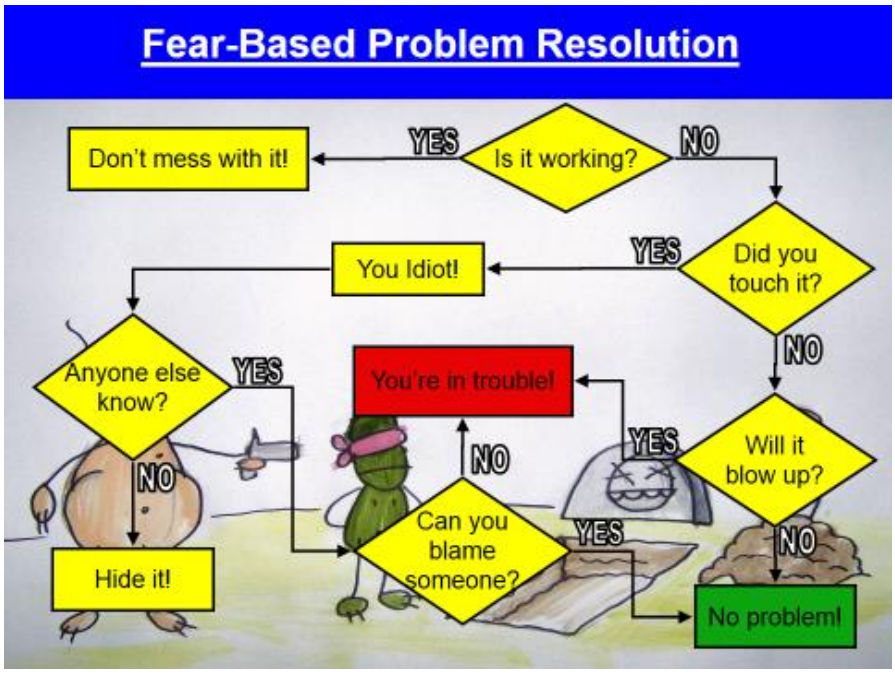
The feedback stops, and the opportunities for improvement end.



Fear-based Problem Resolution

Here is an example of fear-based problem resolution that typically exists in a culture of fear and blame.

The problem-solving approach that I call "blamestorming" is what develops when appropriate leadership is not provided to drive out fear.



Strategy: Create a Culture of Total Quality Management

You have to provide leadership to **promote a culture of cooperation.**

Encourage behavior that lifts others up; behavior that enhances morale; behavior that inspires others to do their best.

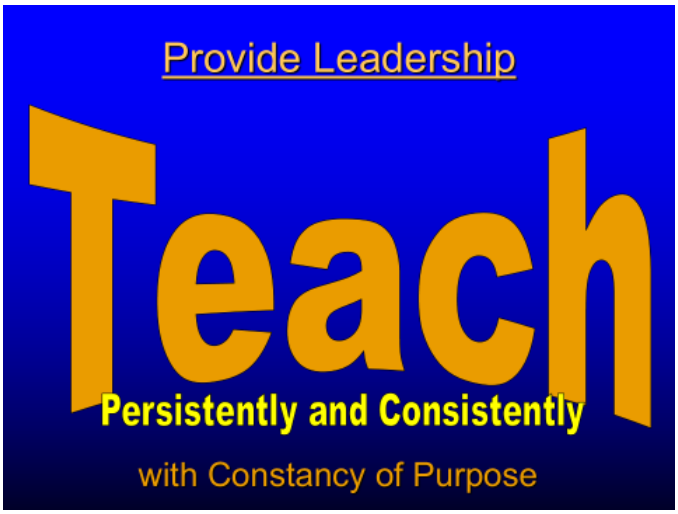
Discourage behavior that pulls others down. No one can do his best if he fears being the target of blame, gossip, innuendo, sarcasm, or rudeness.

Discourage internal competition. Internal competition is a deterrent to helping others succeed. An employee's performance evaluation should depend on behavior that enhances the performance of the whole team, and not just the individual's competence.

Encourage teamwork. No one wins unless the whole team is successful.

Teach

One of the roles of the physicist is teaching. You have to teach – with a constancy of purpose, and that means Persistently and Consistently.



Follow the Process

Teach them to follow the process. You can't tell if the process needs to be improved if it's not being followed.

Don't bypass the system

If the system is not working, don't bypass it, fix it.

Give feedback

They can't expect to get what they need if they don't communicate.

Solicit feedback

If you're not meeting your customer's needs, you're wasting your time.

Attack the problem, not the person

When there's a problem, say "Let's work together on this problem." Or "I need your help with this problem."

Root Cause Analysis

How do you get started creating a culture of TQM?

Provide the staff with a simple formula that can be used for process improvement. This is a procedure for root cause analysis.

1. Assemble a representative group and ask the question, "What is the problem?" Or "What happened?" At this stage you're just trying to get all the facts before moving on to problem solving.
2. If there was an error, ask, "What do we need to do to fix the immediate problem?" The error may have already been corrected at the time of the root cause analysis,
3. Ask, "What circumstances contributed to the problem?" These are the root causes. It's important here to not assign blame.
4. Ask, "What can we do to avoid the problem in the future?" Consider changes in processes or environment. Do this as a group and try to arrive at a consensus.
5. Lead the group to a consensus, which becomes the implementation plan.
6. Decide a follow up date to evaluate how the changes are working.
7. Document for review by the CQI Committee.

When you embark on building a culture of TQM, if the staff are accustomed to a culture of fear and blame, it would be wise to perform root cause analyses with the entire staff together. This can be inefficient, but if you meet with multiple groups, each group may fear that the other groups are blame-storming, i.e. looking for a scapegoat. It's better if everyone is hearing what everyone else has to say about the problem. In the beginning, this process may be tedious. One problem is that each person is afraid to reveal information about what happened. If he reveals how he was involved with the

incident, he may fear that someone will take that opportunity to scapegoat him. Or, if he reveals another's involvement in the incident, he may fear retaliation. With persistence, though, each individual in the team eventually begins to implicitly take a root cause analysis approach to problem resolution. When that happens, the group has developed a culture of TQM, and problem solving becomes efficient and almost effortless.

Quality improvement is a journey – not a destination. It never ends.

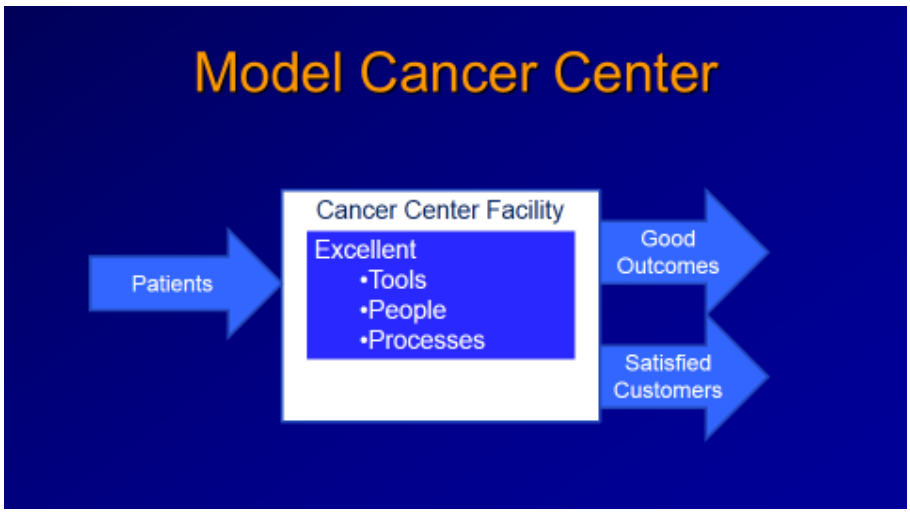
Once your team has developed a culture of TQM, the journey is not over. They are then ready for other more proactive approaches to process improvement, such as Failure Modes and Effects Analysis (FMEA) and Error and Near Miss Reporting Systems.

These are possible next steps on the journey that are beyond the scope of this presentation.

Experience Design

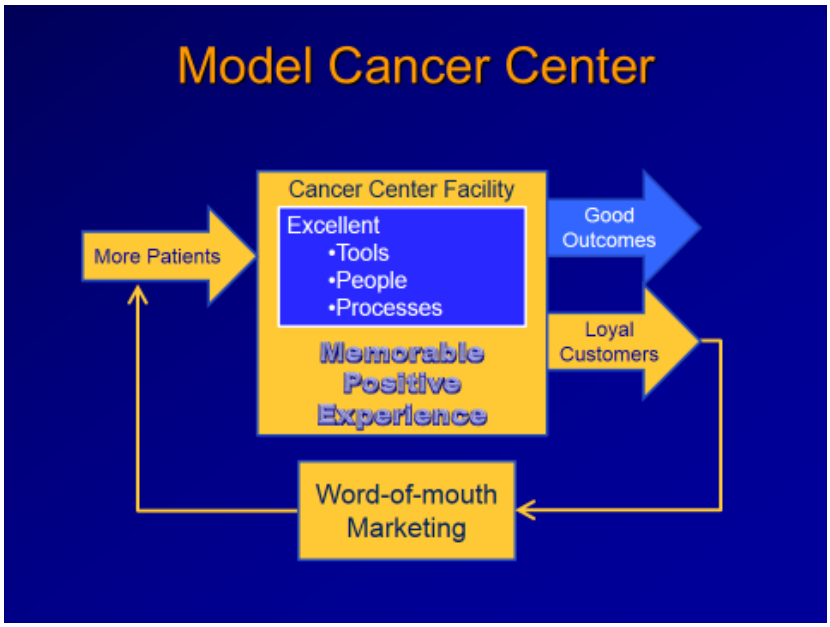
What about the experience? The patient may get the right dose to the right place and have a good outcome, but hate the experience. The quality of the experience should be included in our measure of quality of care.

Let's look at what goes into a model cancer center.



Patients come to a cancer center. If it has excellent tools, excellent people, and excellent processes, they achieve good outcomes, and they have satisfied customers. This is a necessary, but not sufficient, condition for a successful cancer center. How are you going to attract more patients who can benefit from these good outcomes?

If you can provide the patients a memorable positive experience, then the satisfied customers become loyal customers with stories to tell. They provide word-of-mouth marketing. And that leads more patients to come there for their cancer care.



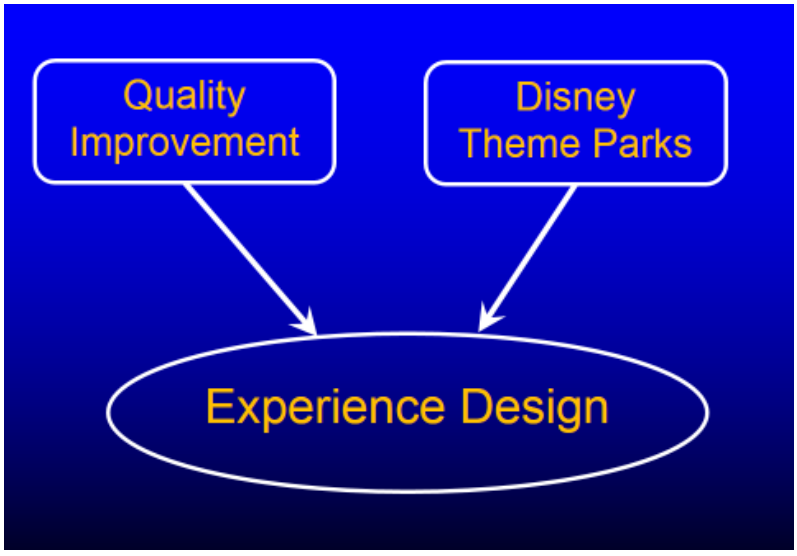
This is a model for a successful cancer center.

This brings us to the strategy of Experience Design.

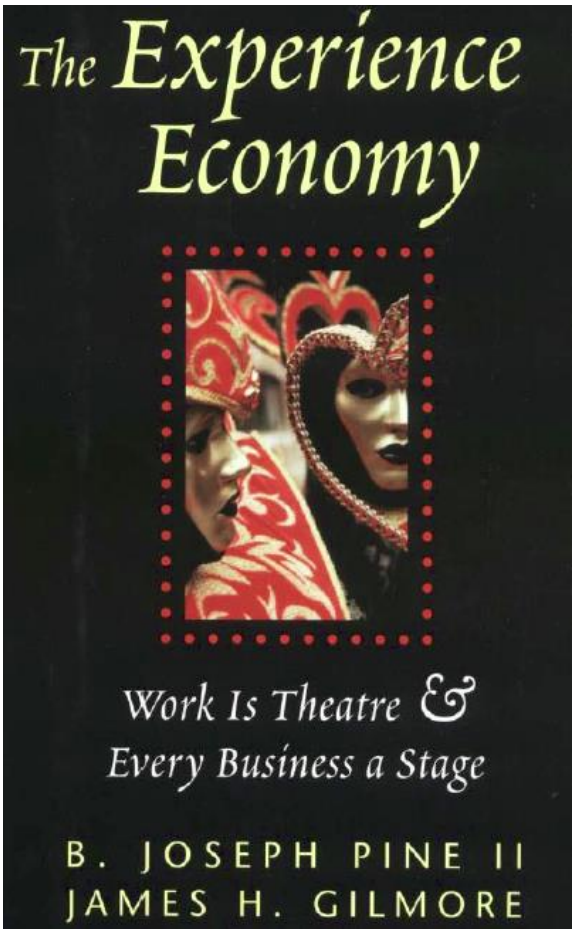
Strategy: Experience Design

The physicist has an opportunity to influence experience design through the quality improvement program. It's the right thing to do for the patient. It's also the smart thing to do, because Experience Design is a way for the cancer center to differentiate itself in a competitive market. Do you like getting paid? Help your employer be more successful by providing the customers with a positive memorable experience.

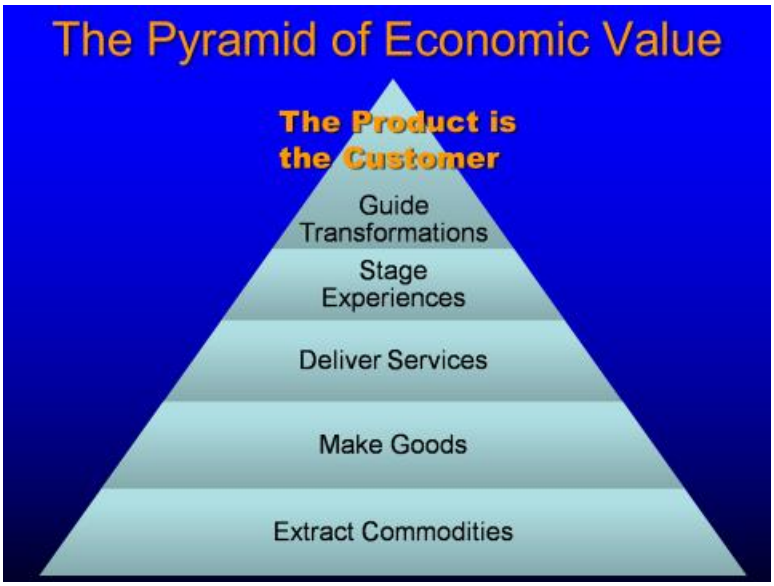
Although I initially saw experience design as an extension of quality improvement, it's actually a convergence of quality improvement and an approach that derives from things like Disney theme parks.



The application of Experience Design to any business has been described by Pine and Gilmore in their book "The Experience Economy – Work is Theatre & Every Business a Stage." (Pine, 1999)



Pine and Gilmore describe the progression of economic value as a pyramid, progressing from extracting commodities, through making goods, delivering services, staging experiences, to guiding a transformation.



At the pinnacle, if the experience leaves the customer somehow transformed to a better state, then the product is not just the experience. The product is the customer.

Some desirable transformations in oncology might be making the patient well, reducing their pain, acceptance of their new status as a cancer survivor, or maybe just helping them adjust their hopes to match their new reality.

Mr. Cellophane

In the musical movie "Chicago (Marshall, 2002)," John C. Reilly sang,

> *Mr. Cellophane*
> *Should have been my name*
> *You can look right through me*
> *Walk right by me*
> *And never know I'm there.*

So much of what the physicist does is transparent. He's Mr. Cellophane.

How can you influence the processes that people follow?

How can you influence the culture?

If they don't even know you're there?

You have to somehow make yourself visible.

The Opportunity, Influence, Impact Cycle is an effective strategy for gaining influence.

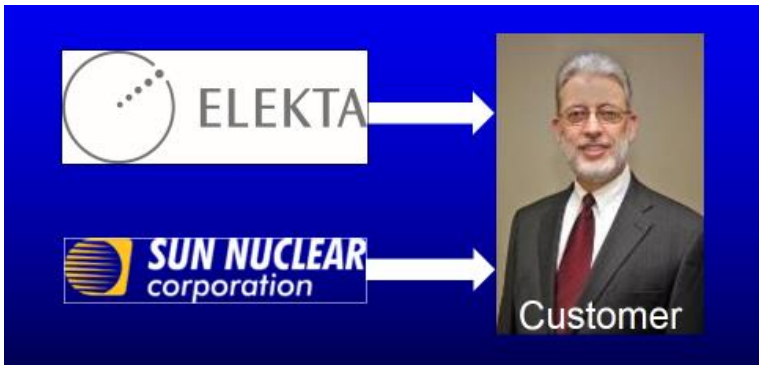
Strategy: Opportunity, Influence, Impact Cycle

Take advantage of every opportunity to have influence. If you have a positive impact, you'll be offered more opportunities. The more you practice this, the more influential you'll become.

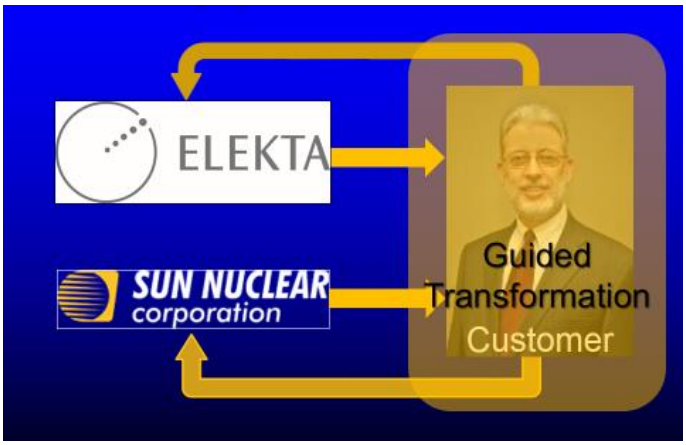
Add this to your lexicon: "I need opportunities for awareness and influence." You can't use the Opportunity, Influence, Impact Cycle if you're not aware of the opportunities. Information often flows through the Administrative Director and doesn't get shared with the physicist. Management needs to be repeatedly reminded that you can't do your job without opportunities for awareness and influence.

Strategy: Customer-Supplier Relationship

I use the Opportunity, Influence, Impact cycle to gain influence with my product suppliers. Deming said that you should have a relationship with your suppliers to help them better meet your needs. They should be part of your quality improvement system. This can best be done if you select a few preferred suppliers that support a culture of quality improvement.



My main suppliers happen to be Elekta for treatment equipment, and Sun Nuclear for physics tools. I want them to provide me with a guided transformation. But that's not going to happen if I'm Mr. Cellophane.



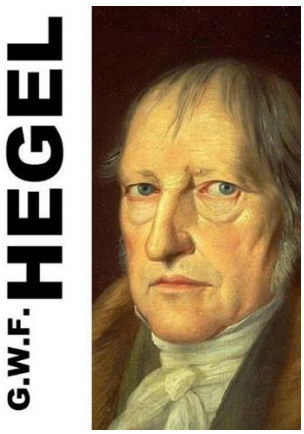
So, I'm assertive about giving them the feedback that they need so that they will know how to immerse me in a memorable positive experience. Or even better, a guided transformation that makes me somehow better as a medical physicist. The value that I receive is not in the tools that they deliver. The value is in what I am able to do with those tools. The product is not just the tools. The product is the customer.

Your suppliers are in the business of supplying their customers' needs, but in practice they fall short to some degree. If you want them to meet your expectations, you need to close the loop and let them know how they have missed the mark. My mantra with my suppliers is, "Let me help you help me!" They like to hear that.

So that's the strategy of the customer-supplier relationship.

Strategy: Be a Champ, not a Chump

This strategy of helping your supplier may seem to go against the paradigm of competitive individualism that dominates American culture. But if you take a broad perspective, you'll see that helping your suppliers, and helping others in your professional and personal community, is really a smart thing to do. It can contribute to a greater sense of happiness and lead to greater long-term success.



Philosophers through the ages have debated our essential interdependence with others in our community, from John Donne, who said "No man is an island," to Albert Einstein, who said ". . . almost the whole of our actions and desires are bound up with the existence of other human beings."

The 19th century German philosopher G.W.F. Hegel seemed to have the right idea when he concluded that individual freedom is of greatest value when communally guided. And ethical life consists in integrating ourselves into the right kinds of community, because we need the collective knowledge and wisdom of the community to help us know the potential consequences of our choices. (McCumber, 2011)

Darwin once wrote that a tribe with many people acting like givers, who "were always ready to aid one another, and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection." (Grant, 2013)

Since Darwin, the relative success and natural selection of Givers *vs.* Takers, or Cooperators *vs.* Defectors have been thoroughly studied. The fields of hedonistic psychology (Dunn, Gilbert, & Wilson, 2011), organizational psychology (Grant, 2013), and mathematical biology (Nowak & Highfield, 2011) provide some interesting results.

Hedonistic Psychology

First, let's look at what the science of hedonic psychology tells us about what makes people happy. Dunn, Gilbert, and Wilson (Dunn, Gilbert, & Wilson, 2011), from the Universities of British Columbia, Virginia, and Harvard, reviewed the scientific literature on how people predict the hedonic consequences of future events. That is, what they think will make them happy. They found that the things that actually make you happy are usually not the things that you think will make you happy. Here are some of the things that they found.

- People gain more happiness from buying experiences than from buying things.
- People gain more happiness from buying something for others than from buying something for themselves.
- Almost anything we do to improve our connections with others tends to improve our happiness.

Do you want to be happy? You can increase your sense of happiness through helping others in the medical physics community by sharing your knowledge, and thereby improving your connections with others in your community.

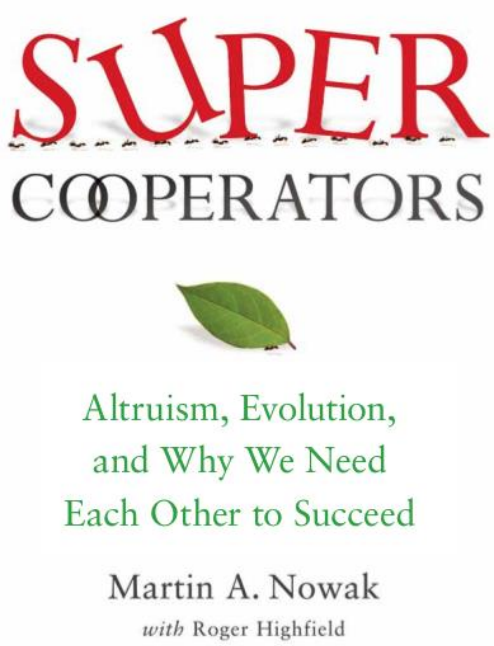
Organizational Psychology

In the field of organizational psychology, the reciprocity styles of individuals are divided between Givers, Takers, and Matchers. Adam Grant (Grant, 2013) describes research that explains how Givers are more successful than either Takers or Matchers in the long run.

For example, new medical students were tested for reciprocity styles and their grade performance was ranked at the end of each year. After one year, Takers were the top students, and Givers were at the bottom. But after the second year and beyond, the top students were Givers, and the bottom students were also Givers. Studies show that this pattern holds through all professions. The Chumps are the altruistic Givers who keep getting taken by the Takers. The Champs are the smart Givers who learn to recognize the Takers and adjust their reciprocity style accordingly. And over the long haul, the Takers fall behind all but the Chumps that are their victims.

Do you want to be more successful? Be a Giver. It may not be good for a 100-yard dash, but it's a good strategy for a marathon. But be a Champ, not a Chump. The challenge is learning to recognize the Takers and adjusting your reciprocity style when you recognize a Taker. Also, there are effective strategies for effecting what Adam Grant calls the Scrooge Shift, in which takers in a group are influenced to change their reciprocity style to become Givers. For more about Give and Take, see Appendix A.

Mathematical Biology



Martin A. Nowak, a mathematical biologist, describes how mathematical modeling of the evolution of populations can explain how altruism arose in our otherwise competitive world (Nowak & Highfield, 2011). Natural selection picks the individuals that are best suited to a given environment, but cooperation, says Nowak, is the master architect of evolution. Evolution is as much about survival of the fittest group as it is about survival of the fittest individual. Nowak found that evolution of groups of cooperators could occur under conditions that are increasingly more prevalent in today's modern highly connected world. These conditions include:

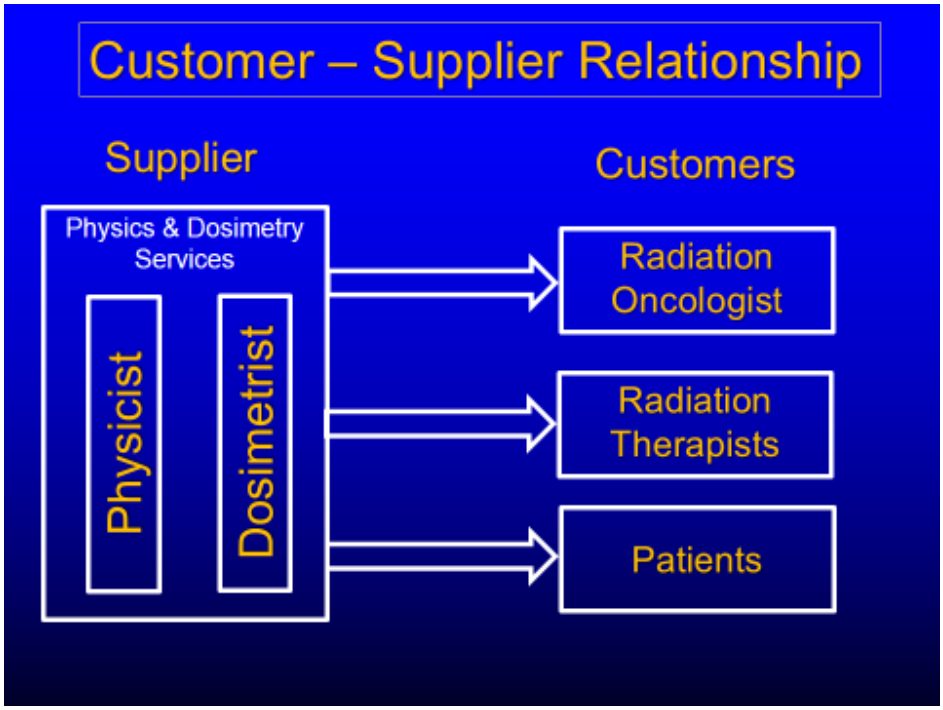
- Opportunities for repetitive interactions
- Knowledge of reputations
- Formation of symbiotic clusters of cooperators
- Competition that leads to natural selection of groups.

Do you want your professional community to be more successful? Be a Giver, and promote a culture of mutual cooperation. For more on this topic, see Appendix B.

Strategies for Effective Reporting Relationships

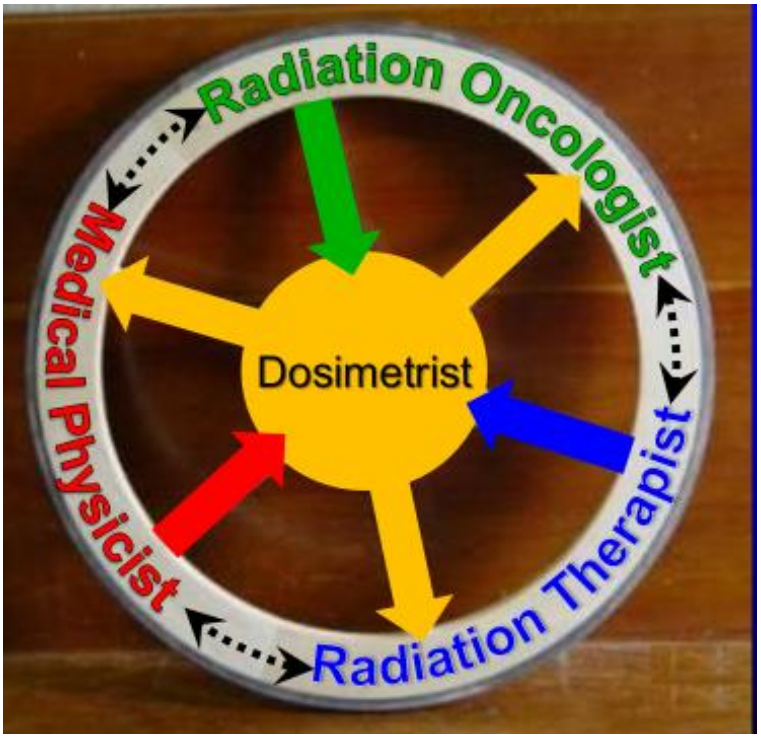
Now let's talk about strategies for achieving effective reporting relationships in the organizations where we work. I'm still learning that this topic is not as simple as one might think.

One way of looking at reporting relationships for physicists and dosimetrists is in a customer-supplier model. In the model shown here, the physicist and dosimetrist are the suppliers of Physics and Dosimetry Services. Their customers are the radiation oncologist, radiation therapists, and the patients. I intentionally put the Dosimetrist at the front counter of Physics and Dosimetry, with the Physicist in the back, because that usually facilitates a more efficient flow of information..

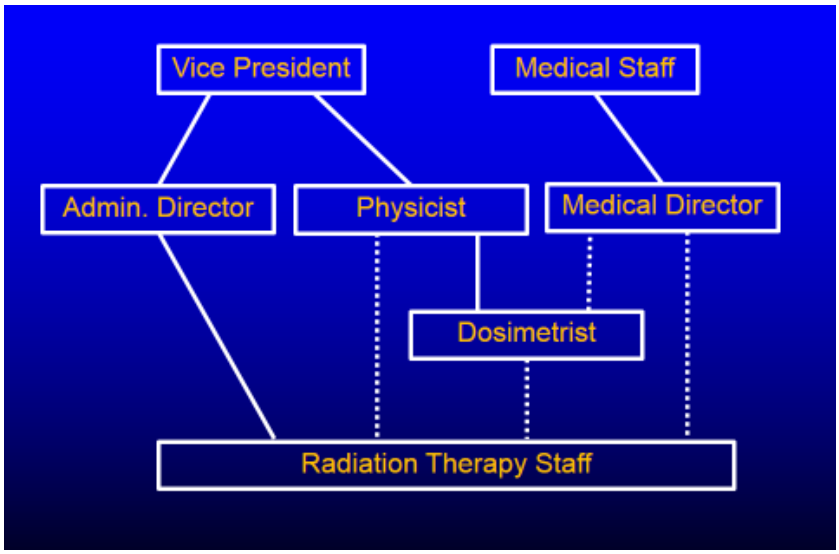


Here's another chart that illustrates the common flow of information in a radiation therapy department. This structure is like a wagon wheel, with the Dosimetrist at the hub.

In this model, the Radiation Oncologist, Radiation Therapist, and Medical Physicist are arranged around the rim of the wheel. The communication between each of the three groups is often difficult, as represented by the dotted arrows. In my view, the Dosimetrist is frequently at the hub of communications. Each of the groups communicates frequently through the Dosimetrist for matters regarding the formation and execution of the plan of treatment. And the Dosimetrist is often better suited to communicate information to each of the groups on the rim of the wheel.

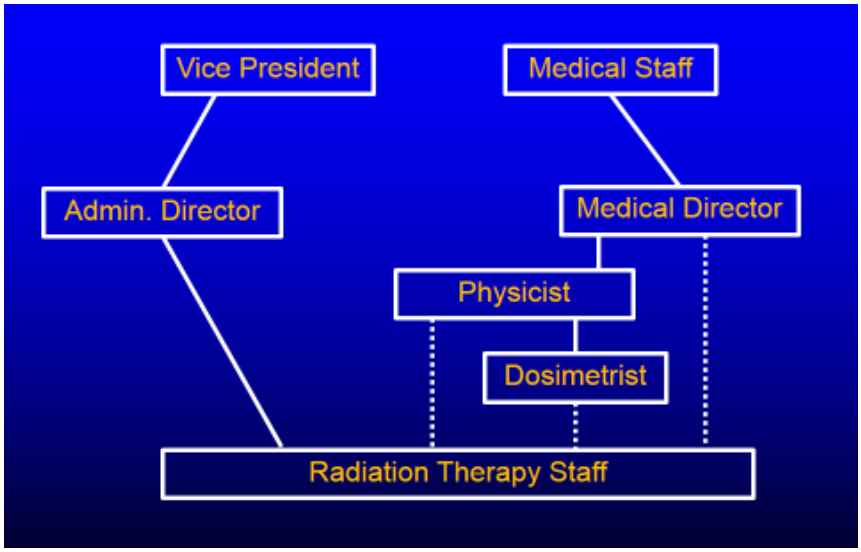


The organizational structure illustrated here is one recommended by the American College of Radiology. This structure shows recognition of the overlapping responsibilities of the Administrative Director, Physicist, and Medical Director, who have unique and overlapping responsibilities for different facets of the same organization. The dashed lines represent indirect, or secondary, authority. The advantage of this structure is that it gives the physicist authority to exercise his professional judgment without authoritative interference by an administrative director who lacks understanding of the depth and breadth of the physicist's knowledge and responsibilities.



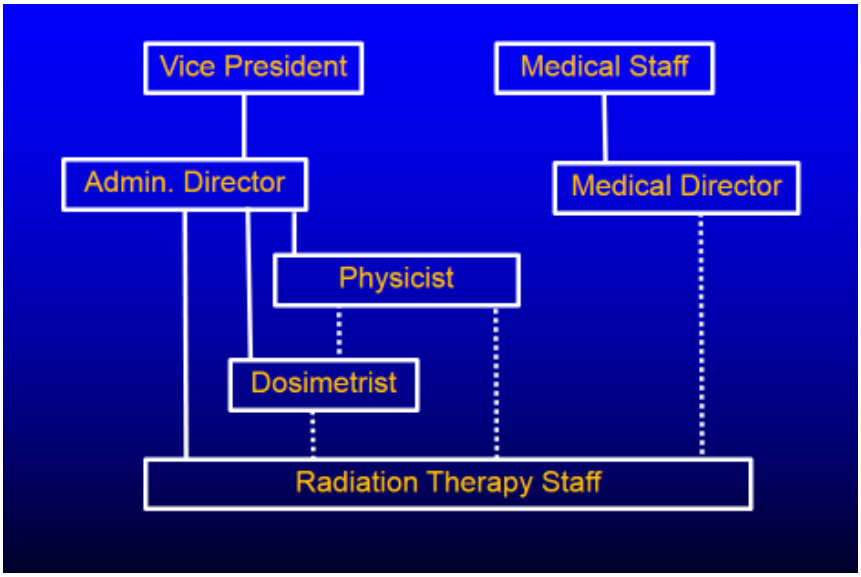
The disadvantage, though, is that it puts the physicist in the management chain and requires a lot of time spent on management activities. However, an offsetting advantage of the time spent in management meetings is the opportunities for awareness and influence that it provides

The American College of Radiology also recommends that the physicist report to the medical director of Radiation Therapy. With some employment arrangements, this can be a good reporting relationship.



One of the problems with this, though, is that the physicist is not connected to the hospital organization through either the administrative chain or the medical staff. So there may be fewer opportunities for awareness and influence.

Physics professional standards have long recommended against an organizational chart like the one shown here, in which the physicist reports to the administrative director. This relationship can be problematic if the administrative director sees the physicist as a subordinate.

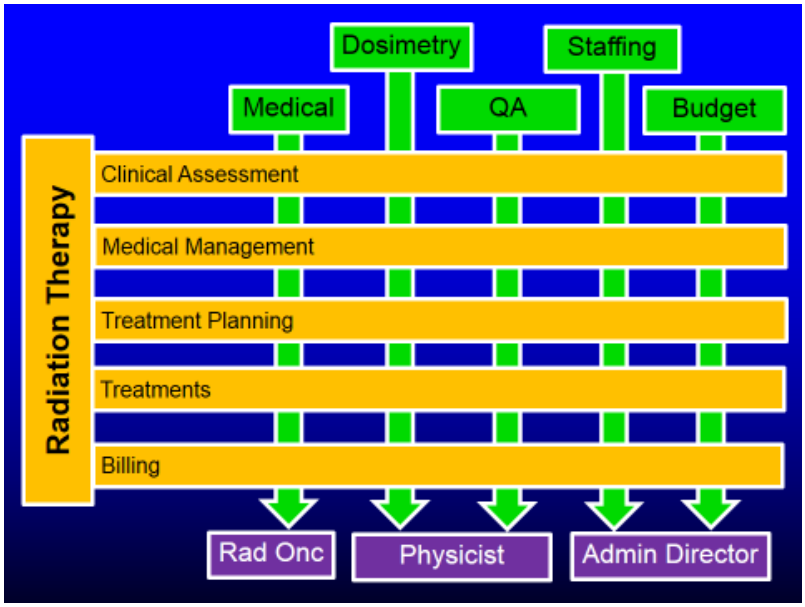


My experience, though, has been that this can work very well if the Administration Director sees his role as one of managing resources to empower people to do their best, and he understands and respects the depth and breadth of the physicist's professional and technical responsibility.

How this works can be best understood from the perspective of a matrix management model.

Matrix reporting is an organizational scheme that was introduced in the 1970s. In matrix management, you have a straight-line boss, who is the person who prepares your performance review and decides on your raise; and a dotted-line boss, who may also assign you work but has less control over your review. Matrix reporting systems are designed to keep people working together in teams that best utilize their core competence, while avoiding people working at cross-purposes. This allows an organization to meet their needs in terms both of functional coordination and product focus.

Matrix reporting is not widely understood, because it does not easily lend itself to a visual diagram. One way to visualize how matrix reporting works is the diagram here, in which the product focus is Radiation Therapy Services. Some of the functional activities involved are shown in the horizontal bands in which multiple people are involved. The matrix of responsibilities for different aspects of each of these functional bands are



- Medical, for which the Radiation Oncologist has primary responsibility
- Dosimetry, and QA, for which the Physicist has primary responsibility,
- And Staffing and Budget, for which the Administrative Director has primary responsibilities.

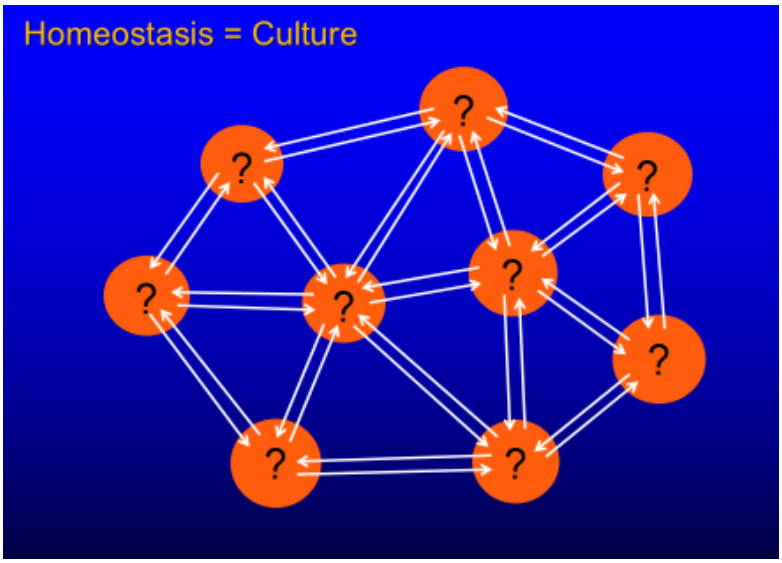
Of course, there are other activities and responsibilities, but these primary responsibilities can be used to illustrate the concept. Accountability for the service line and keeping people focused on strategic goals falls on the Administrative Director. It's important for matrix managers to make sure that people understand the reasoning behind matrix reporting and choose their behaviors accordingly. In matrix reporting, the formal structure becomes less important to getting things done, so managers need to focus on the soft structure of relationships within groups, networks, and teams that are needed to get things done.

Systems Theory

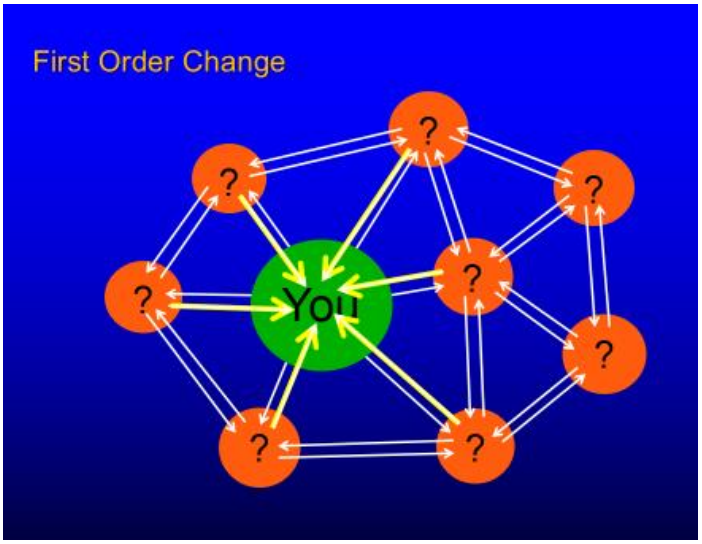
Quality control checks of equipment performance is not enough to assure quality if people are not following effective processes. So, one of the perennial challenges for a physicist in radiation therapy is answering the question, "how do you influence the staff if you're not their boss?"

I didn't go into physics because of my strong aptitude with interpersonal relationships. In fact, I married a psychotherapist to help me with that. When I was helping her write papers for her master's degree in Marriage and Family Therapy, I learned about Systems Theory, and I have found it to be helpful in understanding how to influence people within a group. Systems theory is a model of the behavior of individuals in a group.

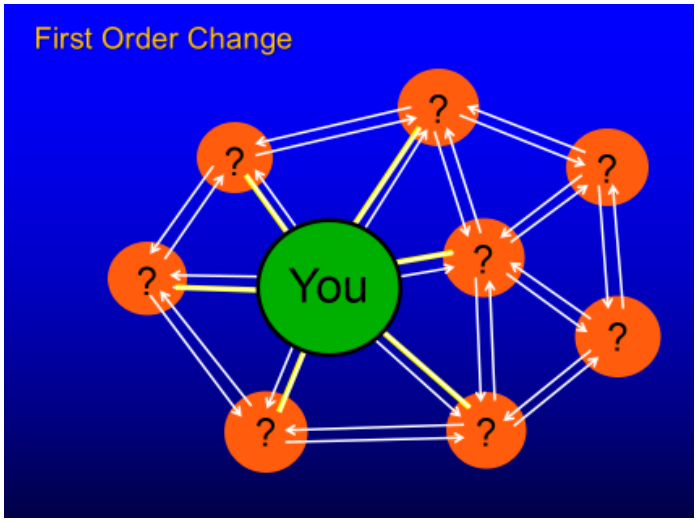
In this model, the thoughts and motives of the individuals are not characterized. Instead, the interaction between individuals is characterized by negative feedback loops. We know that negative feedback loops act to resist change. So, in systems theory, the behaviors that provide negative feedback lead to a group homeostasis, which is the culture of the group. And we already know that a culture is difficult to change.



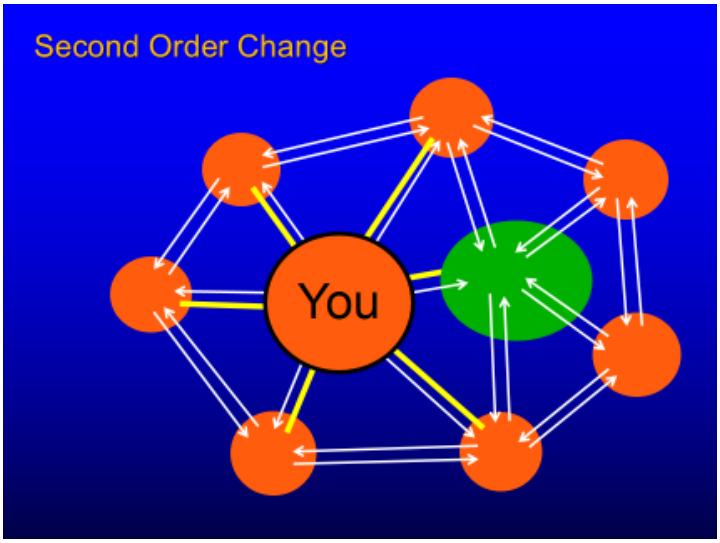
Let's consider what happens with a first order change. If you, the physicist, decides to expand your role to include influence over processes, the feedback from the group will push back against the change. And this pushback can be quite malicious.



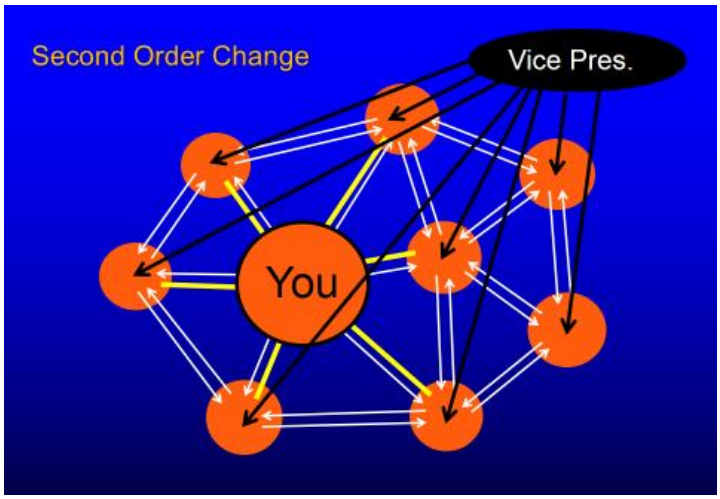
If you are determined and persistent, and you develop a thick skin, the group will eventually adjust to your change. But it can take a very long time.

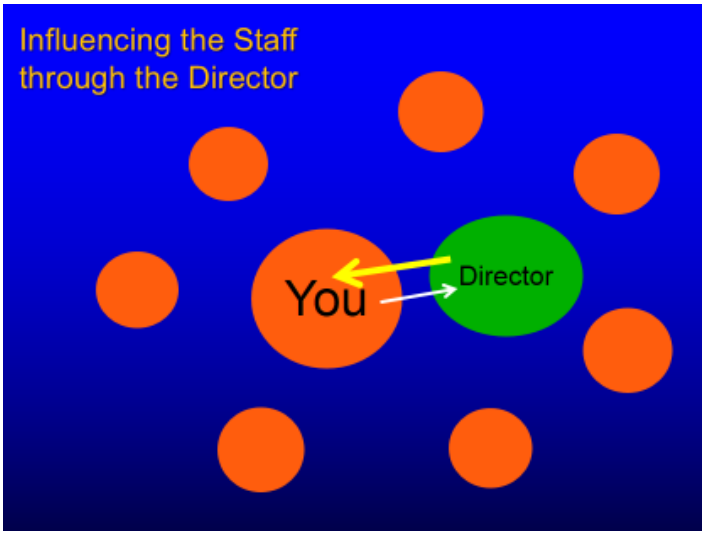


Sometimes, a second order change is needed. This might consist of bringing in a new person to replace a troublesome employee.

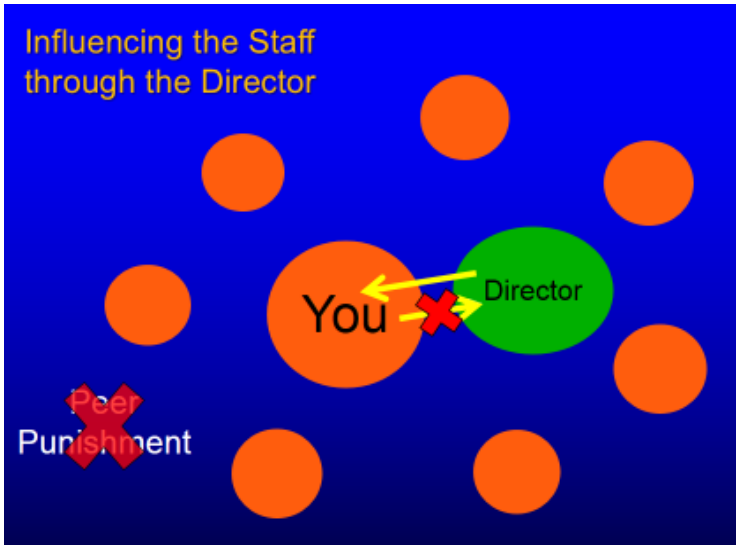


Another second order change is to elicit the support of an administrator, who is insulated from the push-back.





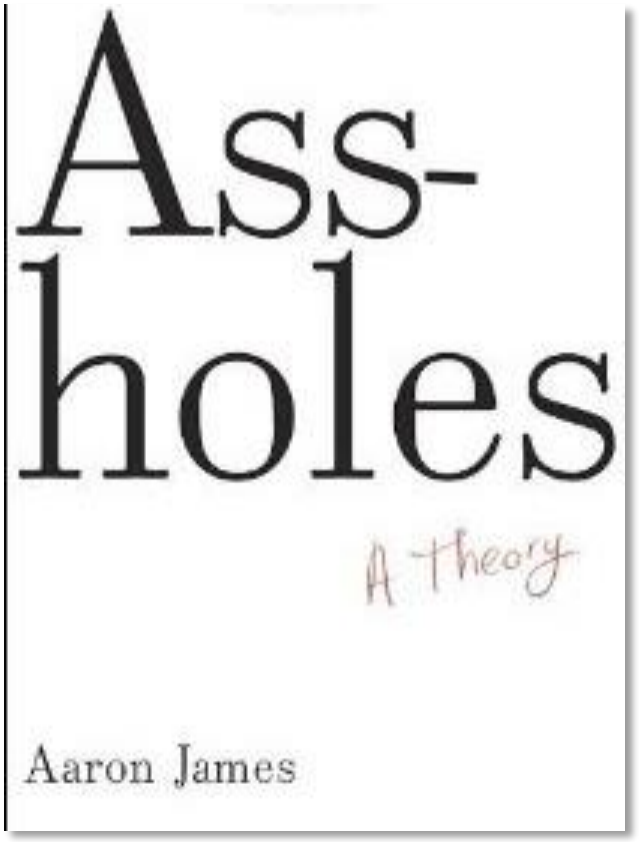
The goal should be to influence processes through the authority of the Director, who is the supervisor of the radiation therapy staff. But when you try to collaborate with the Director, he may push back with animosity



You may be compelled to retaliate, or apply what Nowak refers to as Peer Punishment. You should avoid this, because Nowak found that peer punishment will destroy any chance of evolving a group of cooperators.

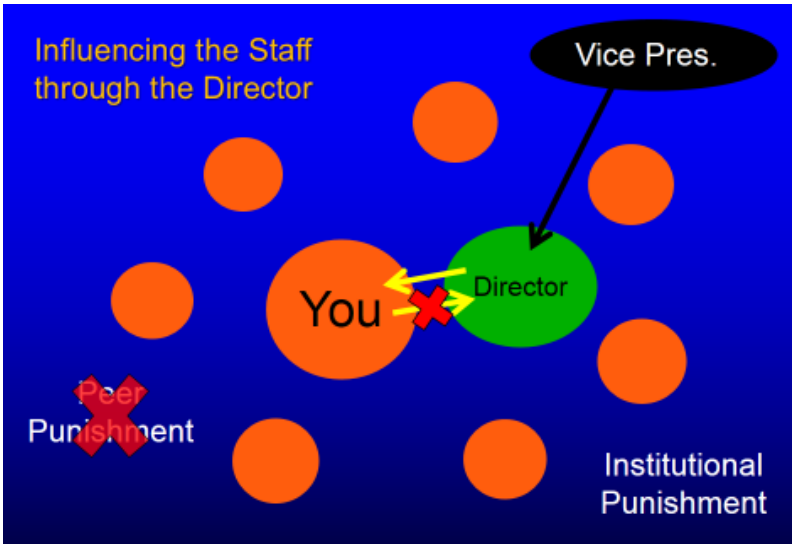
Mohandes Gandhi taught us to be the change that you want to see. This applies here. Never retaliate!

Sometimes it's practically impossible to influence a group to be cooperators if there is a powerful person like that described in the book by Aaron James (James, 2012). The terminology for description of this personality type has been well established in the literature. The expletive person is one who has an inherent sense of moral superiority. He thinks that everyone should show him the utmost respect and deference. But he doesn't believe that others are entitled to the same respect from him. That can lead to a culture of fear and blame, like that I portrayed earlier in the humorous flow chart. In my experience, the following approach can be effective in neutralizing the negative influence of such a spoiler. In Systems Theory, it's called a second order change, which is one in which there is influence from outside the defined system.



Nowak refers to this as Institutional Punishment.

In order for this strategy to work, though, you must have influence on the administrator. You have to have credibility. You must always model good behavior and express pure motives.



Mohandes Gandhi said, "The moment there is suspicion about a person's motive, everything he does becomes tainted."

Strategy: Be the Town Marshal

For the next strategy, I want you to consider two medical physicist archetypes from 20th century American mythology.

The Lone Ranger

The fictional Lone Ranger was a wealthy former Texas Ranger, who swore to fight injustice. He, and his partner Tonto, would roam the territory looking for trouble in the land.

When they would find trouble, they would do some surveillance in town to get to the bottom of the problem. The Lone Ranger had the uncanny ability to appear at just the right time to thwart the troublemakers. Then he would ride away on his silver steed to leave the townspeople to mismanage their affairs in the same way that led to their previous problems. The Lone Ranger is a great American mythological hero who did as much good as he could under difficult circumstances.

This is the archetype that is emulated by many consultant physicists. They do the best that they can under difficult circumstances, but it's not enough for achieving total quality.

Marshal Dillon

The fictional Marshal Dillon was the resident lawman in Dodge City, Kansas. He was portrayed in Gunsmoke, the longest running prime-time television show in history, with 635 episodes from 1955 to 1975. Marshal Matt Dillon was played by 6 foot, 7 inch James Arness.

Marshall Dillon lived and worked in the town of Dodge City. He kept his finger on the pulse of the town, and he could spot trouble coming before it became a problem.

When trouble became a problem, he didn't need to magically appear. He was already there.

This is the archetype for the medical physicist who wants to assure total quality.

Summary

In summary, I have presented:

- Quality of care as the greatest value for ethical decision-making.
- The strategy of “Tools – Not rules!”
- The strategy of delegation through the use of situational leadership
- The strategy of process design and process improvement.
- The strategy of creating a culture of Total Quality Management, and getting started on that journey with Root Cause Analysis.
- The strategy of Experience Design and the value of guided transformations.
- The strategy of the Opportunity, Influence, Impact cycle.
- The strategy of seeking Opportunities for Awareness and Influence.
- The strategy of customer-supplier feedback and why it’s the smart thing to do.
- The strategy of being a Champ and not a Chump through intelligent giving
- Strategies for effective reporting relationships using Matrix Reporting
- Strategies for influencing behaviors in a group using Systems Theory.
- The strategy of being the town Marshal, and not the Lone Ranger.

Bibliography

Aguayo, R. (1990). *Dr. Deming: The American Who Taught the Japanese About Quality.* New York: Simon & Schuster.

Axelrod, R. (1984). *The Evolution of Cooperation.* New York: Basic Books.

Deming, W. E. (1982). *Out of the Crisis.* Cambridge: MIT Press.

Dunn, E. W., Gilbert, D. T., & Wilson, T. D. (2011). If money doesn't make you happy, then you probably aren't spending it right. *Journal of Consumer Psychology*, 115-125.

Grant, A. (2013). *Give and Take.* New Yort: Penguin Group.

James, A. (2012). *Assholes; ATheory.* New York: Doubleday.

Lee, F. (2004). *If Disney Ran Your Hospital: 9 1/2 Things You Would Do Differently.* Bozeman: Second River Healthcare Press.

Marshall, R. (Director). (2002). *Chicago* [Motion Picture].

McCumber, J. (2011, June 19). The Failure of Rational Choice Philosophy. *The New York Times*.

Nowak, M. A., & Highfield, R. (2011). *Super Cooperators -- Altruism, Evolution, and Why We Need Each Other to Succeed.* New York: Free Press.

Paul H. Hersey, K. H. (2012). *Management of Organizational Behavior.* New Jersey: Prentice Hall.

Pine, B. J. (1999). *The Experience Econonomy: work is theatre & every business a stage.* Harvard Business Review Press.

Ryan, S. M. (1998). *CQI and the Renovation of an American Health Care System: A Culture Under Construction.* Milwaukee: Quality Press.

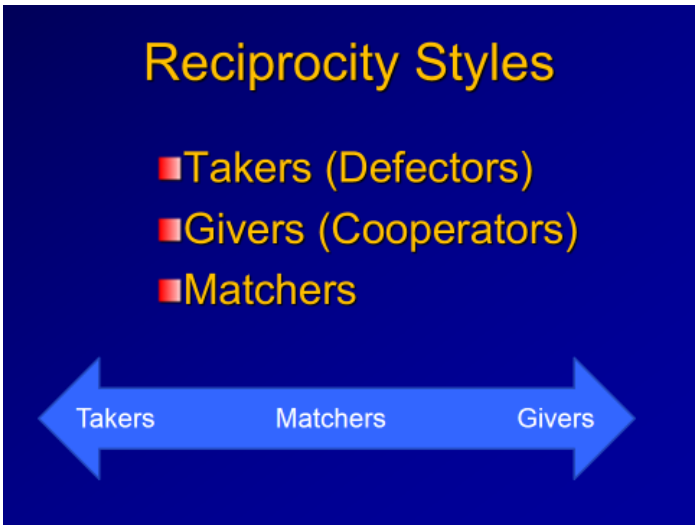
Scherkenback, W. W. (1991). *The Deming Route to Quality and Productivity.* Rockville: Mercury Press.

Walton, M. (1986). *The Deming Management Method.* New York: Putnam.

Appendix A: Organizational Psychology

Adam Grant is a Wharton Business Professor with a PhD in Organizational Psychology. In his book, "Give and Take," (Grant, 2013) he provides a perspective based on personal experience and on experimental study of humans. He also provides several individual case studies with stories of real people that illustrate his general conclusions. His findings are wholly consistent with those of Nowak in "Super Cooperators." (Nowak & Highfield, 2011)

Like all good scientists, Grant works within a model to investigate how well the model predicts the real world. In his model, he characterizes people based on their reciprocity styles as Takers, Givers, and Matchers. Takers and Givers are analogous to Defectors and Cooperators in Nowak's model.



Based on their reciprocity behavior in their relationships with others, he ranks them on a scale with Takers on one end, Givers on the other end, and Matchers in the middle.

He discovered some interesting things in his research and in the research of others. For one thing, he found that, in the long run, Givers are more successful. For example, new medical students were tested for reciprocity styles and their grade performance was ranked at the end of the first year.

The top students were the takers, who sought all the help they could get from the givers, but didn't waste their time helping other students.

Second were the Matchers, who would help other students if the other student would reciprocate.

At the bottom were the Givers, who helped everyone who asked, but didn't have enough time left for their own work.

At end of the second year, and beyond, the Givers moved to the top, the Matchers stayed at number two, Takers moved to third place and, interestingly, Givers were also at the bottom. It turns out that some Givers are Champs, and some Givers are Chumps. For the Champs, though, being a Giver is not good for a 100-yard dash, but it's valuable in a marathon. This pattern of success proves out across many different professions.

Nowak and Grant both recognize the importance of indirect reciprocity in dealing with Takers.

> We need to be able to recognize Takers in our everyday interactions. A challenge of networking lies in trying to guess the motives or intentions of a new contact, especially since Takers can be adept at posing as Givers when there's a potential return. Is the next person you meet interested in a genuine connection or merely seeking personal gains – and is there a good way to tell the difference?
>
> When we have access to reputational information, we can see how people have treated others in their networks. In today's highly connected world, these signals are easier to spot than ever before. Networks have become more transparent, providing us with new windows through which we can view other people's reputations.

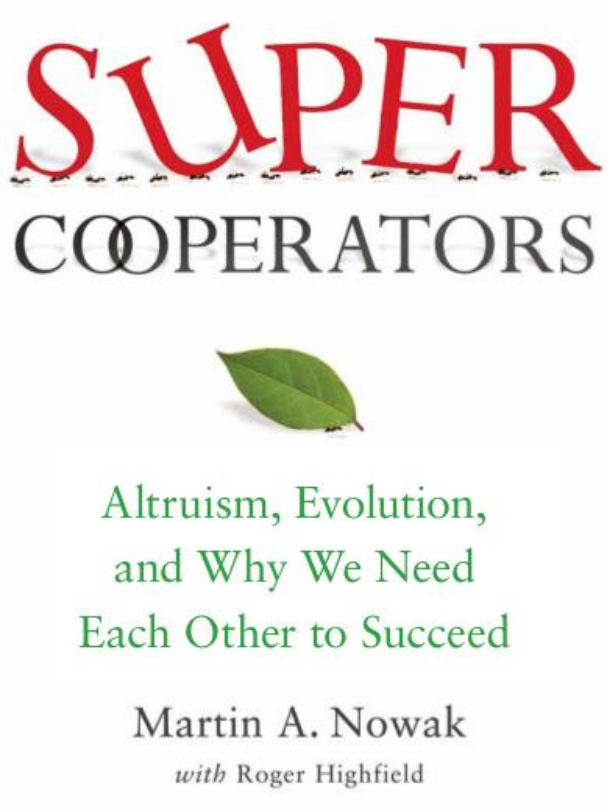
Don't fall into the trap of stereotyping agreeable people as Givers, and disagreeable people as Takers. We often overlook that there are disagreeable Givers and agreeable Takers, otherwise known as "fakers."

> Once successful Givers begin to spot agreeable Takers as potential fakers, they protect themselves by adjusting their behavior accordingly. They become Matchers in their exchanges with Takers. It's wise to start out as a Giver, since research shows that trust is hard to build but easy to destroy. But once a counterpart is clearly acting like a Taker, it makes sense for Givers to flex their reciprocity styles and shift to a matching strategy.
>
> According to Nowak, in "Super Cooperators," (Nowak & Highfield, 2011) an effective strategy, called "Generous Tit-For-Tat," is to never forget a good turn, but occasionally forgive a bad one. You start out cooperating and continue cooperating until your counterpart competes. When your counterpart competes, instead of always responding competitively, in Generous Tit-For-Tat, you respond competitively only two times out of three.

In group settings, Givers can make sure that they're not being exploited by getting everyone in the group to act more like Givers. Nowak calls this "The Scrooge Shift." People rarely have a single reciprocity style that they apply uniformly to every domain of their lives. If a group develops a norm of giving, members will uphold the norm and give, even if they're more inclined to be Takers or Matchers elsewhere. This reduces the risks of giving: when everyone contributes, the pie is larger, and Givers are no longer stuck contributing far more than they get.

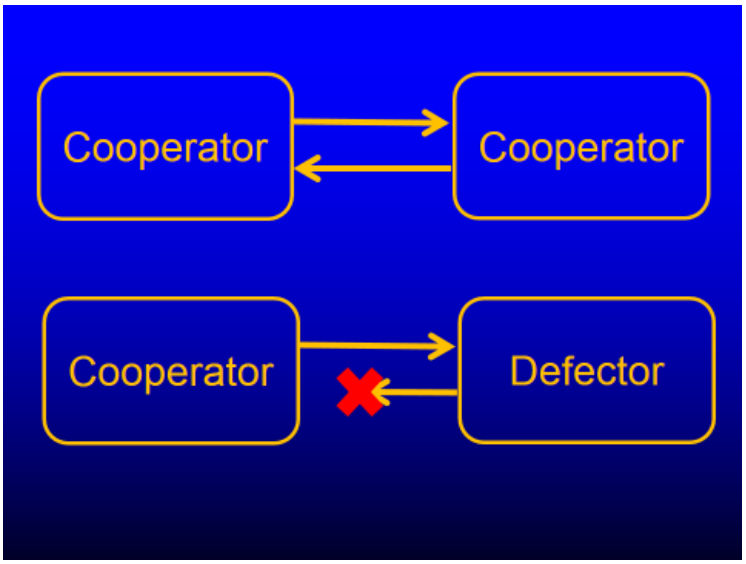
> Common ground is a major influence on giving behaviors. People are motivated to give to others when they identify as part of a common community.
>
> Being part of a group with shared interests, identities, goals, values, skills, characteristics, or experiences gives us a sense of connection and belonging. At the same time, being part of a group that is clearly distinct from other groups gives us a sense of uniqueness. The more rare a group, value, interest, skill, or experience is, the more likely it is to facilitate a bond. People are happier in groups that provide optimal distinctiveness, giving a sense of both inclusion and uniqueness. These are the groups in which we take the most pride, and feel the most cohesive and valued. These are the kind of groups that can influence someone to be a Giver.

Appendix B: Mathematical Biology



Martin A. Nowak, a native of Austria, is a mathematical biologist whose career has included stints at the Universities of Vienna, Oxford, Cambridge, Princeton, and Harvard. In his book, "Super Cooperators – Altruism, Evolution, and Why We Need Each Other to Succeed," (Nowak & Highfield, 2011) he describes his career and research in modeling the evolution of cooperation in various organisms and species. This modeling, similar to Monte Carlo modeling of radiation transport, scores the iterative application of variations of the Prisoner's Dilemma game to hypothetical populations. (Axelrod, 1984)

In this modeling, individuals are categorized as either cooperators or defectors.



In the simplest form, a cooperator extends something of value to another individual. If he receives a *quid pro quo*, the other individual is a cooperator. If the cooperator extends the value and receives nothing in return, the other individual is a defector.

In the classic Prisoner's Dilemma game, each player has two choices, namely cooperate or defect. Each must make the choice without knowing what the other will do. No matter what the other does, defection yields a higher payoff than cooperation. The dilemma is that if both defect, both do worse than if both had cooperated. (Axelrod, 1984)

Axelrod reported that, in Prisoner's Dilemma computer tournaments, the Tit-For-Tat strategy was a consistent winner over every other strategy when the competition covered many iterations. (Axelrod, 1984) The Tit-For-Tat strategy starts with being a cooperator, but switches to defector when the opponent defects. The Tit-For-Tat strategy is unforgiving of a defection. Nowak, though, found that when the interactions included a component of random errors to simulate human error, then a more forgiving strategy was the winner. He refers to that forgiving strategy as Generous Tit-For-Tat, in which the strategy is to forgive one out of three defections, and he asserts that Generous Tit-For-Tat is an effective strategy in human relationships. (Nowak & Highfield, 2011)

Nowak's research demonstrates how cooperation arose in our apparently competitive world. In evolution, mutation generates diversity. Selection, which can be either genetic or cultural, picks the individuals that are best suited to a given environment. But cooperation, says Nowak, is the master architect of evolution, which is as much about survival of the fittest group as the survival of the fittest individual.

This is not a new discovery, though, but a demonstration of multi-level selection theory proposed by Darwin, who once wrote that a tribe with many people acting like givers, who "were always ready to aid one another, and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection." (Grant, 2013)

By modeling the evolution of populations while varying the rules of interaction between individuals, Nowak discovered mechanisms that must have been at work for humans to have evolved into the Super Cooperators that they are. These mechanisms are:

- Repetition, which brings direct reciprocity into play. I'll scratch your back and you scratch mine.
- Reputation, which brings indirect reciprocity into play. I'll scratch your back, and someone will scratch mine.
- Spatial selection, which allows cooperators to prevail by forming symbiotic clusters of cooperators.
- Multilevel selection, in which selection acts not only on individuals but also on groups.

So, for human evolution, while it was important for people to not adopt a short-sided perspective in interactions with other people, it's the same characteristic that is important for success in a modern highly-connected world.