

Olney Medal Address

The Joys of Problem Solving

By HERBERT T. PRATT, 1993 Olney Medalist

Most of us have been solving problems of one type or another for most of our lives. By problem I mean any unsettled question that bewilders, perplexes, vexes, troubles, irritates or distresses us. And by solving a problem, I mean dealing with it in such a way that it is no longer a major source of distress.

Some problems can be solved in a few minutes; others require a lifetime of work; some cannot be solved at all. My contention in this paper is that problems, although troublesome, can be downright fun to solve. It all depends on one's outlook.

The first problem of any type that I can recall solving on my own must have been when I was about four years old. The pants I was wearing had patch pockets, but only on the front. What I wanted was pants having back pockets just like my Dad's. So, standing in the middle of the front lawn, I took off my pants and put them on backwards. I'm sure I must have been pleased as punch with myself. But it probably didn't take me long to realize that in solving that problem, I had created another by moving the pant's fly to the rear.

Attitudes Toward Life

How one faces any problem has much to do with one's outlook on life; namely, whether or not one is a defeatist, a stoic or an overcomer.

The Defeatist

Defeatists, on the whole, view life as a negative experience. They feel sorry for themselves and see problems as retribution to be borne, meted out perhaps by a displeased God. From birth to death, life for them is toilsome, or to use a popular 19th century term, a "vale of tears." These people have little or no incentive to solve problems. "Woe is me," they cry, and blame others for their plight. Their only hope, if they have hope at all, is in a future blissful state of rewards (or punishments).



THE OLNEY MEDAL was presented to Pratt (left) by Winfried T. Holfeld of Du Pont, a member of the selection committee for the award. In addition to the medal, the award includes the scroll shown here and an honorarium.

The Stoic

Stoics are mostly indifferent to problems and see their lot in life as being determined by the luck of the draw. They take life as it comes, do whatever is necessary to get by, being neither excited nor dejected at any turn of events.

The Overcomer

Overcomers view life positively and see problems as a challenge, a difficulty to be

corrected, an opportunity to learn something new. Like mountain climbers and channel swimmers, they tackle problems eagerly because they are there. Overcomers make the most of any situation. As a boy, I read and reread Horatio Alger stories, having titles like *Struggling Upward* and *Strive and Succeed*. Alger's heroes were always overcomers, and all the story lines were virtually the same. The virtuous, honest, hard working son of a poor widow always overcame adversity and rose to the heights of fame and fortune. At the same time, the hero's constant antagonist, usually a snobbish, selfish son of wealth, would see his own family sink into poverty or other misfortune. Undoubtedly, these stories had a marked effect on my outlook on life.

Mark Frye, a young Baltimore police officer gunned down in a holdup and now paralyzed from the waist down, took up mountain climbing. Last year, he climbed the 3600-foot vertical stone face of Half Dome in Yosemite National Park. How did he do it? Certainly not by crying "Woe is me!" Mark is an overcomer.

I believe some overcomers see themselves as Providentially guided to a specific place at a specific time to deal with a specific problem. Michael Faraday, the greatest of the 19th century scientists, discovered benzene on which the synthetic dye industry was based, developed optical glass and established the fundamental principles of electricity. Faraday was also a devout Christian. From careful analysis of hundreds of passages that Faraday marked in his Bibles, I have concluded that he saw himself as having been divinely singled out by God to unravel some of the mysteries of the universe (1).

Confronting Problems

Much of what we know about coping with problems we learn from parents, teachers and peers in the formative years. And successfully coping with problems in one stage of life prepares us for the next.

The Joys of Problem Solving

I believe that the extent to which we are able to cope with life's problems determines how happy we are and how successful we are, by whatever standard of success we as individuals choose for ourselves, as opposed to standards that other people might choose for us. Failure to cope with our own standards, at minimum, leads to frustration and can cause depression, anger, verbal or physical abuse of others or even lead to suicide.

Three Types of Problems

As I see it, there are at least three types of problems: personal problems, objective problems and speculative problems.

Personal Problems

Personal problems are those that relate to us as individuals and are common to us all. In the formative years, we learn to walk, talk, read, ride a bike, whistle, get along with people, talk to the opposite sex, develop a work ethic, begin to think about a vocation, embrace a system of ethical and religious values and conquer fear of the unknown. In the middle years, we choose a vocation, usually find a spouse, learn how to provide for ourselves, nurture a family and live within our income. In the declining years, we retire, learn to live on smaller incomes and fill spare time, give up houses for apartments, grow old, deal with sickness and pain, and inevitably face death.

Several years ago, the popular TV minister, Dr. Robert Schuller, compiled a

Table I. Ten Positive Attitudes Needed to Solve Personal Problems^a

- Problems are natural occurrences. Do not be embarrassed that you have a problem.
- All problems are distortions or departures from the normal.
- Every problem is temporary.
- Admit to yourself, "I created my own problems." Do not see yourself as victimized.
- All problems are complex and comprised of many little problems.
- No problem is totally impossible.
- Every problem has a solution somewhere. Discover what part of the problem you can solve.
- Every problem is manageable.
- Every problem is pregnant with possibilities. Find those possibilities and benefit from them.
- Problems are only decisions waiting to be made.

^a Paraphrased from Dr. Robert Schuller

list of ten positive attitudes needed to solve personal problems (Table I). Three attitudes stand out from the rest: (1) Realize that all problems are natural occurrences; (2) admit to yourself, "I created my own problem; I have not been victimized;" and (3) know that every problem is complex and composed of many little problems (2).

There is a natural tendency to believe that our own problems are worse than anyone else's. Although to deal with personal problems one might seek professional help such as from a psychologist or counselor, sometimes the best therapy is to try to help someone else (Table II).

Objective Problems

Objective problems are those that are amenable to analysis and solution based on factual evidence undistorted by personal feelings or prejudices. In my own experience, objective problems have been either functional or historical.

Functional Problems

Functional problems arise when a product, machine or process fails to do what it is supposed to do or fails to behave as the designer or originator intended. For example, your automobile stops dead in the middle of moving traffic and will not restart. Such a functional problem can be attacked rationally and systematically. One can collect facts about it, develop an hypothesis as to its cause, test the hypothesis by experiment, draw conclusions from the experimental data, and then take further action. Finding solutions to functional problems is limited only by the amount of money, manpower and time available, and by one's ability to design meaningful experiments.

There is a knack to solving functional problems, and the word *knack* is used purposely because it connotes a skill that is difficult to analyze, teach or acquire. Some individuals are more successful at it than others, and an adept problem solver's ability varies from time to time. The degree of individual success undoubtedly

Table II. Points to Remember in Helping Other People with Their Personal Problems

- Do unto others as you would have them do unto you.
- Recognize communication difficulties. Define terms. Ferret out backgrounds that affect others' points of view (as well as your own).
- Be a good listener. Lend a sympathetic ear without being judgmental.
- Be available.
- Be patient. Realize that time heals many wounds.
- Make other people feel important. Realize that each person you encounter knows more than you do about at least one thing.

depends on many things, but at least three personal attributes are involved: an insatiable curiosity, a varied background of experience and the ability to communicate—namely, to ask questions and to hear answers objectively (3,4).

I believe that one of the most important obligations that parents have to their children is to encourage them to deal with problems as they arise. It takes a lot of wisdom, however, to strike a balance between exposing them to the hard realities of life as opposed to isolating, protecting and shielding them. Undoubtedly they will make mistakes, but hopefully they will learn from them.

The first technical problem I can remember solving was when I was about ten years old. I repaired a porch light that hadn't worked for years. My Dad was not much of a tinkerer, and during the Great Depression of the 1930s, probably didn't have the money to have it fixed. So, out of curiosity one day, I took the lamp apart. A tiny brass screw was missing that seemed to me should have been there. I scrounged one from some place and put it in. The light worked! In fact, it continued to work until it was replaced some years later during remodeling. My only reward, as I recall, was a hug from my mother, probably not so much for fixing the light but out of gratitude that I had not electrocuted myself. From that time on, I have found it a challenge to repair anything that does not work.

Historical Problems

In contrast to functional problems, the only data available to solve historical problems are those that can be discerned from written records of the past, artifacts and memories. The challenge then is to locate those materials wherever they can be found and from them piece together a coherent story.

Let me illustrate.

Over the past two decades, I have devoted a large share of time to researching the biographies of obscure chemists. One person I became ardently interested in early on is one Mrs. Fulhame author of a book on chemistry and textile dyeing

Table III. Nature of Problems that Claim a Place in History

- Readily identifiable.
- Catches the imagination.
- Impact is understandable.
- Can be overcome by dramatic intervention.
- Solution is understandable.
- Solution is a first time event or is seen as relieving suffering or improving the standard of living.
- Problem solver is seen as facing danger or taking unusual risks.

published in London in 1794 (5). As far as I can determine, this was the first such book written by a woman.

Little is known about Mrs. Fulhame other than what can be learned from the book itself. The copyright records show that her given name was Elizabeth. In the Preface she refers to her husband as Doctor Fulhame. The text shows that her chemistry was very up to date and that she used Lavoisier's new nomenclature. Through a review of her book, I have established that she lived, for a while at least, in Edinburgh, Scotland, where her husband taught chemistry at the university, and I even found the location of her house. From her remarks in the Preface I know that she was an ardent feminist, and being a feminist myself I have been in love with her ever since we met. Otherwise, her life is a nonentity. Where was she born? When? When did she die? Where? Did she have children? It is highly probable that these questions will never be answered because the records apparently don't exist. But I'm still searching.

Speculative Problems

Speculative problems pose the ultimate questions. Is there a God? Is there life after death? Does man have a soul? When does personhood begin? What is the true religion? What is the best system of government? Is capital punishment justified? What should be done, if anything, to control the world's population? Are abortion, euthanasia and assisted suicide immoral? What about the use of fetal tissue in disease treatment? Or, what about using genetic engineering to create new forms of life?

In my opinion, there are no *absolute* answers to such questions. They cannot be analyzed scientifically because they are questions of faith. Each individual, however, can develop *personally* satisfying answers, even though they might be based on pure emotion, faulty assumptions or poorly thought out ethical and religious beliefs. I believe the best answers are arrived at by garnering a wide spectrum of opinions through reading and dialogue, by arguing with one's self, and by much deliberate study, thought, meditation and prayer.

Some of these questions are as old as civilization itself. Others are very recent, the consequence of explosive advancements in science and technology. But the questions, regardless of age, are inseparably intertwined because how a person answers the most recent questions is so highly dependent upon his or her answers to the earlier questions. Because our scientific and technical capabilities are so rapidly surpassing our moral, ethical, theological, legal, emotional and economic abilities to deal with speculative questions, I believe that each one of us has a sacred duty to spend time pondering them so that

we can contribute to an informed consensus that will shape the future.

Rewards

So why is problem solving so much fun? As I see it, it is a matter of rewards all of which do one or more of the following: lift our spirits, spur us on to further activity, inflate the ego, reduce the natural tendency toward selfishness, and build self-confidence. In other words, all rewards relate to exhilaration, motivation, egocentrism, altruism and assuredness.

Exhilaration

The 19th century American poet, Ralph Waldo Emerson, once wrote "The reward for a thing well done is to have done it." To have done it means to have participated, to have felt the thrill of the search, the heart pounding excitement that comes with a breakthrough and learning something new, with conquering the unknown and with doing the undoable.

In a small problem, such emotions might well up only once—when the problem is solved. In a greater problem, there might be many such incidents, each one breaking the monotony and routine of the search.

Perhaps I can best describe the feeling of exhilaration with a story.

In 1991, I published a biographical sketch of Peter Crosthwaite (1735-1808), an 18th century museum keeper living in the village of Keswick in northwest England's lake district (6). Although known far and wide in his day, by the time of my work Crosthwaite had been virtually forgotten. My interest in him lay in the fact that during the years 1788 to 1793 he had collaborated with John Dalton (1766-1844), later to be known as the father of the atomic theory, in developing data for Dalton's first book, *Meteorological Observations and Essays*.

The lake district in the 1790s was becoming a haven for tourists, and in hopes of finding descriptions of Crosthwaite written by someone who visited his museum, I searched the manuscript holdings in a number of libraries. I had spent a day at the Library of Congress, systematically reading old letters and other documents. The search had been fruitless, and I was very tired after having struggled for hours with faded and often hard to read hand writing. Then, near the end of the day, I found a diary kept by one William Teackle of Virginia, who, while in England in 1799, had traveled by stage coach the hundred miles or so from Manchester to Keswick.

Although I had an almost overwhelming urge to skip through the diary to Teackle's entries about Keswick, I forced myself to read word-for-word his day-to-day descriptions of scenic wonders, villages and people. Having traveled the same road myself several years before,

tension mounted as the distance dwindled mile by mile. Finally Teackle entered the town, took a room at the inn and found the museum. His detailed description concluded that the museum consisted more of gimcracks than antiquities—the greatest curiosity being old Crosthwaite himself.

My weariness evaporated in a flash. High on success, I wanted to shout or dance or tell the person at the next table. But restraint prevailed and as I reveled in silence, one thing was certain. To find that short description had been worth every hour and every minute of the search. And I still get a thrill just thinking about it.

Motivation

The exhilaration of emotional highs is usually followed by a strong desire to "get on with it." Regardless of how small the high is, it revives hope, renews energy, fosters commitment and urges one on to a solution. Such interludes are extremely important because without them, there is likely to develop a strong sense of "What's the use?"

Some years ago I found in the Archives of AATCC an 8 × 10 inch photograph of a group of eight men and ten women which, based on the styles of clothing, obviously had been taken in the early 1900s. I recognized two individuals—Sir William Henry Perkin, discoverer of mauve, the first synthetic dye, and young Louis A. Olney. There was nothing to indicate who the other people were, where the picture had been taken, when it was taken or why. My curiosity aroused, I set out to find the answers. They didn't come easy. In fact, it took months to piece together the jigsaw puzzle of a story, with each clue added spurring me on to the next. Along the way, I learned that the picture had been taken on October 11, 1906, at the Country Club in Brookline, Mass., which was one of a dozen or more stops made by Perkin, his wife and two grown daughters on a tour of the United States and Canada. The trip had been sponsored by the American chemical industry in celebration of the 50th anniversary of Perkin's discovery of mauve. Eventually, I identified each person in the picture and worked out the itinerary of the entire 45-day trip from London to New York, Boston, Montreal, Toronto, Buffalo, Washington, Baltimore, Philadelphia and a number of smaller cities (7).

All the while, however, one thing bugged me exceedingly. In city after city, newspaper accounts of Perkin's visit invariably mentioned the "Misses Perkin" or "the Perkin daughters." But not one of the 40 or so newspapers that I read during the six-month project gave the daughters first names, not even the one in Philadelphia that interviewed them. Even Perkin's biographers were of no help since they scarcely mention the American tour.

From the New York Times, I had

learned that the Perkins had arrived in America on the ship Umbria on September 29th. With this information, I went, as a last resort, to the National Archives in Washington to search for the ship's manifest for that voyage. In less than an hour, I found it. As I recall, the names were in no particular order, apparently being listed as each passenger boarded. After leafing through a number of pages, I found Perkin, Sir William; then Lady Alexandra Perkin; and finally the daughters, Sascha and Annie. Not only were the daughters' names given but their heights, weights, ages and birthmarks. Since I already had several published pictures of them, with their physical measurements I could readily identify which daughter was which.

Although this is an insignificant contribution to the world's storehouse of knowledge, it shows how compelling the desire to know can be, and how one small breakthrough urges one on to another.

Egocentrism

Most of us are egotistical to a degree and we swell with pride when we see our names in print, or when others read about us in the press or see us on TV, or when we are honored by our peers as being expert in one field or another. Believe me, it is a heady affair to receive the Olney Medal.

Most of us are also materialistic to some degree, so it is only natural that we want to benefit tangibly from any success that we have in solving problems, particularly technical problems. Like nothing else, a pat on the back, a letter of commendation or a raise in pay smooths away self doubt, assuring us that our efforts are appreciated.

Finally, there is the small possibility of creating for one's self a lasting place in

history. It seems to me that those who are remembered beyond their own times worked on problems that have a number of characteristics in common: the problem is readily identifiable; it catches the imagination and is understandable; it can be solved by dramatic intervention; it is a first-time event, or is seen as relieving suffering or vastly improving the standard of living. If the problem solver also faced danger or risk in his or her work, the "hero" element plays a major part.

Altruism

In direct contrast with the rewards of egocentrism which glorify self, there are those which stem from altruism; namely, the unselfish regard or devotion to the welfare of others. In altruism is found the ultimate sense of inner satisfaction that comes from having contributed to a cause outside of one's self, regardless of whether anyone else recognizes that contribution. For example, to know that some problem that I solved has made someone else's life easier or the world a better place is sufficient reward in itself.

Perhaps the best test of altruism is motive. I read some place that if one can do a good deed for someone else and then keep that good deed a total secret, then the motive was pure and unselfish.

Dr. Charles M. Stine, director of research at Du Pont in the 1930s, lived by the philosophy that since as professionals we owe our livelihoods to the chemical industry, we have the responsibility to give back to that industry at least as much as we receive from it. For that reason, he encouraged the publication of research so that it could be shared for the good of all (8). I believe it is highly probable that it was Dr. Stine's altruism that also led the company not to copyright the name nylon but to

establish it as a generic for all polyamides.

Assuredness

As an individual comes to terms with, or overcomes, one problem after another, be they personal, objective or speculative, there builds within that person's psyche a sense of accomplishment and self worth. As one is freed from self doubt, and fear of the unknown fades, there develops a sense of mastery over one's world and living environment. That person then has assuredness and knows, "I am in control; I am secure; I can cope."

Perhaps the rewards of assuredness are the most valuable of all, because the person who has no doubts about being able to cope with whatever comes, finds happiness in all situations and can live life to its fullest. ☺

References and Notes

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- (2) I am indebted to my friend Kenneth J. Bredin of Wilmington, Del., for supplying this material.
- (3) Pratt, Herbert T., "The Knack of Problem Solving," *Textile Chemist and Colorist*, Vol. 24, No. 12, December 1992, p16.
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