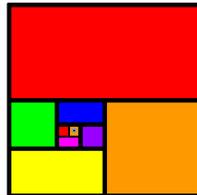


Twenty Eight Tales of Troubleshooting

A Troubleshooters.Com[®] publication



Revenge

Divide and Conquer

Take Pride

Corrective Maintenance

Betrayal

Love

Evil

Persistence

Hope

Bottleneck Analysis

Symptom

Steve Litt

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Twenty Eight Tales of Troubleshooting

by Steve Litt

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Twenty Eight Tales of Troubleshooting

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Author: Steve Litt (slitt@troubleshooters.com)

Publisher: Steve Litt (slitt@troubleshooters.com)

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Dedication For Sylvia.

How to Use this Book

By far the best way to read this book is in order, cover to cover. Each story assumes knowledge of terminology explained in previous stories. It's *especially* critical that you read the first story, "Heather's Revenge", first. That story introduces all major concepts of the Universal Troubleshooting Process.

If you're like me, you read your favorite books several times. Once you've completed "Twenty Eight Tales of Troubleshooting" for the first time, subsequent readings can occur in any order. On subsequent readings, feel free pick and choose your favorite stories.

Different people learn in different ways. "Twenty Eight Tales of Troubleshooting" is written to give you a front row seat as the characters in these short stories make discoveries about troubleshooting, each discovery building on others. This enables you to learn not only the *facts* of the Universal Troubleshooting Process, but also the more difficult *why*. Methodologies are a dime a dozen — methodologies you believe in are priceless. That's the purpose of this book.

"Twenty Eight Tales of Troubleshooting" is designed to be an electronic book. As such it can be viewed on your computer in any PDF viewer, or it can be printed. If you view it on a PDF viewer, keep in mind that the page numbering in the table of contents and the page headers is not the same as the page numbering given by your PDF viewer. In the headers and contents, page 1 is the introduction to Part I, but the PDF viewer will list this as page 11, because it counted the cover and front matter that occurred before page 1. For any page number in the contents or a header, you find that page in the viewer by adding 10 to the page number in the contents or header.

If you choose to print this book, the form it takes depends on the kind of printer and stapler you have. Here at Troubleshooters.Com, when we print a book, we do so on a duplexing printer that prints on both sides of the paper. We have a mechanical advantage stapler using 13/16 inch staples that can bind the entire book, plus 110 pound card stock covers. Depending on your printer and stapler, you might decide to bind each story separately, or even split some of the longer stories ("Heather's Revenge", for instance). Large, heavy duty staplers are often available at consumer oriented print shops. For instance, my local FEDEX KINKO'S store has a 75 sheet stapler. *Unless you*

have a duplex printer and large stapler, you might be best off ordering the printed book at Troubleshooters.Com.

The Troubleshooters.Com Bookstore

You can find the Troubleshooters.Com bookstore at

<http://www.troubleshooters.com/bookstore>.

The Troubleshooters.Com bookstore is devoted to extending human performance, especially in the areas of troubleshooting and learning. Here is a list of the books we have so far:

Twenty Eight Tales of Troubleshooting: Twenty eight short stories of troubleshooting, some true, some fictional. Each story is crafted so you can learn right along with the main character. This is perhaps the easiest introduction to the Universal Troubleshooting Process, and is recommended for anyone interested in troubleshooting. Upon completion of this book, you'll understand and be able to use the Universal Troubleshooting Process. This book is available in both paper and electronic format.

Manager's Guide to Technical Troubleshooting: This is a manager's overview of the Universal Troubleshooting Process. It starts with a thorough and logical explanation of the *why* of the Universal Troubleshooting Process, then an overview of troubleshooting principles, followed by a complete but simple treatment of the Universal Troubleshooting Process. The final chapter is "Implementing the UTP in Your Organization". This book is especially recommended for managers of technical people, but is also valuable to technologists as a gentle introduction to troubleshooting and the Universal Troubleshooting Process. If you're a manager deciding what training to give your team, this book is a must. If you're a technologist who sees sub-par troubleshooting throughout the department, recommend this book to your manager.

Troubleshooting Techniques of the Successful Technologist:

This is a complete and rigorous treatment of the Universal Troubleshooting Process. It contains almost everything I learned about troubleshooting between 1979 and 2000. The person reading and understanding this book will find himself a *troubleshooting Ninja*, with most of the knowledge derived from taking my troubleshooting course, and then some. This book is a dry and difficult. It

is recommended for *motivated people only!*. I recommend starting with either “Twenty Eight Tales of Troubleshooting” or “Manager’s Guide to Technical Troubleshooting”, and then if you’re interested in learning more, moving on to “Troubleshooting Techniques of the Successful Technologist”.

Rapid Learning: Secret Weapon of the Successful Technologist:

It’s not so easy being a technologist these days, is it? Outsourcing, offshoring, rapid obsolescence, voluminous requirements for even the most mundane of technical jobs. In today’s economy, you must learn new technologies in days or weeks. This book teaches you to do just that. It also contains some tips and tricks for getting jobs, so you needn’t work low tech all day and study high tech all night. If you’re frustrated with your career, or it seems like people with half your ability and drive get all the best jobs and promotions, get this book. *BEWARE*: This book is based on a very cynical view of the job market, and details many controversial “no more Mr. Nice Guy” job-getting techniques. *We DO NOT recommend employers purchase this book for their employees!*

Acknowledgements

Thanks to my wife, Sylvia Litt, who has encouraged me and accommodated my strange schedules and habits for fifteen years. Ditto to our kids. Thanks to Sylvia’s whole family for helping out with the kids all these years.

Thanks to my parents for teaching me the value of education and hard work. Thanks to my many friends and teachers for teaching me technology.

A special thanks to my father, Walter Litt. Upon reading an early draft of the book, he said that I write like O. Henry. I’ve had a lot of compliments on my writing throughout the years, but that’s by far the best. Thanks Dad!

About the Author

Steve Litt is the creator of the Universal Troubleshooting Process, used in organizations large and small throughout America. His work as an electronic technician and software developer enabled him to refine his troubleshooting techniques for maximum efficiency. His work as a troubleshooting trainer pro-

vided the opportunity to enhance the understandability of the Universal Troubleshooting Process.

Steve is the author of “Troubleshooting: Tools Tips and Techniques”, “Troubleshooting Techniques of the Successful Technologist”, “Rapid Learning: Secret Weapon of the Successful Technologist”, and “The Manager’s Guide to Technical Troubleshooting”. He is also the webmaster and content creator of the Troubleshooters.Com website.

Steve Litt is well known in the world of GNU/Linux and free software. He was a contributing author to “Red Hat Linux 6 Unleashed”, “Linux Unleashed”, and Red Hat Linux 7 Unleashed. He is the main author of the critically acclaimed “Samba Unleashed”, which is still in print six years after its introduction.

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Part I

Discovery

The easiest way to learn is from the mistakes and discoveries of others. In Part I, you'll learn right along with the characters. You'll also gain insight into how this book's author learned troubleshooting in the school of hard knocks.

The stories in Part I form a basis for the terminology and concepts used in the rest of the book. It's absolutely essential that you read the stories in Part I, in order, before reading the rest of the book.

Heather's Revenge

Author's Note

They say one picture is worth a thousand words. As you read this story, picture a talented and pretty middle aged woman, forced by desperate circumstances to discover, learn, and really understand the process of troubleshooting.

If you were in Heather's shoes, would you observe the same things? Would you draw the same conclusions? Were there other troubleshooting techniques Heather needed to learn, and if so, how could she have learned them? After finishing this story, ask yourself whether you have a better understanding of troubleshooting.

This story is fictional. Any resemblance between its characters and real people, alive or dead, is purely coincidental. Any resemblance between organizations portrayed in this story and real organizations is once again, coincidental.

"Let's all congratulate our June employee of the month", squawked the company intercom, "Heather Woodruff".

At her desk, Heather smiled. Things were finally getting better. She was an up and coming manager in Physician's Financial Accounting Solutions, Inc, better known as *PFAS*, purveyors of everything from Medicare billing to tax shelters for wealthy doctors. Heather chuckled at the phrase "up and coming", which is more often applied to someone 22 years old rather than 32. But here she was, a 32 year old single mom, climbing the corporate ladder. Heather's mind wandered back through her life.

Heather had been smart since first grade, culminating in a 3.8 high school grade average. In a just world she'd have gone to a top-notch college, but as one of seven children of a plumber, the money wasn't there. Several decades ago scholastic performance like hers would have been rewarded with a full scholarship to a fine college, but by Heather's time merit scholarships were rare. On paper her father made enough to put her through school, always assuming the family ate beans and oatmeal for every meal. Heather wasn't in any minority groups that interested either the government or private endowments. So she started working her way through community college.

Young, cute, and happy, Heather had no problem finding jobs serving tables, eventually working her way up to an exclusive eatery, called Barteloni's, where typical tips were in five dollar multiples. It was at that job where she first learned of age discrimination. There wasn't one female server over 30, despite a steady stream of applicants in that category. That wasn't Heather's problem — she just had to get through college, and her current income could finance a degree within 5 or 6 years.

Life was good, and it got even better the when she met Jake. Six feet four, lean and muscular, with a chisled face softened by a humorous smile, he sat in the restaurant with three business associates.

"Hi, I'm Heather, and I'll be your server this evening", she said in her sweetest voice, flashing a 500 watt smile and beaming a sparkle out of her eyes. At the meal's conclusion, Jake tipped her a fifty dollar bill wrapped in his business card, which proclaimed him as "Jake Turlington, Jackson, Goldstein & Brubaker". Jackson, Goldstein & Brubaker was a huge corporate law firm whose attorneys frequented her restaurant. Within a month she and Jake were dating, within a year they were married.

Heather left school to work full time helping Jake buy their dream home, a million dollar colonial in a fashionable suburb. Jake told her not to mention her job to his co-workers. Had she been older and more experienced, that would have rung an alarm.

She was 21 and Jake was 27 on their wedding day. Heather had found the man of her dreams — cute, handsome, successful, with a six figure future. Heather didn't know it, but what Jake had found was a prop to help him achieve partnership in the firm — a good looking wife whose intelligence showed after ten minutes of conversation. She made the proper impressions, Jake showed the proper combination of legal acumen and "business development" (salesmanship), and was inducted as a partner four years later. Jake's salary was now \$200,000 per year plus bonus. His first partnership year's bonus was \$150,000. Heather became pregnant. She and Jake now had financial security. What she didn't know was that Jake had taken everything he needed from Heather, and was now looking for greener pastures.

Two things happened to Heather at the age of 26: Her son Seth was born, and Jake left her. In her sixth month of pregnancy, Heather answered the door and was served with divorce papers. Jake's shark of a lawyer ran circles around her. Jake got the house, most of the money, and the newer car. He did

this by aggressively pursuing sole custody of their future son on the grounds that Heather was a shrill, big spending woman, and would be a neglectful mother.

He claimed *she* demanded a house they couldn't afford, and a new BMW to drive. *She* was the reason they were heavily in debt. *Her* spending habits would cause neglect of their baby's care and education. He accused her of being violent and temperamental.

It was nonsense, but it was nonsense used effectively as a huge club. She gave up everything to get Jake out of hers and her baby's lives. She ended up with thirty thousand dollars and the Buick Jake was driving the day they met. Jake ended up with the house, the BMW, and \$800,000 in debt, which of course he could pay off in five years if he were at all frugal.

Just before her baby was born, Heather went to court and changed her name back to her maiden name, Woodruff. She didn't want her baby saddled with the last name of a man who would cynically use him as a bargaining chip. When the baby came, she named him Seth.

A year after Seth was born, her money almost gone, Heather tried to get her old job back, but pregnancy had not been nice to her figure. The restaurant wanted cute and skinny. They wanted girls who would attract the successful male customers. You know, like Jake. She applied to all sorts of fine restaurants and was turned down at every one. Nobody said it was because she was "chunky", but one look at the difference between their servers and Heather made it clear.

Desperate, Heather got a job as a Data Entry Specialist at Physician's Financial Accounting Solutions, Inc. She was a data entry clerk making eight dollars an hour. She worked faster and more accurately than others, and showed up to work on time and sober. Within a year she was promoted to supervisor. A year after that she was promoted to manager.

Although still making less money than she had as a twenty year old waitress, Heather had found her calling. She was a good manager, motivating her flock to superior productivity and accuracy. She smiled at her crew, greeted them by name, asked in a friendly and interested way how they were doing, led by example, and spurred them on.

This isn't to say she couldn't be tough when needed. One day Derek, one of her better workers, walked in her office and announced that he'd received a job offer elsewhere for two dollars an hour more. Heather listened, thought for a moment, wished Derek the best of luck on his new job, and with Derek still in the office, phoned a temp agency to get a replacement

for Derek starting the next morning.

Derek turned white as a sheet. “Wait”, he said, “I didn’t say I accepted the job. I like it here, I like working for you, I just need a little more money”.

Heather smiled her friendliest smile. “Derek, that’s why I’m replacing you. I can’t pay you one cent more. You’re getting the maximum you can get at this company for the job you’re doing.”

“Would you consider giving me a little more at my next performance review?”, he begged, voice cracking.

“I might, if you show such exemplary work that I can justify it.”

“That’s all I want.”

Heather jumped on it. “OK then Derek, you’ll continue at your current salary and say nothing more about other jobs. The little bluff you tried to pull today will remain our little secret and will not appear in your personnel file. In turn you will start, today, performing exemplary work. If, by your next performance review, which is in eight months, you have continuously performed in a spectacular manner, I will recommend you for a raise, or perhaps even a promotion. Now please get back to work.”

Constantly encouraged by Heather, Derek indeed performed spectacularly, even filling in for his supervisor during breaks and illnesses. Eight months later Heather saw to it that Derek was promoted to supervisor, together with a four dollar an hour increase. Heather was one of those managers inspiring devotion amongst her troops, performance out of her department, and a nod of admiration from her bosses.

Heather loved her job. It would have been perfect if it had paid more. Perhaps with time and promotions, that too, would take care of itself. The only trouble is, Heather needed a new car. Her old Buick gave her continual problems. Perhaps she could find cheaper child care for Seth and get a low interest loan on an inexpensive car. Well, never mind, today was Heather’s day, she was employee of the month, and everything was rosy.

1 Year Later

“I’m sorry Heather, but we need to let you go”, apologized Mary McGuire, the Human Resources Manager. Mary was a pretty woman with a wide, open face. Mary was always supportive. She’d given Heather many tips along the way, and had even guided Heather in firing Geoffery Goddard, a truly recalcitrant

employee. The past few weeks Heather had seen Mary use the exact same techniques on her.

“Could you please give me one more chance?”, asked Heather. Heck, she didn’t ask, she begged. “I’ll take care of my transportation problems this week.” Heather used every ounce of willpower not to cry. She would not cry. The past six years she had been subjected to indignity upon indignity, but she would not cry.

“I’m sorry Heather, but reliability is our most important criteria in a manager, and lately, admittedly through no fault of your own, there have been many days you didn’t show up for work. I’ll have Jonathan show you out.”

Jonathan was a fifty something security guard. He came in, escorted Heather out, and that’s how Heather joined the unemployed masses.

Driving home, Heather fumed. The fault could be laid at one man’s feet, John Wintekeller. John Wintekeller owned Wintekeller’s Automotive Repair, a couple blocks from Heather’s apartment. She’d brought the Buick to John a month ago, when the temperature gauge began climbing close to the red. She left it there that day and picked it up a couple nights later. Wintekeller had charged her \$212.50 to replace the water pump, keeping the car for 2 days, during which her next door neighbor had driven her to work, after sufficient pleading.

The first five miles on the drive home made it was obvious that the problem was unchanged. She drove it right back but the shop was closed. Because she’d taken the time to drive back, she was late to pick up Seth at his after school childcare facility. The childcare administrator bluntly told Heather that she could not be late again.

The next day she left work early to get the car back to Wintekeller’s. Her boss was none too pleased that she left early, but she had no choice — the temperature gauge had gone in the red, and when she parked the car she could hear boiling and steam came out the hood. She left the car and managed to get John Wintekeller’s son to drive her home.

That night Heather contemplated calling in sick the next day and buying a new car. That way she could have reliable transportation. Trouble was, between doctor visit co-payments for Seth, childcare for Seth, food and rent, paying a car payment and comprehensive insurance on a new car would have left her running in the red.

This was a clearly untenable situation. Cars don’t last forever. Sooner or later Heather would need a new car, and that required a higher salary. Heather decided to look for another

job. She had a proven managerial track record at PFAS, and certainly could get at least 10% more elsewhere, quickly. She would repair the car now, get a better paying job within the next few weeks, and then buy a new car.

The next day Heather spent \$28.00 plus tip getting to work in a cab. She spent much of her work day lining up transportation and begging John Wintekeller to tell her what was wrong and when it could be fixed. It was noticed.

Wintekeller ended up keeping the car four days, two of which she was late to work. The bill was \$318.00 for a new radiator. Within 10 minutes the problem reappeared, but the Wintekeller Automotive Repair had already closed. Driving to work the next morning, the car overheated and stalled. Forty minutes late she managed to get it started again, but it ran very rough and spewed white smoke out the exhaust.

She managed to nurse the car into work, but arrived an hour late. The first thing she did was call Wintekeller, who assured her that “a little temperature fluctuation is normal”. That afternoon Mary McGuire called Heather into her office, discussed punctuality with Heather, and required Heather to sign a paper detailing the contents of the discussion. Heather had given Geoffrey Goddard a similar paper to sign a month before she fired him.

Heather had the car towed in to Wintekeller at 5:30am the next day, left it there, rode Seth to school on the back of her bicycle, and took the bus to work. That night she picked up the car after Wintekeller charged her \$52.50 to change the thermostat. The car overheated in 10 minutes: Heather parked it and took the bus to Seth’s after school care facility, where she was told that because she had been late so often, they could no longer care for Seth.

Heather called in sick the next day in order to get other childcare for Seth, and also to deal with Wintekeller. It took her a couple hours to rent a car. By the end of the day she had a childcare service who would pick Seth up from school, and had the car towed once again into Wintekeller. When she called Wintekeller at lunch time, he explained that she had a broken head gasket, and the cost of repair would be \$2500.00. She told him to leave it alone, and called several other garages, as well as using the Internet, to find possible cheap used cars to buy. She lacked the cash to keep the rental more than a couple more days.

She left work early to pick up the car, and have it towed back to her apartment. The tow truck driver, whose name was James, seemed sympathetic, so on the ride home Heather asked

why this was happening. James said there could be a million reasons. After dropping off the car, the James looked in the hood after Heather turned on the engine.

“Look at this!”, James exclaimed. “The lower radiator hose is collapsing. That will cause overheating every time!”

“How much will that cost to fix?” asked Heather.

“About \$65.00. But now you have other problems. The overheating caused your head gasket to break”, he said, pointing to the clouds of white smoke coming out her exhaust. Fixing that will cost a couple thousand, and if you keep driving a car with a bad head gasket, the engine, starter and flywheel will deteriorate”.

Heather thanked James, paid him, gave him a \$20.00 tip she could ill afford, and took the rental to pick Seth from after school care. She was late and was warned.

Early the next morning she had the car towed to a different garage and asked them to replace the bottom radiator hose. Then she drove the rental into work, arriving 15 minutes late.

When she picked up the car that night, the mechanic berated her: “If you’d just shut down your engine immediately upon overheat, and if you’d then immediately had this repair done, you’d have a good car now. But because you drove it long and repeatedly in an overheated condition, you broke your head gasket, which is very expensive to fix. If you don’t fix it, your car won’t run right, and will die an early death. Until you repair the head gasket, you must check your coolant level several times a day, and you must change your oil often, like maybe every 500 miles. I’d recommend you have us fix the head gasket right now. We can fix it for \$2248.00.”

Heather explained she didn’t have the money, and would drive it as is, watching the coolant and changing the oil. She drove off, carefully watching the temperature. The car didn’t overheat. It never overheated again. The entire problem had been the \$65.00 lower radiator hose.

As she drove to return her rental car, Heather was fuming. Wintekeller’s incompetence had caused every one of these problems. If he’d noticed the collapsed hose on her first visit this would have been minor, inexpensive, and she wouldn’t have been in trouble at work. This smug creep made his living by guessing, and then charging customers for his bad guesses. It was inexcusable. Heather swore revenge on Wintekeller. She’d report him to the Better Business Bureau tomorrow, and that was just a start.

But the next day brought bigger fish to fry. Heather was fired.

Four Years After That

Heather dreaded the checkout line. Cashiers gave her “the look”. So did customers behind her. If you ever want to see revulsion on people’s faces, just pay for your family’s food with food stamps. She’d long ago learned to avoid their faces.

The last four years featured a quick slide down the ladder of success. She’d applied to eight medical management companies and thirty fine restaurants. The medical management companies wanted references, and PFAS would not give a good reference because they had blocked her unemployment by elaborating, in great detail, how she’d been fired for violating company policy. The fine restaurants wanted oh-so-cute thin girls in their early 20’s. Girls with smiles untouched by hardship. Not slightly overweight single mothers with too much worry and too little sleep.

Heather ended up waitressing in a cheap and rather empty family restaurant, making just over two hundred dollars per week, including tips.

Heather had approached the manager with some ideas to get and retain more patrons, but the manager was just there to do his job. Heather marvelled at the fact that if she were the manager, this restaurant could really be something. But she needed the money and this restaurant worked around her schedule with Seth. The manager did not question her saving gas and wear and tear on her car by riding her bicycle to work. Heather’s managerial days were long gone.

“Hey lady, hurry up, that’s my money you’re using to pay for your groceries!”. Snapping out of her reverie, Heather involuntarily turned toward the voice behind her in the checkout line. It was John Wintekeller.

“Lady, quit looking at me and hurry up and tear off your stupid food stamps, welfare queen! That’s my money you’re using to pay for your food. Hey, why don’t you give me some of your apples.” Wintekeller stared at her like he’d never seen her before. The man who wrecked her life, the man on whom she swore vengeance every day, didn’t even remember her. On the conveyor belt sat the necessities of his world — a six pack of premium beer and potato chips.

Heather’s eyes opened wide, and she considered assaulting Wintekeller, but in the end just got verbal. “No Mr. Wintekeller, you’re paying for your food with my money. I paid you six hundred dollars to fix my Buick, and you not only failed to fix it, but left it in a condition resulting in a broken head gasket. Your incompetence left me without transportation and got me fired. I’d

ask you for that six pack but I've got better things to spend my money on."

"Shut up and pay for your food", came a voice from behind Wintekeller. Looking, Heather saw a guy about 60 years old.

"Mind your own business, sir!", Heather replied.

"You women are all alike", sniped the old man. "You never take care of your car, you don't know how to describe what's wrong, and then when the repair isn't perfect, you blame the mechanic."

Wintekeller muttered "Amen Brother!", and they both laughed.

Heather picked up a can, and was about to throw it at Wintekeller, when the manager came forward and asked "Is everything OK here?"

"It will be OK as soon as you get the welfare queen checked out", laughed Wintekeller.

The manager sought a quick return to control. "Ma'am, why don't you step over to the next register and I'll check you out personally."

As Heather gathered her groceries and headed to the next line, and the cashier hustled to back out Heather's half complete order, the old guy said "women want something for nothing, and then blame you when it isn't perfect". Heather's stomach twisted slowly, and she fought back tears.

Wintekeller was quickly checked out, and Heather soon afterward. When she saw Wintekeller climb into a brand new, top of the line Lexus, tears of rage shone in her eyes. Putting her groceries in the trunk of her now barely running Buick, she heard a voice from behind. "He couldn't have screwed it up too bad lady, it's still running".

Heather whirled and faced him "What business is this of yours?" She smelled alcohol on his breath.

"I'll tell you what business", the old guy screamed. "It was a woman just like you who cost me my job, and later my wife. The woman complained to the service manager that I hadn't treated her well enough, and that I wanted to charge her too much, and that her engine didn't need rebuilding. She just couldn't accept that her engine was totally shot because she hadn't changed the oil in fifty thousand miles. But she was from an important family, so the service manager fired me on the spot. I applied at 20 other garages, but nobody wants a sixty one year old automotive technician. Two months later my wife left me. She said she didn't want to live with a bum."

The old man kept talking. "We had to sell the house to divide it. So now I live in a beat up little shack in a bad neighborhood, and for the first time in 20 years I have a mortgage. I'm too

young for medicare or social security, but too old to get hired. I'm sixty one years old and all alone, and now I'm a drunk. All because of one woman."

Heather's face softened. In its own way, it was amazing how the man's experiences mirrored her own. She explained, softly and calmly, what Wintekeller had done, and how, from the beginning, the problem was the bottom radiator hose. As she talked, the old man's face softened to parallel hers.

"That's not right", he muttered. "I'm sorry I butted in. Let me guess — you don't have money for a new car or for head gasket replacement".

"That's right", sighed Heather. "I don't suppose you could do the job for me cheap?" she added.

"A thousand is the least I could do it for. Without a lift and all the tools, working in my back yard, it's a three day job." The man looked at her hopefully, which was a pity, because Heather had only \$1600.00 in the bank, and \$1300.00 would be gone on food, medicine and rent before month's end.

"Sorry sir, I just don't have nearly that much money. Perhaps you can give me advice."

He smiled for the first time. "Well, of course I'm very busy, but yeah, I can give you some free advice. I'm Max Janssen"

Heather introduced herself and they shook hands.

Heather Fixes a Head Gasket

The next three weeks, Heather spent every bit of her free time in Max's back yard, fixing her car, with eleven year old Seth doing his homework or watching her work, when not at school. Lacking a car, Heather used her bicycle. When Seth went to and from school, he used a bicycle.

Max provided the tools, and lots of advice. He taught her to make a drawing of anything she disassembled, so she could put it back correctly. He explained that once she really knew this stuff the drawings would be unnecessary, but for now it would be the difference between a good car and a hopeless rustpile.

He taught her toolsmanship, explaining that tools must be quickly available, cared for, and never lost. He taught her to use a tool tray. Not remembering where tools should go, Heather labeled the drawers in Max's two huge tool cabinets. Max smiled and nodded his head.

Heather ate less so she could give some food and Gatorade to Max, who wasn't much better off financially than she was. Heather was hot, greasy, and filthy. She showered with hand

cleaner to get clean enough to go to the restaurant. It was the toughest time of her life. But she learned. And she gained confidence.

Three weeks later she turned the ignition key, and it started, but didn't run well. The car bucked and jerked.

"Darn", yelled Heather. "The problem's still there!"

"Slow down Heather", slurred Max. It was early afternoon and he'd already downed about 4 home-mixed Martinis. "Let me ask you a question".

"What", said Heather a little too sharply.

Max apparently didn't notice Heather's tone, because he continued without skipping a beat. "Tell me what causes a machine to malfunction".

"That's obvious. Something went wrong with the machine."

"So how do you fix it?"

"Well, you just do." Heather replied.

"Let's knock off for today", Max suggested. "In the meantime, think about those two questions".

Heather spent the rest of the day wondering what the crazy old coot was getting at.

Seth was hot and tired after spending the whole Saturday in Max's back yard. "Mom, can you turn down the thermostat, it's really hot in here!"

The thermostat was set at 74, so Heather set it to 68. She didn't like spending the extra money for electricity, but she wanted Seth comfortable.

"Mom, please turn down the thermostat, it's still boiling in here". It was a half hour later, and Seth still had the same complaint. What in the devil was wrong with the thermostat? Turning it all the way down to 50, she noticed the fan didn't come on.

She phoned the landlord, and asked him to fix it. The landlord, a very nice man named Terry Melbourne, guided Heather, over the phone, to the breaker box in the closet, and asked her to verify that the breaker marked "air conditioner" was flipped to the left. It wasn't — it was flipped to the right. He instructed her to flip it to the left, and when she did so, she heard the fan go on. "That should fix the problem", Terry said.

But it didn't. An hour later, the air conditioning went off. Heather checked the box, and once again, the air conditioner breaker had flipped to the right again. She called Terry, a little bit irritated.

"Hang on, I'll be there in a few minutes.", said Terry. True to his word, he arrived 20 minutes later with a bright flashlight, a multimeter, and some tools. Turning on his flashlight, he

flipped every breaker to the right except the air conditioning breaker, and then took Heather on a tour of the house.

“Look for anything on. Any light, any sound, let me know.”, he said.

They didn’t have to look long. On the living room desk, Heather’s computer lit the room brightly. Yesterday Heather had moved the computer to the living room after rearranging the apartment. Terry uttered a vile oath, and then apologized.

“Some fool electrician wired this place wrong”, Terry said. “Your air conditioner is supposed to be on its own circuit breaker, but somebody wired this socket, you know, the one your computer’s plugged into, into the air conditioner circuit breaker. For now, find another outlet for your computer. In the next week or so I’ll have someone wire this correctly. Don’t worry, there’s no danger, it’s just an inconvenience that I’ll have fixed as soon as possible”.

An hour later Terry called her, explaining that his records showed that Janblowski Electric had installed that outlet two years ago. He’d get them to fix the problem, no charge, tomorrow.

Heather went to bed, but she couldn’t sleep.

She had assumed the problem was the thermostat, but in fact it was the breaker. No setting of the thermostat could get the air conditioner to turn on, but as soon as she flipped the breaker, the air conditioner worked. She had guessed at the wrong cause.

Hey, just like Wintekeller had wrongly guessed it was the water pump, and then the radiator. Maybe she was as incompetent as Wintekeller. That put a new spin on things. Except that she was not an air condition repairman, but Wintekeller was a car repairman.

But it wasn’t really the breaker, was it. The breaker was flipping only because her computer was on the same breaker as the air conditioning, overloading the circuit. The circuit breaker was doing what it’s supposed to, flipping on excess current.

Terry had fixed the problem by moving her computer. But, she really wanted her computer where she had put it. Terry had fixed the symptom, but his solution was a great inconvenience. Luckily, within a week he’d have it fixed the right way.

Heather finally fell asleep and dreamed of a stack of boxes. On awaking, all she could remember was some sort of stack. She thought of this while she and Seth biked to his school, and then as she rode back. At home again, getting dressed for her waitress job, she suddenly grabbed a pen and paper and drew

a stack of boxes. Staring at it for several minutes, she finally wrote in the boxes:

The air conditioner didn't work because the circuit breaker was flipped.
The circuit breaker was flipped because the computer drew extra current through it.
The computer drew extra current through it because the computer outlet was wired to the Air Conditioner circuit breaker.
The computer outlet was wired to the air conditioner circuit breaker because Janblowski Electric messed up when wiring it.

The air conditioner failed because Janblowski Electric had messed up. But the failure went through a chain of causes.

Heather Gets a Lesson

It was dark by the time Heather's restaurant shift ended, so she couldn't work on the car. She called Max nonetheless:

"Hi Max, it's me, Heather. **I know why a machine malfunctions. It malfunctions because a person made a mistake. And you fix it by undoing that mistake.**"

"Interesting Heather. How did you come to those conclusions?"

Heather told the entire air conditioner story, from the moment Seth asked her to turn down the thermostat until the time Terry told her about Janblowski Electric. There was silence on Max's end, and then he spoke.

"Interesting Heather. Tell me this. What if the circuit breaker blew and kept blowing because a rat ate through the insulation on the wiring, shorting it? Would that be a person making a mistake?"

"Well Max, I guess the human error would be allowing rats in the building, and you'd fix it by getting rid of the rats."

"Would getting rid of the rats cause the wires to grow new insulation?"

"Of course not. **Part of undoing the human mistake is undoing the damage it caused. I guess just like there can be a chain of causes, there can be a chain of damage.**"

"Do you have a diary, Heather?"

That was an awfully personal question. Yes, Heather had kept a diary since she was 14, and every couple years she still wrote in it, but she'd not told anyone, not even Jake or Seth.

“Why do you ask that, Max?”

“Because I want you to write down that last answer, and remember it forever”.

“OK Max, I’ll write it down on my computer, in a file where it will never get lost. *Part of undoing the human mistake is undoing the damage it caused. I guess just like there can be a chain of causes, there can be a chain of damage.* I guess I answered your questions, right Max?”

“In a way you were right, Heather, but not in a very practical way. Do you really need to fix the human mistake to get the machine running? Wouldn’t fixing the wiring fix the air conditioner, regardless of whether you knew Janblowski did it or not?”

“Yes, but if you neglect the human cause, the problem will just happen again.”

“Very good Heather! Write that down too. But let me ask you this: Isn’t your first duty to fix the machine, and then later prevent future occurrence?”

“Yes, I guess so, but what are you driving at?”

“Heather, you mentioned a chain of causes, and at some point the chain transitions to human error, whether such human error is obvious like Janblowski Electric, or much more subtle. Would you agree that to fix the machine, you need only follow the chain to the last technical link?”

“Sure Max, if you don’t care about preventing future occurrence.”

“Exactly. You fix the machine with the last technical link, and then if possible prevent future occurrence by tracing the cause chain through human error. But remember, nobody pays a car mechanic to prevent future occurrence. They pay for a fix, and they want it as cheap as possible. Sometimes the human error is obvious, like the lady who failed to change her oil for fifty thousand miles. But sometimes it’s subtle. What was your error taking care of your car? You maintained it. Your only error was bringing it to Wintekeller. In summary, you first fix the problem by correcting the last technical link on the chain, and then if possible prevent future occurrence by tracing the human cause chain. By the way, there’s a name for the last technical link on the chain — it’s called the *root cause*. Remember that. Another thing. Remember the ‘chain of damages’ you described? That’s called ‘consequential damage’.”

“Max, you’re a genius. I simply find the root cause, fix it, fix any consequential damage, and I’m done. If Wintekeller had spent any time trying to find the root cause, I’d have a perfectly running car today!”

“That’s true Heather, but let me leave you with this one question: How do you find the root cause? See you tomorrow Heather.”

“Bye Max.”

Terry's Explanation

Heather hung up the phone and dialed Terry. “Hi Terry, thanks for fixing my air conditioner.”

“Da nada!”, laughed Terry.

“Terry, could you please tell me how you figured out the root cause of the problem?”

“Heather, you saw exactly how I figured it out. I turned off all the other breakers, saw what remained on, and unplugged it.”

“But how did you know to do that?”

“Do you want to become an air conditioning mechanic Heather?”

“No, but maybe a car mechanic.”, said Heather, for the first time voicing an ambition that had slowly crept into her life.

“I can see the relation with a car’s air conditioner, but what does your apartment’s air conditioner have to do with a car’s engine, brakes, or transmission?”

“Well”, said Heather, “doesn’t a car mechanic need to find the root cause to fix a car?”

“Yes”, Terry replied cautiously.

“That’s just it Terry, I don’t know how to find the root cause and you do.”

“But Heather, it’s different every time. It depends on the machine, on the surroundings, on the problem.”

“OK Terry, but you must have gone through some mental process to figure it out.”

“Not really. When an air conditioner repeatedly flips the circuit breaker, you always look for other stuff on the same wire.” In spite of his protestations to the contrary, Terry was clearly beginning to get interested in where Heather was going with this.

“OK, but what if you just can’t find any other stuff?”

“Then the problem’s in the air conditioner, and you call an AC tech.”

Silence filled the phone line as Heather tried to put that information in a place where it would fit. “In other words,” she said slowly, “you looked for other stuff on that circuit breaker to see whether the problem was in the air conditioner itself.”

“Exactly Heather! The breaker is flipping. Logically, the

breaker can be flipped for only four reasons:

1. The air conditioner's bad
2. Something else is connected to the air conditioner's circuit breaker
3. The wiring in the wall is bad
4. The circuit breaker itself is bad"

Terry continued. "By far the easiest thing to test for is other appliances connected to the same breaker. That's a five minute test that doesn't even require a screwdriver. So I did that. Otherwise, I'd have called in an air conditioning tech."

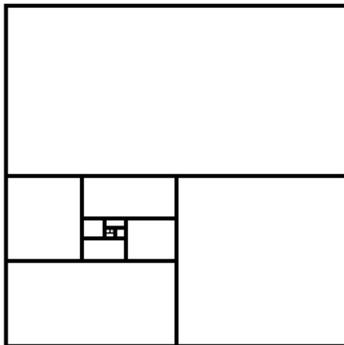
"So what you did, Terry..." Heather paused to assemble her thoughts. "What you did is figure out all the alternatives, and then perform a test to choose between them."

"I guess you could say that." said Terry.

As she helped Seth with his homework, Heather went over it in her mind. Finding the root cause is a matter of choosing between alternatives using technical tests.

As Heather slept that night, she dreamed she was a mechanic fixing a really difficult problem in a car's power steering. Recurring through the dream was a design. For some reason she knew that design was vitally important. Within the dream, Heather willed herself awake, went to her desk, and with the dream fading, sketched the design. She then went back to sleep.

Fixing Seth's breakfast the next morning she saw her sketch. She wondered why she had thought it so important. It looked like this:



Heather folded it, put it in her pocket, and rushed to cycle Seth to school and then get to Max's house. She was anxious to tell Max what she'd discovered.

What Max Had to Say

“Max, you find the root cause by choosing between alternatives, using tests.”, Heather gushed. She went on to tell the story of Terry’s finding the root cause last night.

“Very good Heather.”, replied Max. “But how do you find all the alternatives? If you count every nut and bolt, a car has tens of thousands of parts. You can’t even count the alternatives, let alone choose between them!”

“Well Max, Terry didn’t deal with nuts and bolts. His alternatives were: The *air conditioner*, *something connected to the air conditioner’s circuit*, the *wiring in the wall*, or the *circuit breaker*.”

“Fair enough Heather, but let’s say the problem was in the air conditioner itself, and you had to fix it. What then?”

Heather pondered for a moment, then spoke slowly. “I guess I’d need to choose between alternatives in the air conditioner — what — the compressor or the electronics?”

“Well yeah, plus the outside unit, the pipes between them, and the freon itself.” Max replied.

Heather was on a roll. “And if it were in the outside unit, is the problem that the fan’s not spinning, or the heat transfer part doesn’t transfer, or...”

A broad smile of wonder spread across Heather’s face. “Oh my gosh, I understand!”

“What do you understand, Heather?”

Heather brought last night’s drawing out of her pocket and gave it to Max. “I dreamed of this design last night. Does it mean anything to you?”

Now Max was the one to smile. “By George, I think she’s got it!”

They spent the next couple hours discussing repeatedly testing among alternatives. Max said that this process was called “divide and conquer” by some, and “half splitting” by others. Ideally, half-splitting rules out half the system as a container for the root cause, then ruling out half the remainder, then half that remainder, on and on until the root cause is found. In reality, the splits wouldn’t necessarily be exactly half.

The sun was red in the west — it was time for Heather to go. As Heather walked out the door, Max asked one last question. “Heather, when do you start half splitting?”

Heather looked like he’d asked who was buried in Grant’s tomb. “The instant you begin the repair.”, she said incredulously.

“Not true”, smiled Max. “Think about it and we’ll talk to-

morrow.”

The Riot at the Restaurant

Riding her bicycle, Heather picked up Seth and they biked to the restaurant. Her paycheck was minuscule but the restaurant allowed Seth to use a table for his homework. That was one benefit of having few customers.

Heather knew there was a problem before walking in the door. The cook and a waitress were outside, smoking and cursing. The waitress was crying. Not wanting Seth to hear, she ushered him inside.

A customer was screaming bloody murder, with the manager trying hopelessly to placate him. The customer was asking for the owner’s home phone number, which the manager refused to give out. The manager, who was about 25, was clearly incompetent to handle this. Heather listened long enough to hear that the customer’s problem was that his steak was too rare, and apparently the manager refused to serve him another steak because the customer had eaten more than one bite of the steak. Apparently he had been very hungry and hadn’t noticed at first.

Heather walked to the customer’s table quickly and purposefully. “Sir, we’d be glad to cook you another steak, and tonight’s meal will be entirely on the house. We’re very sorry your steak was cooked wrong.”

“That will come out of your paycheck!” screamed the manager. “This freeloader was...”

Heather quickly turned to the manager and gave him “the look”. Every parent knows “the look”. It tells the other person that they better behave, or else be ready to take the consequences. Still facing the manager, Heather spoke softly and tonelessly, like an ominous voice from a crypt: “If you have a problem with what just happened, Sean, let’s take it in the back room where we’re not disturbing this customer!”

Once in the back of the kitchen, Heather made it quick. “I saved your job back there, you foolish little boy. That guy could have called the owner, or the Better Business Bureau, or given the fact that his meat was undercooked, the Health Department. How do you think the owner would have liked that?”

Heather continued: “I’d like to chew you out more, but I need to get the cook in here to cook a new steak for this guy, and to cook whatever table 3 and table 5 need.”

Heather walked out of the kitchen, smiled and introduced

herself to the aggravated customer. "Hi, I'm Heather, and for the rest of your meal, which as you know is free, I'll be your server. If there's anything you need, please let me know. I'm going outside to get the cook back from break, and I'll be right back."

The customer's anger fell from his face like overheated wax, replaced by a look of surprise, perhaps mixed with pleasure. Heather went out the door.

Outside the restaurant, Heather smiled at the cook, and spoke in a cheery yet reassuring voice. "Ben, the problem's been solved. Could you please get back and start cooking?"

"Get out of my face, Heather!", replied the cook. "I won't cook for that guy. I won't cook for anyone until that guy's left the restaurant!"

"Ben, if you're not back in there in two minutes, I'm firing you! I'll cook the food myself for the rest of the night, and hire another cook than you tomorrow."

"You can't fire anyone, Heather! You're just a crummy little waitress."

At that point the other waitress gave Ben a look of absolute hate, and then burst out crying.

Heather comforted the other waitress. "He didn't mean it like that Shelley. Listen — I'll handle the irate customer, and you take one of my tables. Just please, get back in before the owner hears about all this."

Shelley silently nodded and went back in. Heather turned to Ben, said "You have one minute left.", strode the restaurant and into the kitchen, and began rummaging around the refrigerator for a steak.

A few seconds later the cook came in. "You can't fire me, Heather. I'm working here whether you like it or not!"

"Thanks Ben", Heather replied in the most neutral voice she could muster.

Heather rushed out to the customer, asking him exactly what he'd like. All he wanted was the same kind of steak, but medium well instead of the pink steak he'd been given. Heather delivered the order to Ben, repeating that it must be medium well, with absolutely no pink. Ben scowled, but began cooking the steak.

Heather went out, told the customer the food was being cooked, and asked him if he'd like to tell her what went wrong so she could prevent such problems in the future.

The customer's story was pretty simple — the steak had been pink inside, but he was so hungry he hadn't noticed until about a quarter of it was eaten. He admitted he got a little

rude while asking the waitress to re-cook the steak, and then the manager had gotten rude with him, and things got out of hand.

“Did the waitress ask you how you wanted your steak?”, Heather asked.

“No.”

“I guess she assumed you wanted it rare.” What Heather really wanted to do was find out whether the customer had asked for it medium well, and if so where that information had gotten lost or ignored. But she wanted to ask this in the least accusing manner possible, so she made it seem like the waitress made an assumption.

“I guess so.” said the customer.

“Did you tell her how you wanted it cooked?”

“No, but that’s no excuse to serve it pink inside.”

“Of course not.”, replied Heather. “From now on we’ll be instituting a policy where the server will ask how you want your meat cooked, and the cook will not proceed without that information. I want to thank you for showing us this flaw in our service, and as I mentioned, there will be no charge for this meal. Thank you, Mr..”

“Carter. Sheldon Carter. And thank you Miss...”

Heather realized that she hadn’t had a chance to put on her name tag. “My name is Heather Woodruff, Mr. Carter. As I mentioned, anything you need, just ask.”

Heather looked over at Seth, and saw him staring back, almost worshipfully. Heather had just defused a problem that could have gotten them all fired.

Mr. Carter gave Heather a thirty dollar tip for some steak and eggs, gave her his card, and said his business needed people like her. Heather assured him she’d be in touch.

After closing, Heather called everyone together. In front of her was a row of resentful faces.

Putting on the cheeriest voice she could muster without sounding condescending, Heather started. “From now on, we need the servers to ask customers how their meat should be cooked, and Ben, you should refuse to start cooking until you have that information. We need to make sure what happened tonight never happens again.”

Sean, the manager, was a 250 pound mixture of blubber, muscle and tattoos. He had greasy black hair falling over a dark complected face that was now turning bright red. He advanced threateningly. Heather stood her ground.

“You’re not the manager here, I am!” shouted Sean. “You don’t tell anyone anything — you just smile and wait tables.

You ever pull anything like this again and you're fired!"

Ben raised his fist and shouted "yeah".

Heather grabbed the cordless phone, gave it to Sean, and said "Call the owner."

"I'm not calling anyone!" growled Sean.

"You said you're going to fire me. Call the owner and tell him why you want to fire me. Tell him how I gave instructions to other employees, and gave the customer a free dinner. Tell him how you served raw meat to a customer, argued with the customer, let Ben walk out on his job, and tried to prevent me from fixing the situation. Call him. See who gets fired."

Heather stared at Sean, who stared back. Sean averted his eyes, and put the phone down. "Alright everyone, let's clean up", said Sean.

A half hour later Sean and Heather had a much more private discussion, where Heather apologized for demeaning Sean's authority, and Sean admitted that Heather's policy was a good one and her handling of the customer indeed saved the day. From that day forward Heather never again threatened Sean's authority — not even years later when Sean worked as a manager in Heather's company. From that day forward, Sean observed and listened to Heather, changing his management style for the better. Food and service got better, the restaurant got more traffic, Sean and Ben got raises, and the servers got more and better tips.

Cycling home, Heather and Seth discussed the night. Seth was in awe. Everyone's parents can boss their kid around, but he'd never seen a parent boss other adults around. Then Seth said something truly prophetic: "Mom, it's too bad you didn't get there earlier. If you had, they would have known how to cook the guy's steak."

Seth's words reverberated in Heather's mind: "it's too bad you didn't get there earlier". A connection was trying to form in her consciousness, but she just couldn't get it. The crisp October night air cooled their exertions.

The steady pedalling and whirring of the tires on the pavement lulled them both into a world of their own. "it's too bad you didn't get there earlier." Why should that phrase stick in Heather's head? Block after block they pedaled. Seth's statement played over and over in Heather's mind. Then an earlier phrase from the day played through her mind: "when do you start half splitting?"

"That's it!!!!" shouted Heather. Lights went on in a nearby house.

"That's what?" asked Seth.

As their bike wheels crunched the fallen leaves in the street, Heather explained to Seth about choosing alternatives through testing, about half-splitting, and about the question of when to begin half-splitting, and how **she now realized that you start half-splitting the moment you talk to the customer.** She figured he couldn't understand the concepts, but it was fun to vocalize her new discoveries.

Then Seth surprised her. **"What if they describe the problem wrong?"** Like the man in the restaurant. Even if he'd said he wanted it medium well, how would you know he means the same thing you mean? If a man says his car overheats, how would you know whether he means the gauge reads a little hot, or whether he means there's steam coming out of the hood?"

Heather was in awe. Yes, Seth had seen Heather's overheating car, but he was so young. And more to the point, he not only understood the concepts she was voicing, but actually asked questions to refine her thinking. Every day, Heather was becoming more convinced that Seth was a genius.

"Honey, I guess **I'd have to ask lots of questions to make sure what he said was what I thought.**", said Heather.

"And if you really want to be sure, you can watch the problem happen.", Seth replied.

"You're absolutely right Seth." Heather had marvel in her voice.

Late that night, when excitement overwhelmed sleep, Heather made a list of steps:

1. **Get the symptom description**
2. **Reproduce the symptom**
3. **Perform half steps**
4. **Replace the bad component**
5. **Prevent future occurrence**

"This", she thought, "is the key to troubleshooting." As it turned out, she was half right.

Heather's Pony

Heather woke up looking forward to showing Max what she'd learned. After dropping Seth off at school, Heather cranked her

bicycle full bore to Max's house. She showed Max the five steps of troubleshooting. Max smiled hugely.

"I've continually underestimated you, Heather. I'm sorry for that. Very few people recognize that troubleshooting is a process. How did you figure out steps 1 and 2?"

Heather related how the customer's dissatisfaction could have been prevented by the waitress asking how he wanted the steak cooked. She went on to explain how this related to getting the symptom description, and how half-splitting begins on first customer contact. She explained how Seth had suggested verification of the customer's story, and how she realized he was right.

Max got a distant look in his eye. "Heather, you really are one in a million. It's too bad you don't want to be a mechanic, because you'd be a great one. Now that we've covered the theory, how are you going to half-split your car's rough running?"

Heather didn't respond to Max's assertion that she didn't want to be a mechanic, because even though she wanted very much to be a mechanic, she didn't have the confidence to express this ambition. Instead she responded to the question about half-splitting.

"Max, let's start with alternatives. I think a bad head gasket could cause rough running. I suppose bad spark plugs or whatever feeds them could do it too. Maybe it's not getting enough gas or the gas mixture is wrong. I don't know if there are any more alternatives, or how to test to rule these alternatives in or out."

"It could also be timing, Heather. As far as ruling things out, you can get a \$40.00 'block tester' that tests for combustion gasses in the coolant. This, combined with looking for white steam out the exhaust and white or yellow residue on the oil cap can rule out the head gasket. You can partially rule out fuel by testing the fuel pressure, by plugging my pressure gauge into this little nipple right here." Max pointed to the nipple. "However, all the fuel pressure in the world won't help if your fuel injectors are clogged. As far as spark, you can remove each spark plug wire and see if it throws a spark, but you'll probably get an uncomfortable shock doing so, and that test tells only if there's a spark, but not the timing or quality of that spark. Where would you like to start?"

Heather contemplated. It seemed like the surest ruleout was the head gaskets, but ruling them out would cost \$40.00. Testing the spark plugs seemed somewhat dangerous, and yielded incomplete information. The fuel pressure test yielded incomplete information because it said nothing about the fuel injectors. Heather was about to go for the head gasket test when she

realized that the fuel pressure test could be completed safely and at no cost in 10 seconds.

“Let’s test the fuel pressure, Max.”

Guided by Max, Heather plugged in the tube to the pressure gauge. The fuel pressure was perfect.

Max spoke up. “Let me ask you a question. Look how dirty and greasy your spark plug wires are.” He shut the engine off and pulled a couple ignition wires, and using a mirror on a handle showed Heather that the spark plug looked old. “Heather, when’s the last time you got a tuneup for this car?”

“I have no idea?”, Heather responded.

“Typical woman! Within the last year?” asked Max.

“I doubt it very much.” replied Heather. Heather bristled at the “typical woman” quip, but decided to keep her mouth shut. Max had issues with women, and they were made worse by his dismissal from his last job. The training she was getting was worth having to work around his issues. Besides, she really liked Max, problems and all.

Max continued. “You need to keep this car, which means you really need to maintain it, which means a tuneup every year. If we do a tuneup right now, there’s a good chance it will fix your rough running. If not, at least we’ve ruled out several alternatives. You need to do the tuneup anyway, so why not do it early, so that if you’re lucky it will save you time and aggravation.”

Heather couldn’t argue with Max’s logic. They went to the auto parts store, and Heather spent close to a seventy hard-earned dollars on spark plugs, spark plug wires, air filter and a fuel filter. With Max guiding her, Heather completed the tuneup in two hours. Max showed her how to use a rod mounted mirror and special wrenches to make quick work of removing spark plugs obscured by the valve covers on the top, the manifolds on the bottom.

When all the adjustments and replacements were complete, Heather started the car. It ran smooth as silk.

“Get in the car Max, we’re going for a ride!” squealed Heather.

“I don’t want to get the seat dirty.”, said Max.

In the end they placed trash bags on the seats and went for a ride. The old Buick was quicker and more responsive than Heather ever remembered it. Starting from a stoplight, Heather floored it, and the 3.8 liter engine pushed the tires to leave 20 feet of squealing rubber on the street.

“You had your fun, but don’t do that any more.” warned Max. “Your engine might be perfect, but your transmission is old, so you need to baby it as long as possible, because getting a rebuilt transmission installed could cost you two grand, and

neither one of us is a good enough mechanic to do it ourselves.”

Heather never again laid rubber in her Buick, which she drove until she gave up driving at the age of 87. By that time its transmission had been replaced three times by transmission shops, and its engine had been rebuilt twice by Heather.

They drove and drove, laughing and congratulating themselves. They drove downtown and got out to take a walk. Heather did a cartwheel on the sidewalk, and Max clapped loudly. Across the street, Agnes Anderson, a librarian, thought how strange it was for this woman in her late thirties to be doing gymnastics on the sidewalk, with an old grizzled man, who must be her father, as a spectator.

That evening Heather picked up Seth in the Buick. “Yeah Mom, you did it” yelled Seth when he saw the Buick pull up. Heather wept tears of joy, and Seth soon followed.

Heather not only had a car, but she had a high powered, 30 miles per gallon on the highway pony that would go anywhere, and merge into any traffic.

Heather's Automotive Repair

A week later, Seth asked “Mom, can you start picking me up on the bicycle again? I like it better.”

Heather had similar thoughts. The past couple months she'd gotten used to not having to pay the high price of gasoline. Besides, she felt better after a day of riding, and she was losing weight. Maybe some day she'd be able to work at the fancy restaurant again.

NOT!

Heather didn't want to work in a restaurant. She didn't want to go back to Physicians Financial Accounting Solutions, Inc. Heather wanted her own automotive shop.

The next evening, Heather and Seth rang Max's doorbell. Max seemed genuinely pleased to see them. After an exchange of pleasantries, Heather said “Max, let's start our own auto shop.”

“We don't have the money!”

“We can do the work in your back yard”, countered Heather.

“Yes, we could do light repairs in my back yard”, agreed Max, “but I don't want the hassle of owning a business. If we do this, I'll be an employee and get paid like an employee.”

In the end they agreed that Max would get fifteen dollars an hour for every hour he worked, and Heather would pay Max \$582 per month for the use of his back yard. The \$582 was

Max's mortgage payment. And so it was that Heather's Automotive Repair was born.

That very day Heather made two phone calls: One to Mary McGuire, the human resources director at Physicians Financial Accounting Solutions, and the other to Sheldon Carter, the irate customer in the restaurant several months ago. In both cases, she invited them to Barteloni's, the fancy restaurant where she used to work. Heather budgeted three hundred hard earned dollars for these two meals. She got an appointment with Mary McGuire two days hence, and Sheldon Carter the day after that. Then she had business cards made from a printer promising one day service.

Heather went to sleep plotting the course of Heather's Automotive Repair.

A Meal with Mary

Mary McGuire showed up precisely on time, and Heather escorted her into Barteloni's. At the table they began with small talk.

"So how've you been, Heather?" We've all missed you.

Heather marvelled at the fact that only Mary McGuire could sound convincing saying that.

"Excellent, Mary" gushed Heather. "I've spent the past couple years in the hospitality industry while I trained in automotive repair."

Heather bit the inside of her mouth to keep from laughing at the malarkey she was slinging. It was important she deliver the next line effectively, which meant she couldn't laugh.

"And now, I'm starting a garage." said Heather lightheartedly.

Mary looked disappointed. "Oh. I was hoping you'd ask me for your old job back. I could almost guarantee you'd get it, always assuming you now have reliable transportation. People still comment on what a great manager you were. Heather, you're really special."

Heather was flabbergasted. After PFAS called her incompetent in her unemployment hearings, she figured there would be bad blood. It seems like there wasn't.

"Mary, I have the most reliable transportation you can imagine, because now I do my own repairs. I loved PFAS, and would love nothing better than to come back, but I've fallen on a real opportunity."

Heather took a quick breath and continued. "You remem-

ber the bind I was in because I entrusted my car to the wrong mechanic. That happens to a lot of women, and take it from me, it ruins lives. I was fired because a mechanic named John Wintekeller couldn't diagnose my simple overheating problem. After that experience I learned to fix my own car, and now I want to give top notch repair service to women. I won't intimidate women, and I will do a top notch job so they have the transportation they need."

"So do you want me to invest in your business?" asked Mary.

Heather couldn't tell whether Mary was pushing her away or really considering investment, so she didn't stress investment.

"Maybe later, Mary, but right now what I really need is customers. I'd like to give you several of my cards, and when you meet women needing car repair, send them my way. You can pass them out at church, at PFAS, at your kids' school functions, whatever."

"Of course I will.", said Mary, smiling.

For an instant, just an instant, Heather was threatened by Mary. Mary would never grace the inside of a pinup magazine, but she had smooth dark hair, a broad, feminine Irish face, and broad hips that kept her figure in proportion even after bearing her two children. For just an instant Heather was glad there were no attractive men around, because they'd surely go for Mary, and Heather didn't need any more problems with her confidence. Mary was too old and too heavy to be considered beautiful, and yet guys always turned around to look at her a second time.

Mentally, Heather slapped her forehead and told herself to get back on topic.

"Thanks so very much, Mary.", said Heather, handing a box of 250 cards to Mary. "Please spread them like the autumn leaves. You'll be doing your friends a favor."

The rest of lunch was small talk. Repeatedly Mary told Heather how impressed she was with Heather, especially now that Heather was starting her own business. Mary had always been a straight shooter, and Heather began to wonder if Mary was serious. They exchanged home phone numbers and left.

Sheldon: Close But No Cigar

The next day Heather took Sheldon Carter to lunch. It was almost a repeat of the day before. Sheldon had hoped Heather wanted to work for him. When he found out she was starting

the garage, he was disappointed she wouldn't work for him, but very impressed with her. She gave him a box of 250 cards and he promised to pass them out.

Just then the restaurant's owner approached. "Heather, it's so nice to see you again! Why don't you come back to work for us again. We always need servers, and you're as good as they get."

Heather told the owner that if she ever needed another server position, he'd be the first person she'd call, but right now she was starting Heather's Automotive Repair. She gave him a box of 250 cards to pass out.

While making small talk with Sheldon, Heather pondered this latest job offer. She was now 37 years old. There was no doubt that, had she accepted, she would have been the oldest female server in the restaurant's history. She knew she'd lost weight riding her bicycle and working on her car, and this morning she'd seen that she looked good in her dress, but this was amazing. And to think, yesterday she had felt threatened by Mary McGuire's beauty.

Then Heather pondered the fact that Mary, Sheldon, and the restaurant owner had each offered her a job in the past two days. Her confidence surged.

Sheldon asked a question out of the blue.

"How much business can you handle, Heather?"

Heather did a lightning quick calculation. "Three cars a day right now, but I expect that to increase dramatically. Why?"

Sheldon appeared lost in thought for a second, and then spoke. "My company, Sheldon Carter and Sons, is an electrical contractor. We have twelve trucks, and they always need maintenance, and all too often they need repair. We've used the same garage for eight years, but two years ago they were bought out, brought in a different crew, and, well, they're good, but not as good as they used to be. I'm looking around."

"What would it take to get your business, Mr. Carter?"

"Let me take a tour of your garage."

"OK Mr. Carter, let me pay the check and use the restroom. I'll be right back."

In the restroom, Heather used her cell phone to call Max and make sure he was sober (he was), make sure he had worked on light trucks before (he had), and told him to make himself presentable.

"My car or yours, Mr. Carter?"

They drove to Max's house in Heather's car, with Heather elaborating how she brought it back to life after another mechanic had totally screwed it up, and how in doing so she gained

a love for fixing cars.

At Max's house, Sheldon Carter told Heather the bad news. "Heather, you don't even have a lift. You repair cars outside where they can be rained on. I think you'll do an excellent job, but I don't think you're ready for my fleet just yet. When you get a real garage, please let me know."

Heather drove Mr. Carter back to the restaurant, all the while chatting about business. She gave him a couple ideas on motivating his electricians. On parting, they agreed to stay in touch.

Heather's First Customer

On the way home from Barteloni's, Heather's cell phone rang.

"Ms. Woodruff, this is Kathy Jackson. Mary McGuire said maybe you could help me. My car's overheating and I need it to get to work. Can you help?"

Heather heard the pain in Kathy's voice. "Kathy, please call me Heather. Are you able to drive the car without it overheating?"

"Not really."

"Do you have a roadside service plan? Can you have it towed here?"

Kathy sounded almost like she was about to cry. "Yes, but I really need the car tomorrow, Heather."

Heather wanted to reassure Kathy, but she needed to be truthful. "Kathy, nobody can promise you they can fix it by tonight. What I *can* promise you is I'll start on it the minute it gets here, and I'll work late into the night to fix it if I have all the necessary parts. And I also promise you I'll find the right cause right from the start."

Fifteen minutes later both Heather and Kathy showed up at Max's. The tow truck driver drove away.

Kathy had light brown hair. She seemed in her mid 50's, and looked like she'd once been beautiful enough to work at Barteloni's.

Heather, Max and Kathy stood by Kathy's car as Heather asked symptom questions. "OK Kathy, you say your car is overheating. Does the temperature gauge go all the way to the right, or is there some other way you know?"

Kathy looked glum. "Steam comes out of the hood, and I can hear it boiling."

"When did you first notice this?", chimed in Max.

"About 2 weeks ago.", Kathy replied.

“Did you check the water level?” Max asked.

“My husband did. He put more fluid in. Also the man at the corner garage filled it up after he replaced the water pump, but the problem was the same.”

Heather turned around so Kathy wouldn't see the rage in her face. What kind of monkey goes around replacing parts without knowing the root cause. Heather willed herself back into control and rejoined the conversation.

“Let's take it for a drive around the block.”, said Heather. Having gotten the symptom description, she now wanted to verify the symptom.

A couple loops around the block showed the temperature gauge rising near the red. Heather immediately drove back to Max's yard, watching the temperature gauge almost continuously. When she shut it off she heard a gurgling sound and saw a little steam rising from the hood.

With the engine still running, Heather opened the hood and felt the top radiator hose. It was hot and full of coolant. Kathy's thermostat was passing coolant.

Heather shut off the engine and waited 20 minutes for the engine to partially cool.

“Stand back, everyone!” Heather exclaimed as she used a heavy towel to undo the radiator cap. After a brief escape of steam, the radiator was open. Heather could see no water.

“Max, we need to find out if the coolant leaked out, or if the overheat blew it out.”

“I'll get my pressure tester, Heather”, said Max. Max had read Heather exactly right. She had no idea how to find out whether the coolant leaked out or steamed out, and her command was her way of asking Max how to determine that.

The pressure test showed a rather brisk leak. Max stuck his ear in the engine compartment, heard a hissing, and found it. A small crack in one of the heater hoses. He showed the leak to Kathy. He wrapped several turns of duct tape around the hose and pumped again. No other leaks appeared, although there was still a small amount of leakage under the duct tape.

“Kathy,” Max said, “you have a leak in your heater hose. Your heater hose is defective and needs replacement. That may or may not be the only thing causing your overheats, but the only way to find any other causes is to replace the heater hose.”

Kathy nodded.

Max continued. “Normally we'd need to wait until tomorrow for our parts guy to deliver the hose you need. But given the urgency of the situation, I can pick it up at a parts store. It will cost a little more, but there's a good chance you can get your

car back tomorrow. There's no chance otherwise."

Kathy stood there indecisive.

"I'll drive you to work tomorrow myself if this doesn't work." said Heather. Years later Heather would look back, marvelling at how easy it is to provide such personal services are when your business is tiny.

"Do you really think that will fix it?" asked Kathy.

Heather had heard questions like this before. Kathy wanted reassurance.

"Kathy, I can't answer that for sure. No reputable automotive repair facility could answer that for sure. What I can tell you is we'll do our best, we'll keep working on it, and if necessary I'll drive you to work tomorrow."

"OK", Kathy said.

Max removed the hose and drove to the parts store. A half hour later he came back with a new hose and three gallons of antifreeze. Heather replaced the hose with some subtle guidance from Max, then she mixed the antifreeze 50/50 with water and filled the cooling system. A pressure test showed no more leakage. They piled in the car and drove around the block. The temperature needle was rock steady. They drove on the highway. Rock steady. The overheat was fixed.

Max made a receipt on a piece of notebook paper. They charged Kathy \$125.00. The parts, antifreeze and tax came to \$35.00. Max got \$30.00 for two hours work. Heather's brand new company made \$60.00. As soon as Kathy drove away, Heather did several cartwheels and screamed for joy. Sixty two year old Max tried a cartwheel and almost made it. They laughed for joy — two people seeing the end to a long bout of poverty.

The next day Mary McGuire called Heather to thank her personally. Kathy, who was an excellent employee, had been one more absence away from termination due to her car. Mary would have hated to fire her. Mary promised to send more business. She made good on the promise.

The Attitude

Weeks went by. Business came in. Repairs were done well. Word got out. Heather and Max were knocking on the door of the middle class.

One day Heather was in a particularly bad mood following yet another screwup by an incompetent vendor. While performing a spark test on a car that intermittently lost power, Heather

got a high voltage shock. She uttered a particularly vile oath and threw her wrench on the ground.

“Heather, stop!” yelled Max. He ran over, getting between Heather and the car. “Heather, never troubleshoot when you’re mad. You’ll probably damage the car. Stop right now and walk away from it!”

That just got Heather madder. She paced, kicked the dirt, insulted the car, and told Max she was perfectly capable of controlling her emotions.

“Heather, take the rest of the day off. I can handle anything that comes in, including this car. I’ve been in this business forty years, Heather, and I can tell you you really need to take the day off. Relax, enjoy yourself.”

Heather looked at Max, wondering if he’d ever been a manager. A dispassionate part of her saw that he handled her angry outburst exactly how she would have handled one from an employee. Heather took Max’s advice and rode home on her bicycle.

The cold November wind felt good on her face, reminding her she was alive. Alive, and not doing too badly, all things considered. Feeling better, she considered going back to work, and then decided she was having too much fun.

Her home was only a mile from Max’s place, but Heather rode 25 miles that day. She rode and thought.

She thought about her frame of mind when she threw the wrench. She really didn’t care about the car. About safety. She was an accident ready to happen. Max was right, anger was the kiss of death when troubleshooting.

She stopped for a burger at a little restaurant. The waitress was a bundle of nerves, getting Heather’s orders wrong several times. The owner yelled at the waitress to pay attention, which just made the waitress more nervous. The owner yelled at the waitress to go faster, and she skittered across the floor serving customers ever faster, but making more and more mistakes. Delivering Heather’s hamburger, the waitress slipped on some water she had spilled earlier, fell backwards, and Heather’s hamburger flew up, hit the ceiling, and fell open faced on the waitress’ face. Heather pinched herself brutally to keep from laughing. Then, with the waitress still on the floor, the owner fired her. It wasn’t funny anymore.

Heather followed the waitress into the parking lot. “Would you like to talk about it?” asked Heather.

“I really needed that job.” replied the ex-waitress. “I have two children to feed, and my husband ran out on me. He never made a cent in his life, so I get no child support. What can I do?”

My poor children.”

Heather put her arms around the poor, skinny, scared woman. This woman couldn't work anywhere. She was a mess. Even at her lowest, Heather had never been this far down. But when the woman talked about a no good husband skipping out, leaving her to support the kids, Heather could relate.

“Is that why you're so nervous?” asked Heather.

“Wouldn't you be?”

“No, and I'll tell you why. You know what you got fired for in there? Nervousness. Plain and simple. You were so nervous you couldn't concentrate on your job.”

“But you saw my boss. Nothing's ever fast enough.”

“That's exactly why you needed to slow down. By speeding up, you brought the whole thing to a standstill. It's not your fault, your boss is a monster, but many bosses are monsters, and you just need to keep doing your job no matter how hard they make it to do your job.”

Now the woman was sobbing. This woman needed help. Heather put her arms around the woman.

Heather suggested they trade phone numbers, and so they did. The waitress's name was Melanie Warner. Heather also gave the Melanie the phone number of the restaurant she'd worked when she met Max. They were still talking when the boss came out.

“Hey lady, you didn't pay your bill.” he screamed at Heather.

“Hey Gentleman, you never served it to me.” Heather countered.

“Whatever, it will come out of Melanie's salary.” expounded the modern monument to generosity.

“Fine, it's \$5.95 plus tax. Here's \$7.00, which should more than cover it. Don't bother with the change, I don't ever want to deal with you again.” Heather said in an ominously soft voice. Heather placed the seven dollars on the ground in front of the man, covering it with a stone so it wouldn't blow away. “No offense guy, but the last thing I want to do is touch you.”

Heather continued. “Watch this, you cretin.” Heather turned to Melanie, pulled a \$50.00 bill from her wallet, and gave it to Melanie. “Melanie, here's the last tip you'll ever get from this greasy spoon. Call me tomorrow and I'll get you a better job.”

Melanie walked off, still hiccuping a few sobs, got in her car, and drove away. Heather turned to the restaurant owner, who was still watching. “So you made the girl cry. Big man. Be careful though, because what goes around comes around.”

Heather jumped on her bike and pedaled off, feeling sorry for Melanie.

If only Heather had had a crystal ball, she'd have seen that by the time Melanie's son went to Harvard, Melanie would be a millionaire.

As she rode, Heather reviewed the waitress in her mind. Melanie was her own worst enemy. Her nervousness over getting fired was a self-fulfilling prophecy. If she had just steered her mind to get on with business, regardless of the pressure, she'd have done OK.

Then Heather remembered an incident two weeks ago, in which she'd made a mistake installing a carburetor (who uses carburetors these days anyway?) and the customer asked her some probing questions. On the edge of panic, Heather had further screwed up the repair while the customer was waiting. Luckily, Max got home just in time, from a parts pickup, and fixed it correctly. **But the fact is, Heather had panicked and therefore screwed up the repair.**

So it wasn't just anger that was deadly. It was panic too. Maybe other things. Hmm. Maybe arrogance. John Wintekeller. Maybe lack of confidence. Max, at least when she first met him.

The bottom line was, before you could troubleshoot, you had to have the right attitude. Which, Heather further surmised, was true of anything. Look at her son Seth. He couldn't do math because he believed he couldn't do math. Most of Heather's math help involved confidence building.

And so, as Heather rode into the setting sun on a now frigid November evening, the sixth step of her troubleshooting process took shape — "Get the Right Attitude". Realizing one could do nothing without the right attitude, she made it Step 1. She thought about this the rest of the way home, and then while she was helping Seth with his homework, and then when she was supposed to sleep. A dreamless sleep came late, and she woke up groggy but happy the next day.

Heather phoned Max. "Hello Max. I'd like to take today off too if you can manage the shop. You'll get paid for the whole day, and I'll do some much needed thinking. I'll be back bright and early tomorrow. Can you handle it?"

"Of course, Heather", said Max. When Max hung up the phone, he wondered why all his bosses couldn't have been as smart and kind as Heather. Max hadn't had a drink in six weeks. Max was no longer bitter. Heather had given him more than a job — she'd given him back his life. His life would be perfect except for the persistent deep cough he'd had for several weeks.

While Max was ruminating, Heather was reading an old, beat up copy of Stephen Covey's "The 7 Habits of Highly Ef-

fective People”, for the fourth time. As always, she marveled that in a world of self-help gurus who blame the victim and tell her that she’s responsible for all her misfortunes, even if a meteor fell out of the sky and crushed her leg, Covey conveyed a practical and doable method for self improvement.

Of all Covey’s habits, the one that had taken her longest to understand was “sharpening the saw”. Life is tough, and it wears you down. If you don’t take time to build yourself up again, you’ll become as ineffective as a woodsman trying to cut down trees with a dull saw.

So how would a car mechanic sharpen her saw? She pondered the question until 3:00 pm, when it was time to pick up Seth. As Heather bicycled over to pick up Seth, the answer came. She already sharpened the saw on every repair!

Whenever Heather finished a repair, after it tested out as correct, she’d jump up and give a little cheer. It was catching — now Max did it too. Heather never failed to take pride in a completed repair, and it kept her going through her long and arduous days. Not only did she cheer after repairs, but after work she’d always go over the course of her day’s repairs — what she did brilliantly, and what needed improvement. That helped her improve both her attitude and her troubleshooting productivity.

That night Heather put Seth to bed early, demanded he stay there, and wrote out a new car repair process:

1. Get the Right Attitude
2. Get the symptom description
3. Reproduce the symptom
4. Perform half steps
5. Replace the bad component
6. Take Pride in Your Repairs
7. Prevent future occurrence

Then she remembered that she only took pride after testing that the repair was complete and hadn’t caused any other problems. So she added the testing step:

1. Get the Right Attitude
2. Get the symptom description

3. Reproduce the symptom
4. Perform half steps
5. Replace the bad component
6. Test
7. Take Pride in Your Repairs
8. Prevent future occurrence

As she fell asleep, Heather held with wonder the fact that she had thought her car repair process had five steps, but now she knew it really had eight. Just before she dozed, she wondered whether there were even more steps.

The next day Heather showed the list to Max.

“Now you’re going farther than I ever did, Heather. Your step 7 is something I never considered. But Heather, I can think of two steps you don’t have.”

“What are they, Max?”

“You’re going to have to figure them out by yourself, Heather.”

Max lapsed into a series of wet, deep coughs that Heather didn’t like at all.

“Max, why don’t you see a doctor about that cough?”

“You know why, Heather. I have no health insurance and I’m three years too young for Medicare, so I don’t go to the doctor. If I went to the doctor and he found something wrong, I couldn’t afford the treatment, so why bother. When I turn 65 I’ll be eligible for Medicare. Then I’ll see a doctor.”

Listening to that cough, Heather wondered if Max would see 65.

“Quit worrying about me, Heather, and think about the other two steps while you fix these cars.”

A New Employee

Fall turned to winter. In spite of the weather, business got better. First it was referrals from Mary McGuire and Sheldon Carter, then referrals from satisfied customers came along, and finally they began some dirt cheap advertising. There were days when they didn’t finish their work. They needed help.

Trouble is, there were two kinds of mechanics: Master mechanics who wanted a paycheck Heather couldn’t afford, and

wannabe hacks who would work for peanuts but couldn't troubleshoot their way out of a paper bag and were too proud to learn.

Heather decided on a third alternative — a mechanic's helper to help her and Max boost their own productivity. She phoned Melanie, the nervous waitress, offering her the minimum wage job. Melanie accepted.

The hardest part of working with Melanie was reassuring her. Melanie had to fetch requested tools, hold mirrors and flashlights, and clean the place up. Having been fired from three jobs since the restaurant, she was even more nervous. Heather warned Max never to show impatience with Melanie. Heather reassured Melanie every day that Melanie was doing a good job, and as time went on, Heather's reassurances became truer and truer. A month later, both Max and Heather agreed that Melanie was indispensable in boosting their productivity. Heather gave Max a \$5.00/hr raise and Melanie a \$2.00/hr raise.

Max was proud, and Melanie ecstatic. They both worked twice as hard, and profits went through the roof. Max and Heather began teaching Melanie the basics of car repair, so that Melanie could do simple tuneups and brake jobs herself, with a little supervision.

Heather began teaching Melanie her 8 step troubleshooting technique. Having never fixed anything before, Melanie had no preconceived notions, so she followed the process exactly. She began to show signs of being an excellent mechanic. But Rome wasn't built in a day..

"Melanie, *never* work on a car with the oil cap off!" Max shouted, perhaps a bit too abruptly.

Heather trotted over immediately. The last thing anyone needed was for Melanie to get nervous. "Tell us why, Max.", asked Heather.

Max's tone changed from urgent to almost professorial. "Because if you happen to drop a nut or other part in the oil fill pipe, you might have to spend hours getting it out, and you can't bill for those hours. If you leave the part in there, the customer's motor could self destruct, and the next mechanic will find the nut and know exactly what happened, and you'd be on the hook. You can prevent all that by having the oil cap on while working on the car."

Heather glanced at Melanie, hoping Melanie wouldn't become nervous. But Melanie looked dreamy instead. Heather asked Melanie what was on her mind.

"Maybe step 1 of the troubleshooting process should be dam-

age control.” said Melanie.

Max nodded approvingly, and you could almost see a light bulb go on in Heather’s head.

“Brilliant Melanie”, Heather exclaimed. “It certainly should be. Except that I think it should be step 3, because you want the right attitude, and you don’t need to consider safety while asking about the symptom description.”

“Not so fast, slim”, Max said to Heather, using a pet name that would have been insultingly improbable just a year ago. “What if you’re on the phone to a customer, trying to get the symptom description. Would you advise the customer to drive 45 miles per hour, and then jam it in reverse? You need to consider safety the second you have any interaction with the vehicle, whether direct or indirect. Damage control should be step 2.”

Nobody could argue with Max’s logic, so Heather wrote with a marker pen on paper:

1. Get the right attitude
2. Make a damage control plan
3. Get the symptom description
4. Reproduce the symptom
5. Perform half steps
6. Replace the bad component
7. Test
8. Take Pride in your repairs
9. Prevent future occurrence

Heather taped the paper to the inside of a window, where it could be seen from the backyard work area.

When Melanie went to lunch, Max said “I think Melanie deserves a bonus. She thought of a step you hadn’t.”

“Max, is that one of the two steps you knew about but I didn’t?”

“Yep.”

“What’s a good bonus for her, a day’s pay?”, asked Heather.

“Let’s give her a hundred dollars. I’ll kick in fifty.”

“No need Max, we make plenty of profit. I’ll give her a hundred dollars from the profits of the business”.

Now completely motivated, from that day forward, Melanie absorbed information like a sponge, eventually outstripping the diagnostic abilities of both Max and Heather.

A Real Shop

Late in the winter, Max informed Heather that the time had come to get a real shop with real lifts. A garage went out of business a couple miles away, and Heather leased it after making sure its lifts could accommodate light trucks. She called Sheldon Carter and informed him, after which he said he'd send a little of his business her way on a trial basis.

Heather gave Max and Melanie an hour long pep talk and dollar an hour raise each, promising more if things worked out. She explained how they'd have to crank out a lot more work by working smarter instead of harder. They might need to hire more mechanics, and she wanted Melanie to be in a position of a senior mechanic by the time that happened. Heather bought several automotive books and started a shop library, loaning them to Melanie, who read them constantly.

Heather also obtained worker's comp insurance, and hired a guy to come in and tell them how to work safely. Melanie took notes and composed Heather's Automotive Repair's first safety booklet.

Last but not least, Heather hired a lady to pick up Seth and care for him until 6:30pm, when Heather always arrived home.

The repairs started rolling in. Some days they didn't finish their work. Then Mr. Johnson's 82 Buick LeSabre knocked them for a loop.

Mr. Johnson needed a head gasket replacement. That's no big deal — Heather's first repair was a head gasket replacement. But there were a few complications in this repair, requiring Heather to spend all day on the repair, and several times she had to pull Max away from his work to help her.

By the end of the day, they'd repaired only two of the six cars brought in for repair that day.irate calls were coming in. Melanie tried to handle them, but handling complaints wasn't Melanie's long suit, at least not back then. Finally Heather had to pull herself off Mr. Johnson's Buick to handle the irate calls, and call others forewarning them of a delay. It was the first day in the history of Heather's Automotive Repair when they did anything less than outstanding work.

The next morning, Heather called a meeting.

"Heck of a time to have a meeting, Heather. We have four

delayed repairs plus Johnson's Buick. We need all the time we can get." said Max.

"Max", Heather said gently, "you would never troubleshoot angry, would you?"

"No." replied Max, who had known Heather long enough to know she would win this argument, but was curious *how* she'd win it.

"Would you ever troubleshoot in panic?"

"No." Max now had an inkling of where this was going.

Heather pressed forward. "Our whole shop's in a panic right now. Something's gone terribly wrong with our system, so we need to find out what it is, fix it, and prevent future occurrence. Who has some ideas?"

"Don't take in junk like Mr. Johnson's Buick." said Max.

"Yeah", exclaimed Melanie. "One piece of junk takes as much time as four easy ones!"

"OK, good", agreed Heather, "we won't take in junk. But tell me, is Johnson's car really junk? And more to the point, when it came in, could we tell it was junk? To me it looked like a head gasket job like I've done on three other cars. If we turn down everything that might be junk, we'll have nothing to work on."

Melanie made another suggestion. "We could limit our work to Mr. Carter's fleet!"

Heather smiled. "Melanie, don't you waitress at the Egg Shoppe on Monday and Wednesday nights?"

Melanie's face turned beet red. She had no idea how Heather knew she was moonlighting. Would Heather fire her for moonlighting?

"Melanie — it's OK. I moonlighted the first two months I owned this shop. I know you moonlight for two reasons — first, because you need the money, but second and much more important, because you don't want Heather Woodruff in control of your entire paycheck. That's just good business sense, and I applaud it."

Melanie looked both confused and relieved, and blushed even harder.

Heather continued. "And for the exact same reason, I don't want our only source of money to be Mr. Carter. I want to continue 'moonlighting' with other customers."

Melanie smiled. "Well, now that you put it that way, I understand."

"So how do we prevent events like these? How do we increase our throughput, and decrease variation in our throughput?"

Nobody said a word. Everyone was deep in thought.

“Heather, did you know that once upon a time I was a cook?”, asked Melanie.

“No.” Heather couldn't see the relevance of the question.

“Yes, and when I was a cook, I quickly learned a self defense technique — do the easy orders first. If six people had ordered hamburgers and one ordered broiled salmon fillet, I did the hamburgers first. That way I'd only have one person yelling at me, and the time I saved not answering questions about the hamburgers, I put toward the broiled salmon fillet. It all worked out for the better.”

“Yes, but in the car business that's just not fair to the poor guy with the tough repair.”

Max looked thoughtful. “But Heather, is 'first in first fixed' fair to the guy who wants an air cleaner replaced? Should he have to wait two days because the two guys before him are head gasket replacements? Maybe all ways are unfair, but at least easiest first benefits the most people, and I'll bet Melanie's right — it will improve our overall productivity.”

“It won't work. If we do the easy ones first, we'll never get to the hard ones!” Even as Heather voiced this opinion, she realized its logical flaw. It just wasn't true.

“Would you rather never get to the easy ones?” asked Melanie, pinpointing the exact flaw Heather had detected.

Heather squinted her eyes in thought. “Yeah, you're right Melanie. If you don't have time for easiest first, you never would have had time for first in first fixed. If you can't complete the tough ones, there are only three explanations:”

1. You're quitting after the easy ones
2. You're taking in unprofitable junk
3. You've got too much business for your current staff and facilities

Heather continued. “Number one is as simple as understanding that 'easiest first' does not mean 'easiest only'. During inevitable slack times we must do the tough ones. Number two is obvious — if it's not worth our time to repair it, we turn it away, thereby spending our time making a profit and paying your paychecks. And if it's number three, congratulations to me, because that means I'm making so much money I can afford to hire another mechanic and make even more money. Easiest first sounds great. Good thinking, Melanie. OK everyone, let

Mr. Johnson's car wait, and let's do all the rest as quickly as possible."

By the end of the day, everything was done except Mr. Johnson's car. Mr. Johnson was miffed, to say the least. Heather loaned Mr. Johnson her car until his was done two days later. From that day forward, with the same employees and the same shop, Heather's Automotive Repair did 20% more business.

A couple days later, Max, Melanie and Heather had a "bull session" off the clock, to finalize discussions on where their throughput ideas fit in the troubleshooting process. Melanie wanted to insert it as a step in the troubleshooting process, but couldn't figure out where. Eventually, Max and Heather convinced her the reason she couldn't figure out where was because it was apples and oranges — **the troubleshooting process was a process for a single repair, whereas their throughput ideas were for the *flow* of repairs.**

Reflections on an Unbusy Day

One day, for whatever reason, very little business came in. Heather had done all the paperwork, and had made some sales calls that would hopefully attract additional business in a few days. She had also called several mechanics she knew, because sooner or later the shop would need more capacity, or even a second shop.

But right now, Heather found herself with absolutely nothing to do. So she watched Max and Melanie work. She noticed how much more adept Max was at tool handling than Melanie. She noticed the thoughtful way both approached their work, and hoped that maybe in some small way she had influenced them to be so thoughtful. She noticed that on every repair, after reproducing the symptom, Max spent a couple minutes checking fluid levels and inspecting the battery terminals.

On more than one occasion Max cleaned the battery terminals or filled low fluid reservoirs, even though such actions weren't called for in the work order. His actions were costing her money, and she decided to talk to him about that. Customer goodwill is good, but customers would hardly even notice what he was doing. And *why* was he doing it?

Heather made sure Max and Melanie had everything they needed, then took a walk. New leaves emerged from the trees, young birds flew, and the smell of spring was everywhere. Heather walked with a bounce in her step. Businessmen looked at this grease caked woman wearing jeans, a black Tshirt and a base-

ball cap. She looked nuts, but nuts as she might be, she was shapely, happy, and beneath the grease, pretty. They couldn't help looking again.

She walked for miles, thinking of Max's oddball maintenance activities. Max wasn't stupid or wasteful, so why did he do it? Why? Why? Why?

Walking and wondering, Heather saw the sun go overhead, and then head to the west. The day turned peaceful, as only a late spring afternoon can. As she started walking back toward the shop, she thought of her first repair, her Buick. It didn't run well after she replaced the head gasket. It could have been a monumental diagnostic task, but Max had broken down the logic. She hadn't had a tuneup in years, therefore she needed a tuneup, and it's just possible that by doing the tuneup she could get lucky and eliminate the problem, so why not do the tuneup before trying to diagnose the problem.

Maintenance before half-splitting. Over and over again she repeated the mantra. Maintenance before half-splitting. Maintenance might correct the problem. Corrective Maintenance. **CORRECTIVE MAINTENANCE WAS STEP 5!**

Heather jumped, and ran, and screamed. "Corrective Maintenance is Step 5", she screamed to the heavens, over and over as she ran the three miles back to the shop.

About a mile from the shop, a squad car cut her off at an intersection. Both cops got out, with their hands resting lightly on their weapons.

"Ma'am, are you alright?", asked one of the officers. "May we see some identification?"

Heather produced her driver's license. She knew she should get serious instantly. She knew she was about to be pulled into the police station, finger printed, checked for warrants, and very likely given a psychiatric review.

She couldn't get serious. She was just too happy. She slowly reached back in her wallet, and gave each policeman her business card. "If either of you ever needs car repair, I'll give you a 20% discount on the labor!"

A few minutes later the warrant check cleared her of any past crime. One of the policemen took out a cell phone, looked at her card, and dialed a number. Heather heard the policeman's side of the conversation.

"Hello, this is Sergeant Jones of the police department. Is Heather Woodruff there?"

A pause while the person on the other end answered.

"OK Max, what is Heather's position there?"

"No, she's not in any trouble. But tell me, has she been

acting strangely lately?”

“Yes, I can see she’s a very unconventional lady.”

“She’s the best boss you’ve ever had, huh?” At this point the officer smiled and gave the other officer the thumbs up.

“Thanks very much Max, sorry to bother you.”

Officer Jones turned to Heather, smiling. “Look, Ms. Woodruff, let me give you some advice born of experience. You can run, and even how you’re dressed, people will just think you strange. You can shout, and you’ll just look like many other members of our fair city. But if you run and shout, especially dressed how you are, it’s possible a policeman might think you’re dangerous. I’d consider it a personal favor if, for the rest of the day, you either run or shout, but not both at the same time.”

Both officers were grinning broadly.

“Deal Officer, I’ll just run. And don’t you two forget about your 20% discount!”

Three days later Officer Jones brought his private vehicle in for repair, mostly out of curiosity. He was so pleased with the results that he told his buddies about “Crazy Heather”, and they brought their cars in. Within a couple years, many Police called her “Crazy Heather”, but it was all good, because Heather’s business from police far outstripped her business from Sheldon Carter. Perhaps that’s why, even years later, her repair chain had only one robbery in its entire history, and that robber was apprehended within 5 minutes.

In the shop’s parking lot, Heather shouted, screamed, and cartwheeled. Let her customers think she was nuts. She just didn’t care. Max, Melanie and a customer ran out to see what was happening.

“I know step 5!” Heather shouted. “Corrective Maintenance, am I right?”

Max smiled broadly. That’s it! Max then took five minutes to explain Heather’s troubleshooting process to the customer, mentioning that process was why they did better work than their competitors, and taking a little time to detail the history of Heather’s Automotive Repair. The customer looked, saw an ecstatically happy boss surrounded by two smiling employees, and decided he must have stumbled on something good.

Back in the shop, Max chastised Heather. “Heather, you can’t act like that in front of customers. Melanie and I know you, but they don’t.”

OK, Max. Did I hear you say I was right?

“Even I know you’re right.”, said Melanie. “I should have thought of it myself. Why go through a big diagnosis to fix a hum caused by low steering wheel fluid?”

“So that’s it”, exclaimed Heather grabbing a paper and pen. “Our troubleshooting process is this:”, and she began to write.

1. Get the right attitude
2. Make a damage control plan
3. Get the symptom description
4. Reproduce the symptom
5. Do the appropriate corrective maintenance
6. Perform half steps
7. Replace the bad component
8. Test
9. Take Pride in your repairs
10. Prevent future occurrence

Melanie excused herself. On Mondays and Wednesday nights Melanie waitressed at the Egg Shoppe, so she had to spend an hour showering all the grime off herself.

“Melanie, when I waitressed I didn’t have an hour for a shower, so I just showered with hand cleaner.”, offered Heather.

“Thaaaats how you maintain your soft complexion, huh Heather?”, quipped Melanie.

Everyone laughed.

Right there, in the parking lot of Heather’s Automotive Repair, stood three people, all in serious financial straits, laughing and joking. Two of them ended up millionaires, and the third would have if he’d lived long enough. But if, later on, you’d asked any of these three about the best time of their life, they just might have mentioned the day they laughed in the parking lot.

Time for Revenge

Eighteen months later, Heather was almost ready to open another shop when the gas station across the street from Wintekeller closed down. Heather negotiated tirelessly with the landlord, finally getting him to agree to a favorable five year lease. Five years should be enough to put Wintekeller out of business!

“What, are you crazy!”, screamed Max. “Never make a business decision for the sake of revenge! You know, Melanie and I aren’t owners, but that doesn’t mean our sweat isn’t in this business. Don’t do this to us!”

Softly Melanie agree. “Max is right, Heather, this is a bad decision. Back out of it.”

“It’s a good business decision, for all the right reasons.” Heather countered. “Look at it this way. Would Wintekeller be any competition for us?”

“Probably not.” said Max. “But why would we even risk the competition?”

“Simple Max. Wintekeller attracts customers, and we steal em. We laugh all the way to the bank.”

“You know, Max” said Melanie, “she has a point.”

“Tell you what Heather. Are you sure enough of your ‘business model’ to give Melanie and me a five dollar an hour raise?”

“Will you manage one of the shops?” Heather asked Max.

“Yeah, for five dollars an hour more I will.”

They got their raises, and Heather got her new shop. That’s how the second Heather’s Automotive Repair came into being, managed by none other than Heather herself. Heather found a willing ASE certified mechanic named William Washington, paid him an arm and a leg, taught him her troubleshooting process, and learned from his work. Then she called Mary McGuire and asked if Mary knew a humble person wanting to be an entry level mechanic and willing to learn.

The next day Heather got a call from Kathy Jackson, the older woman from PFAS whose job Heather had saved by fixing her car. Kathy wanted to work for Heather, in spite of the minimum wage pay and in spite of the lack of health insurance. Kathy just wanted out of PFAS.

Heather made a large sign saying “We fix what other shops botch”, and hung in plain sight of Wintekeller customers. And so it was that William, Kathy and Heather set out to do battle with the wealthy and long established Wintekeller Automotive.

It didn’t take long. Word got out that Heather’s Automotive Repair fixed it right the first time, usually in one day. Wintekeller’s loss was Heathers’ gain. Heather, William and Kathy formed a rock solid team, hauling in the cash. Meanwhile at the original store, Max and Melanie were somehow doing more business than they had when Heather was there. In August Heather gave everyone a thousand dollar bonus. In December she gave everyone a ten thousand dollar bonus.

It would make a wonderful story if Heather had put Wintekeller out of business, but that’s not what happened. Win-

tekeller's shop made enough money to stay open until Wintekeller retired comfortably ten years later. If you wonder why this story is called "Heather's Revenge", you'll just have to keep reading.

The Third Shop

Less than a year later, a garage on 32nd street went belly up, and the landlord sold the building to Heather for a song. Heather's mortgage payment for the building was less than the rent she paid on her other buildings.

Heather hired another ASE certified mechanic to work at the newest shop, and brought Melanie over to be manager. Then she set out to hire more entry level mechanics.

One night Heather's phone rang. It was Mary McGuire. Heather told Mary that Kathy was working out superbly, and asked Mary if she had another mechanic to recommend. Mary said she did.

"Who is it?", asked Heather.

"Me." said Mary.

After a minute of stunned silence, the two women began discussing what in the world would make a successful human resources director want to be a minimum wage mechanic's assistant, with no health benefits. Mary explained she was sick of PFAS, and her husband had a health plan at work. Mary was in regular contact with Kathy, who just loved her new job. Mary had always hated her job. Most of all, she hated firing people.

Mary was hired as an apprentice, as was Bob Middleton, a middle aged computer programmer whose job had been emailed off to India. Mary went to work in the 32nd street shop, while Bob Middleton went to work at Max's shop, with Heather frequently floating over there to help out.

The money rolled in. Everyone was happy. It looked like nothing could stop Heather's Automotive Repair. But things aren't always as they seem.

Teaching William

William was a great mechanic, usually very fast. However, once in a while, a problem would stump him. Occasionally he'd get it entirely wrong, replacing the wrong part, similarly to Wintekeller.

This puzzled Heather a great deal, so she spent a lot of time unobtrusively watching him work. Occasionally she'd ask him what he was thinking. Slowly the underlying cause of William's variation came to light.

William didn't consistently use the 10 step process. It had been taught to him. It's not rocket science — he certainly understood it. But, he often reverted to the same, non-process, intuitional troubleshooting that her landlord Terry had used to fix her air conditioning. Intuitional troubleshooting often works, but often fails spectacularly. Why in the world was it so hard to get William to use the process? Heather had taught it to Melanie in a couple weeks, and Melanie used it consistently.

Pedaling home, Heather stopped at a fast food place to buy a couple takeout burgers for herself and Seth. As she stepped up to the counter, a very irate customer demanded to see the manager. A minute later the manager appeared.

According to her name tag, the manager was actually the *shift manager*, and her name was Maria Ortiz. Although her English was impeccable and understandable, her accent made it obvious she was Mexican or Central American.

"Lady, you didn't give me my double hamburger." yelled the customer.

"Do you happen to have your receipt, sir?" responded Maria.

"Oh, you don't trust me, is that it?" said the customer with a menacing laugh.

Carefully neutral, Maria said "Sorry sir, it's just store policy. But don't worry about that, I'll give you a double hamburger."

Heather had worked at enough restaurants to read Maria's expression. Maria was hopping mad, but professional enough to maintain her composure with iron control. Either the customer didn't realize this, or he wanted to set her off.

"I want to talk to someone with responsibility!" screamed the customer. "You've cost me fifteen minutes of my time. Who's going to pay for that? I make sixty dollars an hour, so your store owes me fifteen dollars. Give it to me."

Maria turned away from the customer for a second. During that time Heather could see Maria's face, but the customer couldn't. Maria's face was a mask of hate. Then Maria's face dissolved into a neutral expression as she said "Sir, I'll be glad to give you your entire meal free, including the double burger."

Now the customer lost all control. "I SAID FIFTEEN DOLLARS! DIDN'T YOU HEAR ME YOU..."

The rest of his sentence was some of the most vial, obscene and insulting language Heather had ever heard. Then Maria lost it.

Maria's eyes narrowed as she spat out a long, rambling reply in Spanish. Maria's speech was too rapid for Heather to understand completely, but from Heather's high school Spanish she surmised that Maria was basically telling the man he was rude, classless and probably mentally deficient. Heather recognized no obscenity in Maria's speech. Unlike the customer, Maria had class.

The customer's eyes widened, he uttered a weird, high pitched giggle and advanced on Maria. Heather whipped out her phone, called 911, and told the Police dispatcher that a customer in Andy's Burgers on fourth street was about to assault an employee, and please hurry.

The maniac now advanced on Heather, using even worse language than he'd used on Maria. Heather grabbed a metal salt and pepper holder and brandished it against the advancing crazy man.

"Do you know what they'll do to you in prison when they find out a woman beat you up?" said Heather in a soft but ominous voice. "I'll be sure that, wherever you do your time, they know that I beat you up after you assaulted me. By threatening, you've already committed assault. If you touch me you'll have committed battery. The Police are on their way. Your only chance to avoid an unpleasant prison term is to run right now".

The man thought for a second, and then walked briskly for the door. Just before he exited, Heather called out to him. "If you ever issue a complaint against Maria or this restaurant, we will have your name and address, and will be sure you are charged with assault. Do yourself a favor and forget this ever happened!"

The man walked out the door, and with the sound of sirens getting ever closer, he faded into the night.

Officers John Washington and Christine Phillips walked in. Heather and Maria explained the entire incident to the officers, as well as giving a complete description of the man, right down to his yellow windbreaker. The officers went out to search for him, but he was gone.

Heather asked Maria when she got off work, and Maria said 10:30. Heather needed to get home to her son, but said that if Maria came over after work, Heather would give her a letter explaining what happened, so in the unlikely event that the nutcase complained to corporate, Maria would have some backup. Maria thanked Heather and said she'd be over before 11:00.

Pedalling home, Heather went over the evening's events. She thought about Maria, and how when Maria got really an-

gry, her perfect English had failed her. Why?

Perhaps Maria's first language was Spanish, and under extreme stress, she had reverted to the language she found easiest, regardless of that language's effectiveness in the situation.

A thought tried to push itself into Heather's mind, and then the thought retreated, in spite of Heather's attempt to grab it. Somehow, Heather knew the thought concerned Maria's use of Spanish, and she knew the thought was important. For the next five minutes she tried to reel the thought back, and then gave up.

Heather's mind drifted to the maniac. He was all bark and no bite. A 5'7", 150 pound woman had faced him down with a salt shaker holder. Heather thought of what would have become of the man if William had been there. William would have beaten him to a pulp, so perhaps it's best that William wasn't there.

Just then, the elusive thought came and went again. What was this thought? Did it have to do with William, or did it have to do with Maria's use of Spanish? Heather kept riding, with the thought just out of reach.

What did Maria and William have in common? Absolutely nothing. The thought zinged in and out again before she could catch it. Heather visualized Maria standing next to William, with Maria speaking Spanish while William fixed a car. The thought came back, Heather grabbed it, and wouldn't let go. She thought the thought, over and over again, rejoicing in just how important it was.

The thought went something like this: Under stress of the customer, Maria had reverted to her native language. Under the stress of production pressures, William reverted to his native language — intuitive troubleshooting. For William, the 10 step process was a second language, so when the pressure was on, he reverted.

That's why it was so much harder to teach the process to William than it had been to teach it to Melanie. For Melanie, the 10 step process was her "first language". She had no "first language" to revert to. On the other hand, the process was William's "second language", and when the going got tough he often reverted to his "first language", the same intuitional troubleshooting that her landlord Terry used to fix her air conditioner.

Heather promised herself to discuss this with William.

Maria arrived at Heather's house just before 11:00. Heather had already typed the letter, and gave it to Maria. The original was a word processing file on Heather's computer. Maria

thanked Heather for *extricating* her from the situation. Yes, Maria had used the word *extricating*, a word too sophisticated for even Heather's vocabulary. Once again, Heather marvelled at the fact that someone with Maria's command of the English language would switch to Spanish when rattled. Heather decided to explore this.

"Maria, I'm just curious. What caused you to yell at the man in Spanish?"

Maria smiled. "When I get really emotional, I revert to Spanish. It used to happen a lot more than it does now. As time goes on, it happens less."

"Where did you come from? When did you come to America? When did you learn English?"

"I came here from Mexico City 5 years ago, speaking no English."

Heather's face showed amazement. "How did you learn English so well and so fast?"

"It's called immersion, Heather. I associated primarily with English speakers. I watched English speaking TV. I read English language newspapers. I always spoke English, even if the person addressed me in Spanish first. Many people called me a snob for not speaking Spanish. I explained to them that I needed to learn English fast. I never speak Spanglish. Spanglish is too often the language of second generation Americans. They switch languages mid sentence. It's cute, but it doesn't promote good English. Or even good Spanish, for that matter."

"But Maria, in the early days you must have understood very little of what was said to you."

"True enough. I hung around a lot of people willing to speak slowly so I could understand it. Some of these people would even explain an unfamiliar word if I asked for an explanation. Immersion means immersing yourself in a new language, but not in the most challenging environment that language can offer."

"One more thing." Maria continued. "I always carry a dictionary. In the early days, I constantly forgot words and had to look them up over and over again. It was slow, but as time went on I sped up. Now I speak faster and more clearly than the average American."

Maria needed to leave, so Heather thanked her, and of course Maria thanked Heather profusely for the help in the restaurant. Maria and Heather stayed in contact, and became lifelong friends.

Heather stayed awake all night making analogies. For William, immersion meant working only with people using the troubleshoot-

ing process. It meant being made aware that the troubleshooting process was expected every time.

But immersion didn't imply the most challenging environment that the process could offer. The company's expectations of William's productivity must be temporarily be reduced so he has time to work with this new, seemingly foreign process.

Expectation of improved productivity would be delayed until the process was second nature to William. Even then, he would be encouraged to note when pressure tended to push him into using his "first language", stop, and once again follow the process. Heather even created slogans for such situations, *your job is not to fix it, your job is to narrow it down*, and, *how can I narrow it down just one more time*.

The analogy of Maria's dictionary was simple enough — hang several large posters of the ten steps on the garage's walls. Also hung on the wall would be Heather's new slogans, and Melanie's *do the easy ones first* throughput enhancer.

Heather made a table of analogies:

	Maria	William
Immersion	Speak only English, hang out with English speakers	Use the process every time, work with only process oriented people.
Challenge reduction	Hang out with those willing to speak slowly while learning English	Reduce productivity expectations while learning the process
Dictionary	Spanish to English dictionary	Wall posters of the 10 step process, the "narrow down slogans", and the "throughput slogan"

Over the next couple days Heather implemented all those ideas. Almost immediately the quality of William's repairs increased, although his productivity went down. Within 2 months the process was second nature to William, and his productivity was better than it had been before immersion.

Heather wrote a booklet describing immersion learning, and the analogies between English as a second language and process as a second troubleshooting technique. This booklet became mandatory reading for all shop managers, and a strict policy of immersion for all new employees was instituted. The result was a company wide workforce uniformly and consis-

tently using the 10 step troubleshooting process. This in turn resulted in higher quality repairs, more consistent repair times, and more throughput.

Heather would always look back on the night at Maria's restaurant as the most important moment in Heather's Automotive Repair. That was the night she learned immersion techniques, and the fact that such immersion should be gentle, especially at first. Heather's gentle immersion techniques, spread across the organization, yielded a uniform and consistent use of the 10 step troubleshooting process, which in turn yielded customer satisfaction and profit.

As years went by, the 10 step process became well known, and many would-be competitors instituted it. They failed because they expected instant results. They hadn't been with Maria that night, so they didn't understand gentle immersion.

Max's Cough

One of the first things Heather noticed while "floating" back to the old shop was how bad Max's cough had gotten. It was deep and wet. One day he coughed into his hand, and Heather saw blood come out.

"You're coming to the doctor with me right now!" said Heather.

"I have no insurance." countered Max.

"I have cash." insisted Heather.

"No."

Eventually Bob Middleton and Heather convinced Max that a doctor visit would only be a hundred dollars. They closed the shop for the day and drove Max to the doctor, who quickly scheduled Max for tests and Xrays. As requested, they reported back to the doctor at the end of the day.

"Mr. Janssen, you have a very advanced case of lung cancer. I believe it started in your prostate, spread to your lymph nodes, and then to your lungs. It's in both lungs. We could try some very aggressive chemotherapy, but frankly I think doing so would be as likely to shorten your life as to lengthen it, and I guarantee you that from the day you started the chemotherapy, you would be in pain."

"How much would the chemotherapy cost?" asked Max.

"Mr. Janssen, you can't make your decision based on cost.", said the doctor.

"The heck I can't Mr. two hundred thousand a year doctor", roared Max. "I make about \$45,000 a year, and the second I start the chemotherapy I'll need to sell my house to pay the

remainder. Even if I recovered, I'd be sixty two years old and broke. Walk a mile in my shoes, Mr. Two Hundred Thousand!"

The doctor was about to reply when Max continued. "How much has it cost so far. This little girl", Max pointed to Heather, "has signed responsibility for this. She has a son to raise and over ten employees to pay, and for those of us not having the AMA to enforce a monopoly for us, business is pretty tough these days."

Max stormed out.

"Realistically, would chemotherapy do any good?" asked Heather.

"Probably more harm than good", said the doctor. "Pretty soon he'll be in too much pain to take care of himself." The doctor handed Heather a card. "This is a card for a hospice where Mr. Janssen can be treated for pain, and allowed to have a peaceful and dignified end of life."

"Thank you Doctor", said Heather.

Then it happened. The girl who wouldn't cry when her husband left her, wouldn't cry when she got fired, wouldn't cry when abused by Wintekeller in the grocery store, burst into tears. She ran out and saw Max. They hugged each other.

"I'm so sorry Max." Heather sobbed. "The doctor said chemotherapy would probably do more harm than good, regardless of cost. Oh Max, I'm so, so sorry. Is there anything I can do?"

"Yeah, drive me back to the shop." replied Max.

During the next two months, Bob Middleton and Max Janssen became best friends. Bob helped Max with tasks he was no longer healthy enough to do. Max taught Bob everything he knew. They went out to dinner together, spent weekends together. Sometimes Heather joined in, and sometimes Melanie joined in, and sometimes they both did. Heather spent more time helping out at the old shop.

One day a parts driver pulled into the old shop. Heather noticed that while the delivery guy and Max finished their paperwork, the delivery guy kept looking at Heather. The delivery guy was a few years younger than Heather, and muscular. He didn't have health club muscles like Jake — this guy had work muscles. This guy didn't have Jake's chisled features, and certainly didn't have Jake's manicured nails. Jake had been an exquisite glass statue of a man — the delivery guy was a real man — skin, muscle and sweat.

After the delivery guy left, Heather asked Max: "Hey Max, is it my imagination, or was that delivery guy checking me out?"

"Oh yeah, he was checking you out bigtime. He asked me if

you were single, and I told him you were.”

Heather wondered if Max was kidding. “But Max, I look like Rosie the Riveter.”

“Ya know, Heather”, Max said, “my dad was in World War II, and he told me there were a lot of guys who thought Rosie the Riveter was prettier than Jean Harlow. I’ll tell you something else. Remember the time that cop, Jones, came in and photographed the place?”

“Yeah.”

“Well, he took a couple of pictures of you, with your jeans, your tee shirt, your baseball cap, and your grease and grime. He enlarged the picture, captioned it ‘Crazy Heather’, and made copies. According to Jones, several of the cops have that picture of you in their lockers. They hold you in a little bit of awe. You’re not the chubby scared girl you were a couple years ago.”

The delivery man, whose name was Dave Marcus, came to the shop and asked Heather out a few days later.

“Should I wear the clothes I have on now, or should I wear a dress?” asked Heather.

“I’m sure you’ll be beautiful either way.”, Dave replied.

Heather flashed him a 500 watt smile.

Dave and Heather married a year later. Dave started work for Heather, eventually owning and running twelve franchises. It’s a good thing that Dave was younger than Heather, because Heather lived a long, long life, all the rest of it with Dave.

But that was all in the future. For the present, Heather had a busy life managing the chain, helping in Max’s shop, helping Max at home, and going out with Dave. Max kept coughing up more blood, and he was getting weaker, and he was obviously in pain, but he got to work at 8 every morning and stayed til 6 every night.

Max’s Last Days

About three months later, Max collapsed on the shop floor. Bob Middleton called the ambulance, and then called Heather. The old shop closed for the day, and Bob and Heather headed to the emergency room, where the doctors said Max was dying, and would die instantly without oxygen. Max promptly got off the bed and walked out of the hospital. He was tough.

They went back to Melanie’s shop, where it was decided that if Max got into trouble again, they’d bring him to the hospice. Max went back to work like nothing had happened. Then, two weeks later, at four in the morning, Heather’s phone rang.

“Heather, it’s Max”, came the horse rasp. “I can’t go on. I need to go to the hospice.”

Heather came over, packed up a few of Max’s belongings, and drove him to the hospice. Max was admitted around 8:30. At 9:00 the nurse came out and told Heather that she was shocked Max was still alive. Heather called all the shops, told them to take a paid holiday, and lock up. She told Melanie and Bob Middleton to come right away. The nurse had offered to give Max pain medicine, but Max said he wanted to talk to his friends first. They all went in and talked.

Then Max asked to talk to Bob Middleton alone. Bob was in there for a half hour, and then came out crying. Next Melanie went in, and also came out a half hour later, also crying. Then Max asked for Heather. She was crying before she walked in.

In a horribly weak voice, Max started. “Heather, I’ve taught Bob Middleton everything I know. I didn’t have time to play a cat and mouse game like I did with you. If there’s ever anything you don’t understand, ask Bob.”

“Max, you have no idea what you taught me. You saved my life. Seth and I were going hungry when we met you. We had no car. You taught me everything I needed to know. But you taught me much more — how to forgive, how to keep going when things are hopeless, how to be strong. All the employees look at me like Superwoman, but you knew the scared little girl, the welfare queen, and you helped her. Max, I owe you everything, and I love you.”

“It’s mutual Heather. I was a bitter drunk when we met. I wanted to die. Linda and I never had any kids, and when I got fired and Linda divorced me, I had nothing and nobody. You changed all that Heather. You gave me a reason to get up in the morning. You gave me a group to belong to, because whether you know it or not, Heather’s Automotive Repair is a lot more than just a place to work. I’ve always thought my life was a waste, especially after I was fired and divorced. You made me feel otherwise, and I’ll thank you into eternity.”

They talked a few minutes longer, and then Max said he wanted to get some sleep. Melanie, Bob and Heather went out to get a cup of coffee. Fifteen minutes later Heather’s cell phone rang. Max had died. Through a herculean effort, he had kept breathing long enough to talk to each of them, and then he’d simply quit breathing. His last words had been to the nurse, refusing pain medication. He said he wanted to make the transition with his full faculties.

Max's Funeral

It was a cold, windy February morning. At the funeral were the Priest, Heather and Dave, Melanie, Bob, and a few other Heather's Automotive employees. Heather had called Max's ex wife to invite her, but she declined. Heather, Melanie and Bob spoke, relating how Max had taken them under his wing, patiently mentoring them and becoming their friend.

Most funerals have better attendance, but no world dignitary could claim better friends at their funeral than this childless, divorced man who, until recently, believed that his life had been a waste.

Max would be missed. And never forgotten.

Subtle Changes

There were some subtle changes in the months following Max's death. The organization was larger, and they didn't have Max to ask for advice. Melanie was promoted to vice president. Her salary tripled. She spent half the day fixing cars, and half the day teaching troubleshooting. She restated Heather's process to look like this:

1. Prepare
2. Make a damage control plan
3. Get the symptom description
4. Reproduce the symptom
5. Do appropriate corrective maintenance
6. Narrow it down
7. Repair/replace the defective part
8. Test
9. Take pride
10. Prevent future occurrence

Melanie explained that getting the right attitude was only one element of preparation, which included lining up your tools, and cleaning your work area.

Melanie said she preferred “narrow it down” to “perform the half steps”, because in fact many times only a tiny sliver of the remaining root cause scope was ruled out. In fact, Melanie recognized and taught all others, including Heather, that **in selecting diagnostic tests to narrow it down, the mechanic had to consider these four factors:**

1. **Ease**
2. **Likelihood**
3. **Safety**
4. **Even divisions**

Mentally, Heather slapped her forehead as she remembered the day she and Max had decided what to test for first after her Buick ran rough following the head gasket job. Hadn't their decisions been based on this quadruple tradeoff? Heather was awestruck that the skinny nervous woman who had gotten fired before her eyes was now the intellectual leader of her company.

Melanie recruited William Washington to teach automotive technology to the less experienced techs (Melanie used the word Tech instead of “mechanic”, and that custom caught on).

With a happy, highly educated and highly motivated crew, Heather knew she could expand some more. She found a facility with ten bays, hired employees to staff it, and had Melanie and William train them. The next year, the company's revenue exceeded a million dollars. The year after that, it doubled. They were on their way.

James Jackson's Term Paper

James Jackson had spring fever. Sunlight warmed his bare arms, birds chirped, and gutters gurgled with the runoff of the now melting snow. James nodded at a pretty girl as he congratulated himself on winning a debate with his English teacher. Miss Rowe said that the defunct company called *Heather's Automotive Repair* was not an appropriate term paper topic. She said a company thirty years dead would be problematic to research, with vast gaps in information long forgotten. She mentioned that the company had started over 100 years ago, in relative obscurity, so separating fact from myth would be almost impossible.

James, who consistently scored the highest grades in the class, said he'd make it appropriate, and if he didn't, Miss Rowe could give him an F. Miss Rowe was in her 20's, had only been teaching for 2 years, and figured it was just possible that James might be able to pull it off. She finally relented.

James had first learned of Heather's Automotive Repair from a musty book purchased for 15 cents at a garage sale. The book was called "The Leadership Secrets of Heather Woodruff". If even 10% of what that book said was true, Heather Woodruff had been without peer. James wanted to learn everything about her and the company she built. James was 5th generation poor, and he wanted to make sure his children wouldn't be the 6th.

His next two weeks were spent in research. V-Lib, Nanonet, International Information Warehouse, he hit them all. Then he went beyond the efforts of his classmates. He interviewed some of Heather's descendants, gleaning family mythology that just might be true. He interviewed the children and grandchildren of Heather's Automotive employees, learning of the corporate culture and stories passed from generation to generation in a company that lasted 82 years. He even managed to interview a couple people who worked at Heather's Automotive Repair in the final years, when a group of "investors" bought the company and dismantled the corporate culture, creating a civil war within the company and eventually leading to its demise. Slowly a picture took shape.

Heather Woodruff had been smart and poor, like James himself. She'd been dealt two bad breaks — an insincere and unfaithful husband, and an incompetent car mechanic whose mistakes had gotten her fired from a job she desperately needed. She got a good break — she met Max Janssen, and with his help she repaired her car, and in doing so found the career she loved. Besides being smart, Heather was beautiful in a "Rosie the Riveter" kind of way. She was a leader without peer. Heather's rarest and most outstanding attribute was the ability to look at a common scene, and apply its lessons to completely different subject.

She watched her landlord diagnose an air conditioning problem, asked him question after question, and generalized it into a troubleshooting methodology, including cause chains, damage chains, root cause, future problem prevention, and HALF SPLITTING, also called NARROWING IT DOWN and DIVIDE AND CONQUER. From a customer disaster caused by an undercooked steak, she made the connection between a waitress not getting a description of what the customer wanted, and a technician not getting an adequate symptom description. Heather then

made symptom acquisition part of her troubleshooting process. That night her young son Seth made her realize that symptom reproduction must immediately follow symptom acquisition.

Heather learned the importance of a productive troubleshooting attitude when Max told her not to troubleshoot angry, because she would damage the car. That same day came an incident involving a nervous waitress in a burger joint. The waitress was so nervous that she sabotaged herself. Observing that, Heather expanded Max's definition of attitude to include panic, and armed with two attitude killing emotions, she asked herself if there were any more and came up with arrogance and lack of confidence.

Reading a book called "The Seven Habits of Highly Effective People", Heather morphed Covey's "Sharpen the Saw" habit into Step 9 of her troubleshooting process, "Take Pride". "Sharpen the Saw" refers to the problem solver taking care of himself to keep himself sharp and productive. The metaphor is that you can't cut down many trees if you don't sharpen your saw regularly. Heather realized the necessity of taking pride after every repair in order to keep the troubleshooter motivated and sharp.

Heather's ability to extrapolate knowledge from situations into different environments rubbed off on her coworkers, including Max and Melanie. When Max chastised Melanie for working on a car whose oil cap was not in place, Melanie extrapolated that into Step 2, "Make a Damage Control Plan". Melanie also used her experience as a cook to suggest prioritizing "easiest first" in order to prevent shop meltdowns when unusually difficult jobs came in. She convinced Max and Heather that if you didn't have the time to do the hard ones while prioritizing "easiest first", you sure wouldn't have the time to do all the work "first in first out". Then Max pointed out that although "easiest first" sounded unfair to customers with difficult repairs, in fact no prioritization is completely fair, and "easiest first" is the fairest to the most people.

The "easiest first" conversation, about which James read in Melanie Warner's brittle and yellow diary, provided by her great-granddaughter, was particularly fascinating. They discussed the concept of which repairs to refuse, and the fact that if "easiest first" didn't work, it failed for one of three reasons:

1. You're quitting after the easy ones
2. You're taking in unprofitable junk
3. You've got too much business for your current staff and facilities

#1 required better discipline, #2 required refusing junk repairs, while #3 meant you need to hire more technicians and make more money.

Max had a habit of checking and cleaning things before starting a repair. Heather felt it slowed Max down, but was reluctant to mention it. Then, while taking a walk on a beautiful spring day, Heather realized that what Max was doing was corrective maintenance, and he did it to play the odds that corrective maintenance might eliminate the need for diagnosis.

Knowing and using a troubleshooting process is one thing, but teaching it to others, on a large scale, is a much greater challenge. Once again, Heather took an everyday situation, in this case a fast food restaurant manager's reaction to an abusive customer, and turned it into a business principle. In this case, Maria, the manager, lapsed into Spanish when the customer angered her beyond the point of no return. Talking with Maria, Heather learned that Maria's first language was Spanish, and even though she spoke perfect English, when emotions ran high she sometimes switched to Spanish. Heather remembered how her ASE certified tech, William, when under pressure, sometimes abandoned Heather's troubleshooting process in favor of his "first language", diagnosis by intuition and trial and error. In response to this, Heather formulated her "immersion", "challenge reduction" and "dictionary" techniques as an analogy to Maria's method for learning Spanish:

	Maria	William
Immersion	Speak only English, hang out with English speakers	Use the process every time, work with only process oriented people
Challenge reduction	Hang out with those willing to speak slowly while learning English	Reduce productivity expectations while learning the process
Dictionary	Spanish to English dictionary	Wall posters of the 10 step process, the "narrow down slogans", and the "throughput slogan"

It worked perfectly for William. It worked perfectly for everyone Heather taught. So Heather taught immersion, challenge reduction and dictionary to all managers, creating a cor-

porate culture of troubleshooting process. Heather's competitors, who figured all they had to do was tell their technicians about the troubleshooting process, failed miserably.

Although Heather remained one of the world's most acknowledged leaders for the rest of her working life, Melanie eventually surpassed her in the area of developing an effective and reproducible troubleshooting process. Melanie changed Step 1 from "Get the Attitude" to "Prepare" as recognition of the fact that many preparations are necessary. Melanie changed step 6 from "Half Splitting" to "Narrow it Down", because few diagnostic tests split the remaining root cause scope exactly in half. Melanie explained that selecting the most effective diagnostic test required recognition of this quadruple tradeoff:

1. Ease
2. Likelihood
3. Safety
4. Even divisions

When Melanie finished improving the troubleshooting process, it looked like this:

1. Prepare
2. Make a damage control plan
3. Get the symptom description
4. Reproduce the symptom
5. Do appropriate corrective maintenance
6. Narrow it down
7. Repair/replace the defective part
8. Test
9. Take pride
10. Prevent future occurrence

James wrapped up his term paper with the obligatory enumeration of Heather's successes. She'd expanded to 6 shops by the time her son, Seth, graduated law school. Seth had specialized

his studies in franchise law, and quickly helped Heather franchise the operation, which grew like a weed. Heather handed the reins to Seth soon after her 78th birthday, at which time there were over 100 franchises. By the time Seth retired there were over 1000. So strong was the company culture that the troubleshooting process was taught and followed through a succession of 6 CEOs. The 7th CEO, appointed by an investor group that acquired Heather's Automotive Repair in a hostile stock takeover, forbade the use of the troubleshooting process, and was faced with widespread mutiny. Employees kept using the process. Only after all senior and mid-range managers were fired, and several franchises yanked, was the process truly prevented. From that point on, Heather's Automotive Repair began a decline culminating in bankruptcy 7 years later.

That bankruptcy was 30 years ago. Many employees and franchisees had been trained in the troubleshooting process, and had opened very profitable shops. None, however, managed to build a corporate culture necessary for a large and successful organization. Over the past 30 years, use of the troubleshooting process had seen a gradual decline, to the point where now it was unknown to the average person.

James handed in his term paper on the May 4 deadline, but kept working on it. This subject was too interesting and potentially valuable to relegate to academics. For the same reason, he didn't care too much about his grade. He had bigger fish to fry. His graded paper came back on May 25.

Bathed in warm breezes and surrounded by blooming flowers, James Jackson bounced down the street on a late May day. He had gotten an A+ on his term paper. But that wasn't what made him happy. What made this beautiful day perfect was the fact that he knew *exactly* how to reproduce Heather Woodruff's accomplishments.

John Pulaski's Term Paper

16 year old John Pulaski had expected much more resistance from Mrs. Gardner when he asked to do his term paper on Jackson Automotive Repair, named after its founder, James Jackson. Jackson had started a garage right here in this city, and because of a special troubleshooting process which he had taught his employees, in the 30 years since the company's founding, Jackson Automotive Repair had expanded to over 600 outlets, in 40 states and 2 foreign countries. Jackson was a local hero because he provided employment and advancement for

many people in disadvantaged neighborhoods.

Not only did Mrs. Gardner heartily approve of a term paper on Jackson Automotive Repair, but she somehow managed to set up a series of interviews with James Jackson himself, eventually leading to John's becoming a part time employee. As the interviews proceeded and the term paper took shape, John became convinced that Jackson Automotive Repair would be more than just a part time job.

James Jackson let John Pulaski read the 30 year old term paper he'd given Miss Rowe, who later married and became Mrs. Gardner. The more John learned, the more fascinated he became in Heather Woodruff's personal motivations.

Toward the end of his paper, John mentioned that Heather had never gotten revenge on John Wintekeller or her opportunistic first husband. They both retired wealthy. Yet Heather did get revenge. It was revenge on the real enemy, society's abuse of those under economic adversity. Heather had provided competent car repair to millions, more than a few of whom could have lost their jobs if a mechanic like Wintekeller had taken care of them. She had provided jobs to many disadvantaged by race, gender and especially age. She provided a road map for James Jackson, who employed thousands of "disadvantaged youth". Heather's revenge wasn't on a particular person, it was on economic adversity.

John Pulaski was only 16, but he knew his life's work would be at Jackson Automotive Repair, carrying Heather's Revenge to the next generation.

The Loser

Furtively looking around, he dropped the coins in the phone. This was a call he didn't want anyone from Pacific Stereo hearing. It's bad enough if your employer knows you're looking, but for an electronic technician to apply for a janitor job — that's a sure sign of a loser.

In fact, this was just the latest in a long, continuous slide down the ladder of success. After an unremarkable college stint culminating in a BSEE, he'd taken a job as a corrosion engineer. Overworked, underpaid and vastly under-respected, he'd taken a salary cut to become an electronic technician at a nationally recognized university. That's when the real trouble began.

His job was to repair electronic equipment, and he couldn't do his job. He could draw a high or low frequency model of a transistor, design you an amplifier or flip-flop, or use Boolean algebra to reduce a complex problem to a few gates. But he couldn't fix electronic equipment. Word got out. Some coworkers took pity, some issued warnings, and some were cruel. In response to a question concerning how to best fix a reel to reel tape recorder, a professor told him, with several others looking on, to pry up the front panel and drop a lot of oil in the machine. The loser had believed it, eliciting chuckles from the professor and several bystanders. It wasn't much different than teasing the cripple or the retarded person.

After six long months of non-performance, the loser was fired. He drifted between menial jobs for a couple months, and then was hired as an audio technician by Pacific Stereo. Every month Pacific came out with the Technician Production Report, a list of all technicians and their production. Since there were about 40 technicians, in a very real sense it was a "top 40". His first three months he was two or three from the bottom, thereafter moving up one or two places. Because Pacific paid on commission, his paycheck was half that of the engineers he'd graduated with. A total failure, he applied for a janitor job. At least maybe he could be successful at that...

9 Months Later

He got ten congratulatory phone calls his first hour at work. Word was out all over Pacific Stereo. His co-workers shook his hand and marveled at his accomplishment. The female cashiers all gave him the eye and wondered why they hadn't noticed him before. The December Technician Production Report listed him as #2. His \$7411 production and the top technician's \$8700 both broke the former production record. His commission for the month substantially exceeded the paychecks of his engineer friends. He smiled as he contemplated how good life had been the last few months.

His potential janitor job had fallen through in March, so he stayed at Pacific. Soon after, he discovered a method of repairing stereo equipment. He kept splitting the stereo in half, continually boxing the problem into a smaller area. His cousin said that made a lot of sense, because in computer programming the quickest search is a binary search.

Using his new stereo repair method, he made the upper half of the Technician Production Report in April. He was #15 in May, #8 in June, #6 in July, and #4 in August, and #2 in December. As one coworker succinctly put it, "word is out that you can fix hi-fi".

As if things weren't intriguing enough, he had made an interesting discovery while fixing his television. He had never received a minute of training on the repair or operation of televisions, yet he fixed the television. He used his stereo repair technique to repeatedly cut the remaining problem area in half, using a block diagram of a Sams Photofact book to decide how to divide. It dawned on him that given his stereo repair technique and a block diagram of a given machine, he could troubleshoot anything. Realizing that the technique and the block diagram were tools, he named the technique "Divide and Conquer", and the diagram "The Mental Model".

4 Years Later

He'd found the defective chip in the minicomputer, after a parade of programmers and hardware people failed. He was a junior programmer, but his Troubleshooting ability made him a top member of the team. They sent him when everyone else failed, and he always got his bug. By now he had Divide and Conquer and the Mental Model down to a science, and could fix anything. As time went on, his Troubleshooting ability opened

ever more important doors. In 1990 he wrote a book called “Troubleshooting: Tools, Tips and Techniques”, in 1995 he documented the “Universal Troubleshooting Process”, in 1996 he became the webmaster of Troubleshooters.Com, and in 2005 he wrote this book.

So if you tell me Troubleshooting can’t be learned or taught, you’re telling the wrong guy. I’ve been the worst, and I’ve been the best, and the sole factor in my transformation was what I learned about the process of troubleshooting.

Author’s Note

This true story demonstrates that effective troubleshooting depends mostly on performing the right diagnostic tests. It’s not rocket science. It is a key to personal and professional success.

I’m often asked where I learned Troubleshooting. Sometimes I joke that I majored in Troubleshooting in college. As this story shows, what really happened is I learned Troubleshooting the hard way, by failing until I learned enough to succeed.

You’ll run into people who say either you’re a born Troubleshooter or you’re not. Either you’ve got it or you don’t. It can’t be learned or taught. When confronted with such statements, just remember this story.

The Discovery of the Attitude

Author's Note

This story is based on actual events.

May 1989. George Bush (the first one) had just assumed the presidency. Poland and East Germany were striving for independence. In the USSR, Soviet Premier Mikhail Gorbachev flirted with capitalist-leaning reforms. And I discovered The Attitude.

Of course, I had been practicing The Attitude since 1979. It's just that I hadn't discovered it yet. It's precisely this paradox that makes teaching Troubleshooters such a challenge.

When the first George Bush was inaugurated, I believed Troubleshooting to be comprised of two Troubleshooting Tools: Mental Model and Divide and Conquer. Divide and Conquer is simply the act of repeatedly ruling out sections of the system under consideration until the root cause is discovered. The Mental Model is a map of the system in the mind of the Troubleshooter, usually implemented as a block diagram. I believed these two tools were the sum and total of my Troubleshooting expertise. Until a student came to me with a Lotus 123 macro problem she couldn't solve.

She was the smartest in her class. Her classmates came to her for advice. I agreed to help her. Using her knowledge of Lotus 123 (Mental Model), I slowly walked her through the Divide and Conquer process.

But it was tough. She was upset. At every step, she worried that "it can't be that", or she tried to figure all the possibilities instead of just running the test, or she insisted on trying for the immediate fix. Even after I explained Divide and Conquer, and she understood what we were doing, she still resisted. Almost in spite of her, we continued narrowing it down until we found the root cause.

I was puzzled. She was the top student in her class, she knew Lotus 123 like the back of her hand, but she couldn't trou-

bleshoot it. Why not? What was different about her than me? She had the Mental Model. And thanks to me, she knew Divide and Conquer. But it didn't help. What was missing? Was it a difference in attitude? YES! She was operating in panic mode, while I hunted that problem like a cold, deadly predator. The difference was astonishing.

A few days later, communism crumbled throughout Europe, THE ATTITUDE became my third Troubleshooting Tool, and eventually became the basis for steps 1 and 9 in the Universal Troubleshooting Process.

Marching Orders

Author's Note

This story Bottleneck Analysis is based on actual events. Notice the thought patterns. Which patterns will you adopt, and which will you improve?

The meeting included rank and file programmers, project managers, the IT director, and a high-level partner in the organization, who chaired the meeting. One item on the agenda was the Word-Processing Department's HP2000 printer, which was printing at only 1/3 its 20 page per minute specification. The time was 1989.

If you remember 1989, you'll remember you could buy your favorite song on 45 RPM vinyl. Bobby Brown ruled the airwaves with "My Prerogative", and Garth Brooks issued his first album. A 20 page per minute printer was the size of a kitchen stove and cost a king's ransom.

I volunteered to find out why the printer was so slow. The high level partner, who hardly knew me, thought for a second, then told me to leave the meeting immediately and begin solving the problem.

I quickly reproduced the symptom — 7 pages per minute. Printing several pages, I noticed the problem wasn't as bad on partial pages. In fact, using a file containing ten formfeeds and nothing more, it printed at its rated 20 pages per minute. The printer mechanism supported 20, but the per-character rate was slow. A page with a sizable graphic confirmed my suspicion. Several minutes!

Why so slow on a byte basis? In an effort to swap in an HP LaserJet II to confirm that these files should print faster, I noticed it was attached via a serial cable. AHAAH! That's probably the problem.

A call to HP confirmed that our printer came with a serial port. To obtain a parallel port, we needed to buy an expensive adapter card, and have an HP tech install it. Big bucks. I had to be *absolutely* sure this was the problem before spending the money to upgrade.

The answer was simple and elegant. I configured the computer's serial port to transmit at 4800, instead of its usual 9600 baud. If the serial connection were indeed the bottleneck, the printer's speed would be cut almost in half on large files. Indeed, pages with large graphics did take almost twice as long, ruling out the printer itself. I reported back to the partner, who authorized installation of a parallel port.

This illustrates that often the best way to prove a bottleneck is REDUCE its throughput. There are two advantages:

1. It's often easier and cheaper to reduce its throughput than to increase it.
2. If there's another part of the flow pattern that's almost as slow as the bottleneck, increasing the bottleneck's throughput could produce a deceptively small increase in system throughput, as the bottleneck ceases to be the bottleneck midway through the increase. Decreasing the suspected bottleneck's throughput, especially by a small amount, is the most accurate proof.

The work was ordered. Serious money was on the line. Would I look like a hero, or a bum?

A few days later, as Garth Brooks contemplated a career that would span 11 years and 100 million album sales, the Word-Processing Department's HP 2000 assumed its rightful role as a 20 page per minute printer.

Exploiting a Commonality

Author's Note

One divide and conquer tactic is to look for commonalities. This short story is based on actual events occurring when I worked for a radio and TV shop in 1981. The company and receiver model have been changed to protect a company that typically manufactures very good equipment.

In 1981 my shop was inundated with blown BJC 221 receivers. Some had blown fuses, some blown output transistors, some blown bridge rectifiers, and some blown power transformers. Worse yet, a few weeks after after repair, they'd come back blown again. For a while I used higher rated power transistors, but the same units would come back again and again.

Finally recognizing this as a serious problem, I lined up four blown BJC 221's on my bench, and looked from one to the next. A few minute's observation revealed that every one of them had at least one power transistor that had physically pulled away from the heat sink. From there it was easy to observe that every one had pulled away due to the melting of the plastic mounting washer. There were even some power transistors, still tightly engaged with the heat sink, whose mounting washer was melted and deformed.

The failure mode was now obvious. Normal heating caused the inferior mounting washer to deform a little, allowing the transistor to pull slightly away from the heat sink, reducing cooling for the transistor. The now hotter transistor further melted the washer, allowing the transistor to further pull away. This vicious circle continued until the transistor got so hot as to short circuit, at which time it drew catastrophic current. Some were lucky enough to only blow a fuse. Some blew the bridge rectifier before the fuse did its job. On a few unlucky units, the short blew the power transformer. What was clear was that the root cause was the inferior plastic mounting washers.

I ordered some high temperature mounting washers. For every BJC 221 in the shop, I replaced every mounting washer with a high temperature washer, and then recorded the serial

number of the unit. They never came back.

What makes this interesting is that when I phoned in the fix to the BJC company, BJC said their engineers in Japan had determined the solution to be higher power transistors, which I had already proven didn't fix the problem. Unbelievably, the washers cost about 4 cents per receiver, whereas the higher quality transistors cost about \$4.00 per receiver.

Easiest First Isn't Always Easy

Author's Note

Of all the troubleshooting techniques I teach, none meets more resistance than my advice to use easiest-first prioritization. This story walks you through my discovery and mastery of easiest-first. This story is based on true events, to the best of my recollection, although names of some people and places have been changed.

“This can't continue. Steve Litt violated policy and messed up the shop!” This was spoken by my boss, the service manager of the Pacific Stereo store at which I worked. He was angrily speaking to his boss, the regional service manager, who could fire me on the spot.

The regional service manager turned to me, saying “This log is pretty picked over.”. He was referring to the repair log, which I had “cherry picked”, meaning only the easiest repairs had been completed, with the harder ones left for later. This was against our “first in, first out” policy. The regional service manager didn't look pleased.

I stared back at my inquisitors, furious. A week ago my boss had suddenly taken a week's vacation, leaving the entire running of this two tech shop to me. I was a brand new tech, barely out of the trainee stage. Against all odds, this brand new tech ran the shop efficiently, keeping the repairs flowing, waiting the counter, doing the paperwork, ordering parts. I did my job plus the job of my much more skilled and experienced boss.

There's no free lunch — I had created the extra time by skipping the difficult repairs. In every other respect, my performance was miraculous. Their ingratitude made me livid, and I wouldn't back down. I was ready to quit over this. But I was cool...

“Did the shop's gross profit figures drop while you were gone?” I asked my boss.

“No”, answered the boss.

“Is the shop any messier than when you left?”

“No.”

“Other than the cherry picking, are there any problems with the shop’s paperwork?”

“No.”

“Did you receive any complaints about the service department from store personnel for the time I ran it?”

“No.”

“Did you receive any customer complaints about the service department for the time I ran it?”

“No.”

At this point the regional service manager spoke gently to my boss, “You know, he has a point.”

The situation defused. The argument was over.

In fact, the shop’s gross profit figures had *risen* while I ran it, and a big portion of my boss’s bonus depended on the gross profit figure. My boss came back to a neat and clean shop with all paperwork properly written and filed. In spite of the fact that this two man shop was run singlehandedly by an apprentice, the customer perception of the service was excellent. All told, the cherry picking was a small price to pay for leaving the shop in the hands of a raw newbie.

Working together, my boss and I cleared the log of the skipped over units within two days. My boss and I got good paychecks, the customers were all very happy with the service, and everyone lived happily ever after.

Of course, policy is policy, so both my boss and the regional service manager made a great show of warning me never to cherry pick again. And of course pecking order is pecking order, so I made a great show of agreeing.

But...

What the incident had really taught me was the power of easiest first prioritization, so while nodding and bowing and murmuring “of course”, I silently vowed to work “easiest first” whenever possible.

Which I did. I got very adept at testing a tough repair for intermittence while fixing five easy ones, then fixing the tough one when all the easy ones were done. The result was 2 hour turnaround time for most, and a couple days turnaround time for the tough repairs. Two day turnaround time was the chain-wide average for all repairs, so my slowest repairs were average.

Over time Pacific Stereo transferred me to better and better shops, as my knowledge of troubleshooting process improved and my numbers went up. At every shop, my tendency to cherry

pick got me in trouble. At every shop, I mentioned that maybe *everybody* should cherry pick, and we'd all work faster. My idea was shot down every time. My dream of a shop run on the easiest first principle seemed like the impossible dream. Until I visited the Santa Monica store...

The Santa Monica Pacific Stereo

I was based in Chicago, but wanted to move to California, resulting in a whirlwind tour of Los Angeles and San Francisco to see which city was preferable. Santa Monica is a suburb of Los Angeles. On my whirlwind tour, I roller skated into the Santa Monica Pacific Stereo, went to the service department, and introduced myself. The service manager proudly showed off his shop.

The service manager had instituted an easiest first policy. Incoming repairs went right on a small shelf in the main repair area. After finishing a repair, the tech completing the repair placed the finished repair on the shelves in back, went to the small incoming shelf, and picked what he considered the easiest remaining repair. The difficult repairs were done during the inevitable lulls when no new repairs came in.

Customers would drop off the repair on the way to work, and in most cases pick it up on the way home from work. The shop's repairs per technician ratio was double the average. The shop's storage area was neat and 3/4 empty. They never encountered the 10 minute searches for units that typical shops do. The service manager and the two techs were some of the highest paid Pacific Stereo employees nationwide. The shop's reputation was so good that people came from miles around to have the Santa Monica Pacific Stereo repair their audio equipment. For me, seeing that shop was vindication. I had been right all along.

The Transfer

I moved to Los Angeles (Venice Beach, actually) in June 1980 and continued working for Pacific Stereo, at the Torrence shop, which didn't allow cherry picking. Business as usual. I found all sorts of ways to put aside tough repairs, by waiting for parts or cooking intermittents, and whipped out all the easy business, waiting for slack times to complete the difficult repairs. The other technician was doing the same type of thing. The other tech and I pulled dirty tricks on each other.

The service manager looked at his competitive, policy violating technicians and shrugged his shoulders. Yeah, these two techs were a pain in the neck, but repairs were completed almost instantly, the shop's gross profit numbers were stratospheric, and the shop had enough spare capacity to repair 20% more gear.

The Southland Harbor Store

In late 1980 my boss asked me if I'd like to "float" to the Southland Harbor shop. "Heck Yeah!" came my reply. Floating was a synonym for making lots of money.

You see, if you were a good tech like my shopmates or me, the bottleneck on your earnings was the amount of business that came through the door. At the Torrence shop, we all spent considerable time with absolutely nothing to repair.

So I phoned the Southland Harbor shop's service manager. He said they were weeks behind and needed help. I told him I could do 10 units a day, but if he wanted me there he'd need to promise me I'd be able to pick the units I wanted, and that I'd never have to wait the counter or handle the phones. He was in trouble — he accepted my terms.

The Southland Harbor shop had a service manager and two beleaguered techs. The service manager was gone some of the time, and spent much of his other time fixing stereo gear. To a great extent, the running of the shop fell to the two techs, including waiting the counter and phoning customers. Obviously, you can't be fixing something when you're waiting the counter or phoning a customer. Policy at this shop was to work in log order, and also to call each customer the second a repair was done, and to keep calling throughout the day if the customer couldn't be reached (this was before ubiquitous answering machines and services). The bottom line is that the techs spent half their time with non-repair activities.

Upon my arrival, the service manager told his techs "watch this guy work — he's a professional." I thought it was a compliment at the time, but within a couple days the thought of his statement made me cringe.

I began cherry picking, and during the next two days I fixed 22 units and made myself about \$350.00. That might not sound like much for two day's work today, but for an electronic technician in 1980, it was a Midas fortune.

At the end of the second day I told the service manager this would be my last day. I didn't tell him why. In fact, the reasons

were selfish. All the easy units were completed, and most of the remainders were either irreparable junk or stuff the other two techs had already started.

Also, I really hated the way this shop was run. The service manager got a salary plus commission on the gross profit. If memory serves me, gross profit on a tech's work was 62% of the labor charge if a tech did the work, or 100% of the labor charge if the service manager did it. Techs got no salary, just 38% of the labor charge on their repairs. When a tech worked the counter or the phone, he worked without pay. To me, that just isn't right. It's OK when the service manager is at lunch or sick, but normally I don't believe it's right to ask someone to work without pay.

Beyond that, if the service manager had let his techs do their job and only their job, and had concentrated on getting more work in the door, his gross profit figures would have been higher and he'd have made more money. The fact is, in my two days in that shop it became obvious that his techs were excellent — perhaps better than me. They just needed a fighting chance.

I left Southland Harbor and returned to Torrence, vowing that if I were ever a manager, my techs would spend all their time fixing equipment, and get to do the easiest ones first.

The Covina Shop

In early January 1981, an opportunity opened to manage the repair shop at the Covina Pacific Stereo. There would be one technician and me. I accepted the challenge.

What a challenge it was. The shop had a 2 week backlog. The paperwork was an unholy mess. The phone rang off the hook with irate customers. The tech, a young guy with little experience, was in way over his head.

This was a classic case of Repair Time Avalanche. Repair time was consumed by phone calls with irate customers, paperwork, and digging around through mounds of half repaired equipment. With less repair time, less repairs got done, so customers got even more irate, requiring was more phone, paperwork, and digging around. Which led to less time to repair...

I instituted the classic strategy against Repair Time Avalanche. The tech was told to do the easy ones first. I waited the counter, and took in only easy repairs. I brought in a floater — one of the guys from the Santa Monica shop.

Then I pulled the hypocrisy of a lifetime, ordering the floater

go in log order! My command was given to prevent a situation where, after the floater was gone, my tech and I were stuck with tons of old, garbage repairs. The floater refused. He cherry picked just like the rest of us, and made a fortune.

The afternoon of the second day I thanked him and sent him back to his home shop. He'd done such a great job that most of the remainder was tough work, and I wanted my tech to profit from what little easy stuff remained. It was the classic strategy of being loyal to an employee at the expense of a contractor.

The next couple weeks I waited the counter, handled the phones and did the hardest repairs. My tech did the easiest ones first, and made more money than a 24 year old high school graduate has a right to make.

By the end of the first month, my tech made more than he'd ever made in his life, and due to his work and that of the floater, my gross profit was high enough to get a bonus. The entire backlog was gone. Customers dropping off their units before noon were told "call back this evening, and it will probably be ready". We had a 6 hour turnaround time for everything but the toughest units and those for which the parts weren't in stock.

Turnaround time was never a problem again. Now our bottleneck was lack of work. My tech and I polished off most units within an hour of coming in. We spent a lot of time sitting around. I made all sorts of marketing plans, but it's hard when you have no advertising budget and no authority to hang door hanger flyers around town. My tech quit in March, and I quit in April.

Steve's Stereo Repair

From April 1981 to July 1982 my career path was much too convoluted to burden you with. Suffice it to say that in July, 1982, in the middle of a horrible recession, I opened STEVE'S STEREO REPAIR out of my studio apartment in Venice California. I didn't make a fortune but I got by. My shop hours were Tuesday and Thursday 8am to 10pm, and Sunday noon til 10pm.

I worked easiest first. Most people brought in their repairs on the way to work, and picked them up on the way home. Steve's Stereo Repair got a reputation for doing good work, and being *extremely* fast. My toughest competition was Pacific Stereo in Santa Monica — all my other competitors were no competition at all. Had more people known about me I *would*

have made a fortune. On my long workdays, when I wasn't fixing something, I was doing paperwork.

My non-workdays were spent picking up parts for repairs and roller skating and body surfing. Did I mention that my apartment was right on the beach?

It was an idyllic existence, and it would have gone on forever, except I fell in love with computers and got a programming job in 1984.

Pacific Stereo went bankrupt in 1985. Steve's Stereo Repair fixed its last stereo in 1986. But I've practiced EASIEST FIRST in most of my activities ever since.

Universal is a Relative Term

Author's Note

This story is fictional. Any resemblance between its characters and real people, alive or dead, is purely coincidental. Any resemblance between organizations portrayed in this story and real organizations is once again, coincidental.

The image in the mirror was pretty as ever, but Sandy Warner wasn't happy.

Worse yet, she didn't know why.

It was the morning of October 6, 2005. Why wasn't Sandy happy? Her thoughts drifted to the past.

She'd been born Sandra Diane Kazinski in the spring of 1952 — a time when one out of every twenty newborn baby girls was christened Sandra, and that five percent were destined to be the hottest girls in school. It was true, she saw it for herself, her schoolmates named Sandy were always hot (back then they called it “foxy” instead of “hot”), and Sandy Kazinski was no exception. In seventh grade Sandy's looks kept her out of the snubbed middle school masses, and her friendly disposition kept her from being perceived as one of the snobs.

In high school she excelled both on the debate team and the cheerleading squad. Boys up and down the social ladder asked her out. Sandy's math teachers noticed her exceptionally logical mind, and sophomore year Sandy was promoted to advanced math.

Based on her 754 Math SAT score and her debate team success, Sandy received a partial scholarship to a state university, where she maintained an A average in political science. She was unpopular her first semester because she neither drank booze nor smoked marijuana, and was therefore suspected of being an undercover narcotics officer. By second semester, her wavy brown hair, big brown eyes and friendly disposition made her every boy's dream girl.

Sandy graduated in June of 1974 with a 3.81 grade average,

and absolutely no job prospects. She ended up working for Barnett Stereo as a salesperson working on commission. Sandy read several books on stereo gear, talked to the store's repair techs to find out nitty gritty tech details, and became a human encyclopedia of stereo features and benefits. Out of the store's six salespeople, Sandy quickly became number two. Female customers found her attentive, informative, sensitive and non-judgemental. Male customers bought from her out of appreciation of her beauty, all the while justifying their purchase with the voluminous technical information she presented. Sandy couldn't sell to couples. No matter how much she directed her attention to the woman, the man would invariably either flirt with her or gaze at her with awestruck desire. In either case, the woman would quickly pull back.

The number one salesperson was Bob Warner. Bob had boundless energy, talked fast, and could help three or four customers at a time. He was tall, good looking, friendly, and humorous. Bob's commissions were huge. He made twenty two thousand dollars a year at a time when the average engineer made less than twenty. Bob once joked that if he and Sandy married, they'd make 90% of the sales commission in the store. Sandy figured it would be more like 75%.

After eight months working together, Sandy and Bob fell in love at a company picnic. It happened suddenly, and within two months they were living together. Two years later they were married, and their son Jason was born two years after that. Sandy quit work to raise Jason. Bob got a forty thousand dollar a year job selling machine tools. By the end of the 1970's, Sandy and Bob had the All American Dream – a loving marriage, a child, a house, a nice car, plenty of money in the bank, and plenty more where that came from.

During the next two decades Bob worked at ever more lucrative sales jobs while Sandy kept house and took care of Jason. They had a perfect marriage and a house full of love. Jason did well in school.

Sandy managed the family's finances, including investments, investing about a thousand per month, and in later years two thousand a month, in good stocks that paid good dividends. She wisely diverted investments to a federally insured bank account between February 1987 and January 1989, thereby avoiding most losses from the October 1987 stock market crash. She again began diverting investments into savings accounts in late 1998, at which time Bob and Sandy had over a million dollars in the stock market, a fully paid house, and Jason most of the way through college. From her handling of the family fi-

nances, Sandy was proficient with computers and the Internet. They were wealthy, and expected to just get wealthier. They were wrong...

September 11, 2001

Bob came home in a foul mood. He couldn't work, and he was worried about Sandy. Some fools had knocked down New York's Twin Towers and damaged the Pentagon. No revenge short of nuclear obliteration would satisfy Bob.

Sandy worried about further terrorist attacks. She also worried about the economy, which was getting shaky. The Dow Jones Industrial Average had doubled between 1988 and 1994, and then doubled again between 1995 and 1998, and then gained another 30% in 16 months. From that point, which was in mid 1999, the Dow Jones had basically vibrated in place, trending slowly up until early 2000, then trending slowly down. The long boom economy was winding down, and the "new economy" was quickly becoming the "dot com bust". The presidential election nine months ago had been decided by the Supreme Court, with a sizable portion of the populace believing the election had been rigged. The nation was due for a recession any time, and the best that could be hoped for was a "soft landing". With the nation under attack by an unknown enemy, a depression or serious recession was more probable than a soft landing.

Sandy and Bob spent the rest of September 11 discussing the future, calling Jason at his new apartment to make sure he was OK, and gazing in a sky eerily devoid of airplanes, wondering if an atomic bomb would be next.

August 30, 2002

Bob was laid off. 70% of his company's machine tools were purchased by airplane manufacturers, and the airline business was in ruins. Bob and Sandy had to start paying their own health insurance. Within 18 months their COBRA insurance would lapse and they'd need to find individual policies, which for people in their 50's would be very expensive. The Dow Jones had closed at \$8663.50 — the same as it had been in April 1998. Bob and Sandy were far from broke, but the future wasn't so bright. They were no longer millionaires — a lot of their stocks had been tech stocks. With no money coming in and needing for the first time to pay their own health insurance, their budget leaked like a sieve. While Bob joined the unemployed masses

pounding the pavement in search of scarce jobs in a brutal economy, Sandy started a business maintaining computers.

March 2003

Unlike the rest of recession ravaged America, Sandy was having a good time. She charged twenty dollars per hour, for computer configuration and repair, making an average of \$2500.00 per month. It paid for their health insurance and food. They still had to pay property taxes, car repairs, house repairs and incidentals out of savings, but at this rate they could hold out for years even if Bob didn't find work. Better yet, Sandy would soon raise her rate to thirty dollars an hour, a rate at which she could pay all the household's expenses. She'd developed a reputation for lightning quick repairs, whether hardware or software. Her customers all said Sandy was a genius.

Sandy graciously accepted their complements, but she knew the real source of her productivity was the Universal Troubleshooting Process, as described on the Troubleshooters.Com website and in Steve Litt's book, "Troubleshooting Techniques of the Successful Technologist". The Universal Troubleshooting Process, or UTP for short, worked every time. Bob was jealous of Sandy's new found success. The jealousy was regrettable, but given the circumstances, understandable.

January 2004

Happy days were here again. Bob had a new job. It didn't pay as much as his last one, but everyone was working for less these days.

Everyone except Sandy, that is. Sandy billed between 30 and 40 hours a week at \$35.00 per hour. Bob was making even more. Their household income was over a hundred sixty thousand per year. They had begun investing again, and the Dow Jones Average was once again above ten thousand. They hadn't yet regained their millionaire status, but it looked like they would within a few years.

Bob began asking Sandy to work less hours. Sandy didn't want to. Getting better and better at the Universal Troubleshooting Process, Sandy was taking more and more pride in her work. She had stopped watching television, stopped reading fiction books, and now spent spare time reading about computers and troubleshooting.

October 6, 2005

Snapping out of her reverie, Sandy once again saw the sad woman in the mirror. She decided to use the Universal Troubleshooting Process to find the root cause of her unhappiness. She prepared her attitude, vowing to be completely rational about the process of finding the cause of her unhappiness. She made a damage control plan, deciding that she would not take prescription drugs without exhausting other options, and she definitely wouldn't use alcohol or recreational drugs.

She described the symptom — a disembodied unhappiness. The excitement had left her life. It had starting affecting Bob too. There's only so happy a man can be when his wife is unhappy.

In order to reproduce the symptom, Sandy wrote down all her thoughts while in a funk. She felt blah. She resented Bob for his continuing suggestions that she cut back on her work, which was now the one thing that brought her pleasure. She felt old, even though she was a good looking and energetic 54. She still felt blah.

Over the next week she tried corrective maintenance. She ate better, exercised more, took vitamins, and made sure to get 8 hours of sleep every night. Still no joy.

October 13, 2005

With corrective maintenance yielding no solution, Sandy was forced to begin the process of narrowing the root cause scope. It was either work or personal. She started examining work.

For a week she dropped her work back to 10 hours, but in fact that just made things worse. Then she quit work for another week, and it was absolutely terrible. Then she worked 60 hours a week for a couple weeks. It was better than not working, but not much. She was exhausted.

Nothing she could do to her work made things better. The root cause must be personal. Was it her relationship with Bob, or her relationship with herself? She began going to church for the first time in years. No help. She rearranged the house. No joy. She went for long walks in the sunshine and long drives in her car. Nothing. She went to movies with and without Bob. They just reminded her of her own emptiness.

October 24, 2005

More and more, it was looking like the root cause was Bob. Sandy tried having long talks with him. It was boring. She tried biking with him and throwing a flying disk with him. Depressing. She tried having sex with him more often. He liked it, but it made no difference to her. She tried having sex less often, and they were both miserable.

Sandy was snappy with Bob. He wasn't hot looking anymore. He irritated her. Her whole life, men on the street and in stores and offices smiled and flirted with Sandy. Being a nice person, she always smiled back. But now when she smiled back at strange men, it was with a hunger.

December 2, 2005

Sandy gave Bob the news when he came home from work. Tomorrow was Saturday, and she wanted him to move out for awhile. She needed a separation to sort things out.

Bob looked like she'd shot him in the stomach with a 45. His eyes shone with tears. He stayed up most of the night trying to convince Sandy not to do this. Finally they both fell into a fitful sleep. Bob slept until noon, and then took a few essentials and drove away in his car. At 5pm Sandy got a terse call from Bob telling her he was in room 404 of the Delaney Hotel, and giving her the phone number. That night Sandy met a guy at grocery store and went on a movie date with him. It was fun.

In fact, Sandy went on five dates with five different men in the next five days. She also spent a lot of time with her girlfriends, and managed to work 30 hours.

December 10, 2005

It was Saturday night and Sandy went out for a second time with one of the guys she'd met during the week. He took her to dinner, then to a movie, then hand in hand they walked through the cold winter's night. She kissed him a tender kiss when he dropped her off at her door.

The next day Sandy spent the day alone, doing nothing, relaxing. At the end of the day she realized she still wasn't happy. Maybe Bob wasn't the root cause. Sandy considered bringing Bob back, but hesitated. She wanted to absolutely test all aspects of a Bobless life before bringing him back. To do otherwise wasn't fair to him. She didn't call him.

December 12, 2005

“What the heck is going on Mom? Dad has a girlfriend! How did this happen?”

Hearing Jason’s words over the phone, Sandy felt weak and dizzy. Her heart pounded. She asked Jason what he meant. The gist of Jason’s story went something like this:

Jason had called Bob’s cell phone a few minutes ago. As he talked with Bob, he overheard a female voice telling Bob the shampoo was under the master bathroom sink, so Jason asked to speak to Sandy. After an awkward pause, Bob had said that Sandy wasn’t there, which of course led to Jason’s next question — who was talking about shampoo?

Bob related the whole sordid tale. Sandy had kicked him out of the house a week and a half ago. Her only explanation was “to sort things out”. So Bob started going out with Tiffani. She was his girlfriend now, he was practically living with her, he was at her house now, and yes, he was in love with her. Tiffani was 27 years old.

Sandy reassured Jason everything would be OK. This kind of stuff happens to long married couples.

After the phone call, Sandy cried for an hour. These things *don’t* happen to normal couples. This was very bad. Divorce was the most likely outcome. Sandy was livid that Bob would commit adultery just because of a temporary separation. She almost phoned him to give him a piece of her mind, and then to beg. But somewhere in the back of her mind, a little voice whispered she wasn’t in any condition to make this thing better with a phone call.

After an hour, Sandy stopped crying and her trademark logic took over.

Sandy’s Evaluation

An hour after hanging up with Jason, Sandy began evaluating what had happened, and it wasn’t good. Her husband was practically living with a 27 year old girl with whom he was in love. Getting Bob back would be difficult, to say the least. Sandy had pushed him into Tiffani’s arms, and later discovered that Bob wasn’t the cause of Sandy’s unhappiness.

Shaking off all emotion, Sandy realized that for the first time, the Universal Troubleshooting Process had failed her, and failed her catastrophically. Why had the UTP failed?

First, it was obvious she had incompletely performed “Step 2: Make a Damage Control Plan”. She hadn’t stopped to think

that a man on his own might find another woman. But of course that wasn't the only downside risk she'd ignored. A man put out on his own could have just as easily committed suicide, drunk himself into a stupor and had a fatal accident, started a fight that ended with him in prison, or maybe just left town leaving no forwarding address.

In other words, any diagnostic test to rule out her husband would have been too risky. But why? She'd never had serious problems finding safe diagnostic tests before.

Sandy had to get out of the house. She didn't trust her emotions to drive, and she didn't want her neighbors seeing her around the neighborhood. So in the end, she went out to her back yard and paced.

It was 8pm, the sky was dark, and big fluffy snowflakes drifted from the sky. Sandy shivered as she thought about what had gone wrong, and how she could fix it. Temporarily separating from your husband was guaranteed to be too risky a test to perform, but why? As the snow coated Sandy's brown hair, she realized the problem.

When you replace a software driver, the replaced driver doesn't flee to a rival. When you swap a circuit board, the old one doesn't get drunk, belligerent or withdrawn. But, when you perform a diagnostic test involving a human, there's no telling what that human will do, or what damage it will cause.

For the first time, Sandy understood Steve Litt's admonition to use the Universal Troubleshooting Process *only* on well defined systems. A fuzzily defined system, such as a human or an organization of humans, whether a marriage or a multinational conglomerate, offers few safe diagnostic tests. A fuzzily defined system offers no way to predict the reaction of individual elements. After all, human behavior is not well defined.

Imagine being a company's marketing director. You suspect the advertising agency you've hired is responsible for your abysmal sales, so you replace them. It takes a year or two to determine whether things truly improved with the new agency. If they did not improve — perhaps they even got worse — there would be no hope for rehiring the original agency, at least for the original price. The original agency would have either gone out of business or taken on new clients, and would not be disposed to going back with your company.

The UTP isn't absolutely useless in troubleshooting life situations, Sandy realized. Preparing one's attitude is essential when tackling any problem, defined or fuzzy. As she had so unfortunately proven, making a damage control plan is also vital. So is describing the symptom. Reproducing the symptom

is not advisable when troubleshooting a fuzzily defined system — you can't predict what consequential damage it could cause. Corrective maintenance is a valid activity, as long as you define it as maintenance that should have been performed anyway. Getting more sleep, eating better and taking vitamins are certainly valid.

What is *just plain dangerous* is the standard divide and conquer method of narrowing the problem to the root cause. Step 6. Fuzzily defined things such as people could react to a diagnostic test in completely unexpected and damaging ways.

Steps 7, 8, 9 and 10 are certainly valid in solving any problem, well defined or fuzzy. So the usefulness of the Universal Troubleshooting Process in solving fuzzily defined problems looks something like this:

- Step 1: Prepare: Essential
- Step 2: Make a Damage Control Plan: Essential
- Step 3: Get the Symptom Description: Essential
- Step 4: Reproduce the Symptom: Dangerous
- Step 5: Corrective Maintenance: Useful if done appropriately
- Step 6: Narrow it Down: Devastatingly dangerous
- Step 7: Repair/Replace the Defective Component(s): Essential, if one defines this broadly enough to include management of expectations or redesign of the system
- Step 8: Test: Essential
- Step 9: Take Pride: Essential
- Step 10: Prevent Future Occurrence: Essential

Some day Sandy would figure out how to replace steps 4 and 6, but right now she had more immediate concerns — how to save her marriage. As she paced and thought, Sandy's exquisitely logical mind began to develop a plan that went something like this:

If Sandy cried, moaned, or demanded, it would drive Bob further into Tiffani's arms. After all, Sandy kicked him out, not telling him for how long or whether it was permanent. In every respect except legally, she had ended the marriage. Bluntly, Sandy was more at fault than Bob. If Bob was the type to be swayed by guilt, he wouldn't have begun the affair with Tiffani so soon after separation. Guilt or threats wouldn't do it.

Whether she liked it or not, Sandy would have to play the role of "the other woman", and play it exceedingly well.

December 13, 2005

Bob could hardly keep his mind on his work. His every thought was of Tiffani. He counted the minutes until he could see Tiffani. She was 27, with blond hair, a face more beautiful than any movie star, and a figure that was pretty, perfect, and earthily sexy all at the same time. She was unique. Bob couldn't believe his good luck.

He'd known Tiffani for a couple years. They both had their morning coffee at the coffee shop on the first floor of his building. She was a second year associate at Jackson, Goldstein & Brubaker. For the past year Bob suspected Tiffani was hitting on him, though always in a subtle manner that could be explained as "just being friendly". It was insane that this goddess would hit on a 56 year old salesman, but he suspected it nevertheless. He always spoke of Sandy so as to head off any possible propositions, and the relationship remained perfectly respectable. Then Sandy kicked him out of the house on a Friday night.

The following Monday morning Tiffani greeted Bob in the coffee shop, but Bob was naturally in a bad mood and made little conversation. Walking down the street after leaving Tiffani at the coffee shop, Bob's mind went through the three step sequence that causes many women to regret mistreating their men:

1. It would *serve her right* if I had an affair with Tiffani
2. Yeah, I *should have an affair* with Tiffani — it would serve her right
3. *Yeah :-),* I should have an affair with Tiffani

The next few days, he went to the coffee shop early and stayed as late as possible, hoping to meet Tiffani. He was rewarded on Thursday when Tiffani came in. This time, when Tiffani flirted with him, he flirted back. This time, when Tiffani touched his arm, he touched hers. This time, he made Tiffani giggle, and then he laughingly held her hand. This time, he invited her out to dinner, which she accepted. This time, he stayed at her house all night. It had started as revenge against Sandy, but now Sandy was the last thing on his mind.

That first night, Tiffany confirmed that she'd had serious feelings for him for over a year. She loved his easy humor, his quick reaction times, his maturity, and his looks. When Bob told Tiffani that Sandy had kicked him out, she said "You'll never have to worry about me doing that!"

One more thing: Tiffani was smart. Bob found out just how smart when he and Tiffani “double lunch dated” with Jake Turlington, another associate at Jackson, Goldstein & Brubaker, and Jake’s wife Heather. Tiffani and Heather conversed on politics, travel, men, food, computers, psychology, management and law, speaking in quick, logical and pithy statements and replies. Bob felt like a six year old in the presence of PhD’s. Jake grilled Bob on sales techniques, contending that 80% of law was sales, and the attorney who could sell always made more money than the attorney who could win cases.

Tiffani was perfect, and Bob was grateful that Sandy had given him this chance to be with his real true love. After a week, he was already living with her. She had already loved him for a year. If things kept going this well, he’d marry her soon, always assuming Sandy was reasonable about the divorce.

December 16, 2005

Sandy heard the key in the lock, Friday evening just before 6pm. She ran upstairs and looked out the window, confirming Bob’s car was in the driveway. Then she went into her closet and jumped into one of three outfits she’d put aside for when Bob came over. Looking in the mirror, she saw she looked good. The third time Bob called her name, she answered.

Sandy walked downstairs, and smiling, said “Hi Bob!”

“Sandy, I can only stay a minute — I just came to get some clothes.”

Sandy expected that exact reaction on a Friday night — he needed the clothes for a date with Tiffani tonight. Not letting her smile falter one bit, Sandy replied “That’s fine Bob. You’re looking good today!”

“Sandy, we need to talk, but there’s no time right now. Things have changed Sandy.”

“Bob, that’s fine. You just let me know when, and I’ll be sure to be here.”

“Sandy, you’re not taking this seriously. You kicked me out of the house, and things have changed.”

This was the moment. Sandy had to play it exactly right. She opened her big brown eyes and smiled the soft, feminine smile she’d practiced in the bathroom mirror the past two days. “Bob, I talked to Jason, and I know *exactly* how serious this is. When you want to talk, *whenever* you want to talk, let me know and I’ll make it a point to be here.”

Sandy faced Bob directly, took a step forward, saying “Whenever you want to talk, we’ll talk.” Then, ever so lightly, Sandy held Bob’s hands in hers, looked up at him with her soft brown eyes, and said “Don’t worry Bob, I’ll do whatever you want.” She flashed a quick, gentle smile, let go of his hands, smiled again, and said “I’m going to take a walk outside for awhile so I don’t make this any more awkward than it has to be. Bye Bob, it’s good to see you.” Sandy smiled again, walked out the door, down the block, around a corner, went into some bushes and cried.

Even as she cried, a part of her was congratulating herself on the spectacular acting performance. From context, it was clear that her “I’ll do anything you want” comment was a reassurance about taking seriously the changes he had in mind. But Bob was male, and to males over the age of 13, a female saying “I’ll do anything you want” usually produces at least a subconscious thought having nothing to do with context.

December 20, 2005

Bob walked in for their “talk” at 7pm, as agreed. As agreed, they had both already had eaten dinner, separately. Sandy had changed into the perfect outfit for the occasion — a casual dress that gently emphasized the contrast between her hips and waistline. Sandy arranged two chairs, 3 feet apart, so they could face each other. They sat down, and Sandy started.

“Well Bob, what should we do about this?”

“Sandy, there’s no easy way to say it. I want a divorce so I can marry my new girlfriend Tiffani.”

Sandy had rehearsed for this moment a hundred times in her mind. The first few rehearsals had been full of bitter accusations of adultery, but Sandy realized that would be counterproductive, and besides, Sandy bore at least half the responsibility for this screwup.

Sandy smiled a melancholy smile. “OK, we’ll divorce. I guess I really blew it, didn’t I?”

Bob became angry. “That’s an understatement. How stupid can you be? You threw me out of the house and you’re surprised that I found another woman? Did you think no other women would find me attractive?”

Sandy gazed at Bob through teary eyes. “Bob, I know I made a mistake. Please, please don’t mock me for it. I made a mistake that cost me the man I love. Bob, I’ll divorce you, and I’ll be reasonable about the divorce. This was my fault, but please,

try not to hurt me. Let's try to stay friends."

Bob's expression softened. "I'm sorry Sandy, I should have just stuck to our future, and not brought blame into it. You're being really reasonable, and I thank you for it."

Sandy got up, walked around the living room, and watered the plants placed strategically around the room. As she bent over and straightened up at various angles, she wanted to make sure Bob would get a good look at the woman he might lose forever.

Bob stood up and stretched. Sandy turned toward him, eyes shiny with tears. Sandy walked toward him, gently held his hands, and looked in his eyes. She gently touched his waste, slowly ran her hands up his shoulders, reached up and clasped her hands behind his neck, arched her back, and looked in his eyes. Bob just stood there. Sandy went up on her tiptoes and lightly, quickly, and ever so gently kissed Bob. She looked in his eyes again, and kissed him a little longer. Bob's hands wrapped around Sandy's shoulders. Sandy kissed Bob long and passionately, and after a couple of seconds he returned her passion. An hour later Sandy became "the other woman". She hadn't even needed to execute plans B, C or D.

By 10pm Sandy was urging Bob out the door, telling him he needed to get back to Tiffani before she suspected anything. Bob left after kissing Sandy furiously at the door.

January 21, 2006

What a strange journey the last five weeks had been for Bob. He'd been kicked out of his house, fallen in love with a goddess, moved in with the goddess, and soon afterward had begun an illicit relationship with his own wife, cheating on his girlfriend. He knew it was wrong but he couldn't help it — Sandy was irresistible.

On Christmas day he'd visited Sandy for a couple passionate hours. On New Years Eve day, he and Sandy had their own New Years Eve party at noon, and then that night he'd gone with Tiffani to a grand bash at Jake and Heather's.

As the new year dawned, Sandy kept looking better and better, while Tiffani looked worse. Tiffani's beautiful face began looking bland. Her perfect figure became merely entertaining. Her blond hair and ivory skin looked washed out when compared to Sandy's brunette beauty. Her towering intellect began coming up short when compared to Sandy's logical genius. By mid January there was no denying it — Bob wanted Sandy, not

Tiffani.

But it must be handled just right. Sandy kicked him out once, and she could kick him out again. He needed to find out why she kicked him out, and if the underlying cause of his dismissal had gone away.

Today was the day to find out. It was Saturday. Bob was supposed to be golfing, but instead was spending time with Sandy.

“Sandy, I don’t want to start a fight, but why did you kick me out?”

Sandy told him the whole sordid story: Her disembodied unhappiness, her ill-advised use of the Universal Troubleshooting Process to try to find the root cause of the unhappiness, and the diagnostic test involving separation. She explained that at the time she didn’t realize that such diagnostic tests are dangerous, and found out the hard way. The Universal Troubleshooting Process works only for well defined systems, and can be disastrous if used on fuzzily defined systems. In the case of the Universal Troubleshooting Process, “Universal” is a relative term.

That’s not to say most of the Universal Troubleshooting Process isn’t applicable to generic problem solving. Except for steps 4 and 6, all the steps are generic to all problem solving, with a few caveats. Corrective Maintenance must involve only those things that should have been done anyway. The equivalents of wire wiggling and freeze spray could be dangerous in generic problem solving.

Step 7, Repair or replace the defective component, must be defined generically enough that the defective component could be expectations, and also that the defective component could be the entire system design.

“The bottom line”, Sandy continued, “is that although the Universal Troubleshooting Process is the quickest and best way to fix a broken well defined system, for a fuzzily defined system it degenerates into a bunch of handy habits.”

Bob understood the monologue because Sandy had explained the Universal Troubleshooting Process a year before. What she said made sense in a Sandy sort of way. What was really incredible was that she had kicked him out as a diagnostic test.

“Let me get this straight Sandy”, Bob said with a wry smile. “You kicked me out of my house as a *diagnostic test*?”

Sandy blushed. It started from the bottom of her neck and rose, covering her entire face a couple seconds later. She glowed. It was cute.

“I made a mistake. I got my facts wrong. I didn’t consider

the risk of your finding someone else. I was so busy diagnosing that I didn't think."

"Do me a favor and think next time." he chuckled.

Sandy smiled. "Oh, you say there will be a next time?"

That is how the negotiations began. Bob was now convinced that Sandy's blunder was just that, a mistaken use of the wrong tool for the wrong job, not to be repeated. He wanted to live with Sandy forever. No Tiffani. No sneaking around. But he also wanted to make sure he never got kicked out again. They talked, cajoled, negotiated and loved. In the end they forged a sort of treaty:

1. Bob and Sandy will live in this house as husband and wife.
2. Sandy will never again kick out Bob, except if their relationship becomes terminally unworkable.
3. Bob will never kick out Sandy, except if their relationship becomes terminally unworkable.
4. Bob will never again cheat on Sandy as long as they remain married.
5. Sandy will never cheat on Bob as long as they remain married.
6. Sandy and Bob will talk about their problems rather than performing go-it-alone experiments.

They wrote it down, signed it, went to the drug store, bought a frame, framed it, and hung it on the wall. Bob went to Tiffani's condo and dumped her.

Tiffani cried pitifully, proclaiming her undying love for Bob. She begged him to stay. Tiffani said they could work it out.

Bob believed everything she said, but his heart was with Sandy. While packing his stuff and throwing it in his car, Bob explained to Tiffani that their entire relationship spanned less than 2 months, and she'd quickly get over it. There were millions of guys out there, and with her looks, Tiffani could have her pick. She'd find a guy better than Bob. After a half hour heart to heart in Tiffani's parking garage, Bob drove away. He felt like a load had been lifted from his shoulders. Bob moved back in with Sandy and lived with her for the rest of his life.

He never saw Tiffani again, but years later, Bob recognized Tiffani's friend Heather at an auto repair shop called "Heather's Automotive Repair" and asked about Tiffani. It turned out that a couple years after Bob broke up with her, Tiffani married a guy her age with a used car lot. Together, they built it up into a real car dealership. Tiffani was gloriously happy with her

husband and seven children.

April 8, 2006

Sandy looked in the mirror, combing her hair in preparation for dinner with Bob and a movie. She still had a sadness whose source she couldn't identify, but almost losing Bob had put it in perspective. She could live with this sadness. She didn't like it, but she could live with it. She and Bob discussed it frequently, trying to find a way to make it better. Bob had told Sandy that his mother had told him you can't expect to be happy all the time, and if you do expect constant happiness, the unfulfilled expectation will make you more unhappy. This made sense to Sandy, and she began to appreciate the happy moments where she found them. One day at a time.

Sandy still used the Universal Troubleshooting Process every day. Her reputation and profits continued to skyrocket. One day a client offered to pay Sandy to solve a business problem using the Universal Troubleshooting Process. "Never in a million years" replied Sandy, telling the client the story of her trial separation from Bob. "You've got to find the right tool for the task.", she summarized.

As Sandy combed her hair, Bob walked up, hugged her from behind and smiled. Sandy smiled back. The image in the mirror was even prettier now that Bob was in it, and Sandy Warner was getting happier all the time.

Author's Note

When learning of the Universal Troubleshooting Process, some people remark that it can be used on absolutely any problem. I always tell them that using it on a fuzzily defined system isn't always effective, and can be risky, as this fictional story illustrated.

The Lessons of THE ARTIST

Author's Note

This true story can be read at several levels. On one level it celebrates toolsmanship and inspiration. On another level it's a productivity pep talk. If you read between the lines, this story demonstrates how similar all human activities are, and the benefit that accrues to those who observe and question.

This story is dedicated to my wife Sylvia, who put up with my silence on the two hour trip back from Port Hueneme, California, and encouraged me to analyze what I had seen.

I spent an hour watching a guy work, and it changed my life.

Was he a fellow Troubleshooter, master programmer or a best-selling author? No, he was a street artist.

His Latin Lover looks showed through the gas mask worn as protection from paint fumes. He knew maybe 200 words of English. Working with spray paint, stencils and rags on the sidewalk of Port Hueneme's tourist area, he painted the most beautiful ocean and sky scenes imaginable. Every one custom made for the customer. In 15 minutes. For \$20.00. I saw it, I timed it. Every 15 minutes, another \$20.00 check. \$80.00/hr. A recession, combined with shutdown of numerous military bases and departure of the defense industry, was choking California. And this street artist was making \$80.00/hr.

The women in the 100+ person crowd surrounding THE ARTIST raved about his beautiful paintings, and how much they wanted one. The men, every one of whom had done the same timings and calculations as I, wondered aloud if they had chosen the right career. Everyone in that crowd recognized they were seeing something extraordinary. I saw opportunity.

I didn't question my choice of career. My best drawings are stick figures. Art is out of the question for me. But my computer program design experience told me that THE ARTIST was actually designing his art, and then implementing it. So my question became, "Could I use THE ARTIST's techniques to

achieve THE ARTIST's extraordinary productivity?"

My experience in the Quality Movement also helped. I had learned that most human endeavor is achieved by following a process. This led me to ask "What is his process?" I observed THE ARTIST long and carefully, watching his efficient handling of the crowd of potential customers, and his swift, sure creation of the paintings.

He could paint a school of multi-colored fish in 15 seconds. Whip out a fish school stencil and can of spray paint to make the bodies. Center another stencil and grab a different color spray paint to paint the fishes' highlights.

An image of the sun took 20 seconds. Spray a large blob of yellow. Place an empty spray can upright on the yellow, and spray sky color all around. Lift the can, and smear with a rag to get the sun's radiance.

A comet took only 5 seconds. Spray white into a round stencil, lift and smear upwards with a rag.

After 2 hours it was time to go and I still hadn't figured it out. As my wife drove the 75 miles back to our home, I worked on synthesizing THE ARTIST's process. My study of accounting told me there must be a goal — otherwise the result is random. Hence the question — "What's THE ARTIST's goal?"

Playing back his actions in my mind revealed the process by which he deduced his goal. He'd spend a minute interviewing the customer as to what she (most but not all were female) wanted. There would be a little back and forth as he molded her vision into what he could do quickly. Everyone got what they perceived as a custom painting, but all the paintings were actually within some pretty tight parameters. No skyscrapers, no football players. Just ocean, sky, fish, birds, sun, stars, air and water. In the first minute or two, he knew exactly what was to be painted, and had placed it in the framework of what he could do quickly. He had his goal after a 2 minute interview with the customer.

Another obvious fact was that the man made expert use of tools. Stencils, spray cans (both for spraying and for blanking out circles with the bottom of the can), rags, brushes. He always knew where his tools were, always cleaned and cared for them, and always put them exactly where they belonged. For THE ARTIST, finding the right tool was always less than a second.

Big deal! We all have tools, but we all don't produce the way THE ARTIST does. What was his secret for using tools?

Cruising Interstate 101, in my mind's eye I replayed THE ARTIST's every move. In every painting he made the sun the

same way. Every comet was produced by the same series of moves. Every school of fish was the same series of actions. Everything he did was almost a reflex action. I remembered back to my guitar days, and the use of riffs. Yep, just like a guitarist, THE ARTIST used the same riffs over and over again to produce a result which overall looked (sounded) like something new. So THE ARTIST's methodology looked something like this:

1. He deduced his goal based on customer interview, and what his tools allowed.
2. He used his tools to achieve the goal.
3. He employed riffs to speed his use of tools.

Goal, tools and riffs. I'd synthesized his methodology. The next step was to apply his methodology to my work.

It was obvious that computer programming was not a good candidate for THE ARTIST's methodology. Unfortunately, the customer usually dictates the tools the programmer uses, and there's really no way around that in the programming marketplace. So I turned my sights to my other vocation, technical writing. And struck gold!

What were THE ARTIST's stencils if not boilerplates? I could make myself some nice little macros to automatically lay down several stencils (scuse me, boilerplates) at once. I created lots of boilerplates, practiced with each, and with combinations, until their use became riff. I especially concentrated on time consuming tasks like shooting and importing screenshots.

Within a month my technical writing productivity had doubled. When Troubleshooters.Com was born two years later, I created tools and riffs to achieve my goals, both in creating content and in marketing the site. I'm often called prolific. Chalk it up to THE ARTIST, who showed a tourist the connection between quick paintings and technical writing.

Toolsmanship

Years later I realized that THE ARTIST had also taught me toolsmanship. Watching the man work with his tools was sheer joy. Stencils for every kind of bird and fish. Stencils for entire flocks of birds and schools of fish. Various paint brushes and cans of spray paint. Rags to smudge and streak.

His tools were his life. He knew them like a mother knows her child. He knew where each was. After each use it was appropriately cleaned and put back in exactly the right place. He never needed to search for a tool — he just grabbed, used,

cleaned and put back. When you must whip out a painting every 15 minutes, nothing else will do.

But organization of your tools isn't enough. Highly organized people are a dime a dozen, and most aren't any more productive than moderately disorganized people. To achieve THE ARTIST's productivity, you must employ his third secret — riffs.

He's used these riffs thousands of times. From these limited stock riffs he creates thousands of seemingly custom paintings. Whatever *you* do for a living, you can learn riffs to speed your tool use.

Lessons Learned

Toolsmanship involves goal, tools and riffs. One must have the right tools to achieve the goal, and have them instantly available. That implies knowing where they are, which means putting them back in the right place upon completion. It also implies a hierarchy of utility. If you use a pliers every 30 seconds, that pliers belongs in your pocket or on a tool belt worn around your waist. On the other hand, if you use a five pointed wrench once a week, that wrench probably belongs in a toolbox in your truck. Tools used once per hour are probably in a toolbox at the job site, but not on your body. The idea is to minimize the time spent accessing and putting away tools.

Learn your riffs. Deeply learn the capabilities of each of your tools. Learn the subtleties of how to extract maximum performance from those tools. Learn which situations call for which tools. Do you whip out an adjustable wrench, or do you search for the proper socket and mount it on your ratchet wrench? The answer probably depends on the amount of torque you need, the accessibility of the nut or bolt head, and the difficulty of replacing rounded hex nuts or bolt heads.

How do you develop riffs? Ask any musician — the answer is practice, practice, and more practice.

Remember The Goal? All THE ARTIST's works involved water, celestial bodies, fish, birds and the like. There were no football players, no roller skaters, no skyscrapers. He painted certain things, and he had tools to paint those certain things. By so limiting himself, he got the practice necessary to deeply explore his tools, and develop tool based riffs for every situation he encountered. *You* can do the same thing by limiting the types of work you accept.

I think of him often. His Latin Lover looks showed through the gas mask worn as protection from paint fumes. He knew

maybe 200 words of English. But what he taught me about process, efficiency, and toolsmanship I couldn't have learned at Harvard, Yale or Cal Tech.

Part II

Excellence

Some of the stories in Part II are true, and some are fictional, but they all answer basic questions: What does troubleshooting excellence look like? How is it accomplished? How is it learned? What basic skills are involved? And what is life like once you have it?

The Midas Touch in Customer Service

Author's Note

Here's a true story of a truly great shop. Whether you manage a one man repair shop, or a department with 200 technical employees, carefully consider what you can learn from this shop.

As you read this story, consider that good troubleshooting doesn't exist in a vacuum. This shop's greatness started with management, which created a culture neat organization, and of cooperation with vendors, employees and customers.

A half hour before my scheduled 1200 mile road trip from Orlando Florida to Chicago, Illinois, I discovered that my brakes weren't working optimally. The trip couldn't be delayed, so I drove slowly and carefully, keeping at least 10 car lengths in front of me and watching the road like a hawk. Once in Chicago, I looked for a brake mechanic with a nationwide guarantee.

A quick search of the Internet found Midas Auto Service Experts at 60 Skokie Valley Road in Highland Park, IL. The web page spoke of same-day service on most repairs. When you're 1200 miles from home, that's important. The web page had a coupon for \$10 off the repair.

So I called, and David, the manager, answered. Not a messaging system. Not a clerk. Not a harried mechanic anxious to get back to his real work. The manager himself.

I told David the symptoms, which were that it seemed to take inordinate pedal pressure to stop the car, and it seemed like the brake pedal went down a little too far. I explained that the rear drums had recently been replaced, but the front discs were worn clear to the rotors, so the car probably needed new shoes and rotors. Given the action of the brake pedal, I wasn't too confident of the master cylinder either.

I asked him if he had the parts in stock, even for the master cylinder. He said yes. I asked how much for new shoes, hardware and rotors for the front. He quoted \$240.00. That seemed

lower than quotes from Florida (which supposedly has a much lower cost of living), so I told him I wanted the best parts. He assured me these were top quality parts. I asked if he could do it today, and he said “yes”. I drove my car to Midas.

David waited on me right away. No huge line. No crowd of angry customers in the lobby. In fact, I was all alone. David asked me if I’d like to wait for the estimate, and I said “yes”. My car went right up on the lift. No waiting for a car to come off the lift. No angry arguments about who came first. It just went right on the lift. Two, countem two mechanics went to work on my car. A few minutes later another car came in for repair and one of the mechanics went to work on that other car.

Within 20 minutes my estimate was ready. It was the rotor and shoe price he mentioned on the phone, plus \$20 to adjust the rear brakes. He told me his mechanics could find nothing wrong with the master cylinder. I OK’ed the estimate, and told him to also do the \$25 lube and fluid. David asked if I’d like to wait 1.5 hours for the repair, but I elected instead to take a walk.

Walking down the deserted tree covered bike path behind the railroad tracks, I reflected on the great service at Midas. How different this was from the norm of rude clerks, inept service, and phone systems designed to block accessibility to those with the answers.

The shop was exceptionally clean and organized. There were David, 3 techs, and 3 lifts. There was usually a lift open because they worked so fast. It might be tempting for a bean counter to fire a mechanic or move to a smaller shop. On the contrary, his shop’s excess capacity results in considerable profit.

Excess capacity. A curseword among the re-engineering and efficiency crowds, but anyone who’s read “The Goal” by Eliyahu M. Goldratt knows that without excess capacity, an enterprise is unstable and unprofitable. The way this shop handled its excess capacity was inspiring. The techs cheerfully cooperated with each other. If one had nothing to do, he’d help the other, thus getting cars off the lift fast and minimizing the chance of lift unavailability bottlenecking the operation.

How did they achieve cheerful cooperation? I don’t know, but my bet would be that those techs weren’t paid commission on their individual repairs, but instead bonused on the shop’s productivity.

My thoughts went back to my old shop, STEVE’S STEREO REPAIR, another high quality high throughput shop. Like Midas, I fixed things as fast as possible. Like Midas, I had excess capacity (I was open only 3 days a week, so I had plenty of time

to clear any backlogs). Like Midas, I gave clear and accurate estimates. Like Midas, I got customer equipment in and out quickly, meaning my shop could do a surprising volume of business in a very small space. Like Midas, my shop was neat and organized. Like Midas, my customers loved me.

Another commonality between Midas and Steve's Stereo Repair was that we both knew what we do and what we don't. I turn away unprofitable work and stick to what I specialize in. Likewise, Midas specializes in exhaust systems, brakes, suspension, and light repairs. They're not a transmission shop or a body shop.

With the breeze blowing through the tunnel of trees surrounding the bike path, I started writing this story in my mind. Soon the 1.5 hours were up, and I returned to Midas.

David showed me a filthy air filter discovered in the lube and fluid change, and told me if I'd like it replaced that would be an additional \$20 or something like that. I agreed. Finishing the repair took another half hour, during which I observed details of the shop.

Their battery supplier came in and replaced the battery inventory in two different displays strategically placed — one in the shop and one in the waiting room. Vendor cooperation was at work here. For a shop with so much inventory on hand, everything was clean and organized.

But what about profit? In the maybe 3 hours between the time I brought the car in and the time I drove it off, two other cars came in. I overheard the charges — between the three cars it was about \$1000. In 3 hours :-) \$333.33 per hour in revenue. That's \$83.33 per hour per employee. Without breaking a sweat. Without running out of lifts. To the great satisfaction of their customers.

On my invoice, labor was 28.4% of the total. If that's typical, it means that on labor alone they made \$23.69 per hour per employee. I don't know their cost of goods sold, or their rent and utilities on a per hour basis, but it looks to me like this shop is making good money while their customers get quality service for reasonable prices.

You might be wondering about my brakes. I left Chicago at 6 PM on Wednesday evening and got to my Linux User Group meeting in Orlando at 7:30 PM Thursday night. That's a pretty quick pace to achieve with brakes that are anything but perfect. Throughout the entire trip and now in stop-and-go Orlando (home of the non-timed stoplight), my brakes are effortless and flawless.

Lessons Learned

The Highland Park Illinois Midas shop exemplifies the components of great customer service. They start with great communications, with a website and a real live knowledgeable manager who answers the phone with clear explanations and estimates. They have spare capacity to get customer owned equipment in and out quickly.

They don't fear idle time, but instead double up employees in order to finish everything and be ready for the next rush. And I'd presume they optimize the compensation of their team members for team production.

We often hear the phrase "Best practices". Midas in Highland Park, Illinois had some of the best practices I've seen in any shop.

Gavin Gray

Author's Note

This story is fictional. Any resemblance to real people, living or dead, is pure coincidence. As you read this story, notice the evolution of main character Joe Jarvis, and follow his thought patterns during this evolution.

You should also note that this story was written in 1997, so some of the post-1997 events don't mesh with what really happened. Even so, this story's predictive accuracy is surprising, right down to predicting the developer glut of the 2000's. Also, when Joe must go to the library to browse the Internet, keep in mind that this was the norm in 1997.

February, 1997

"Yes sir, may I help you." I say automatically to the customer. Then I look at him.

Realizing who is looking at me across the service counter, my heart thuds and temples throb. It's Gavin Gray. Old friends are great, but not when your business failed five years ago, you've been fired from three jobs since, and your present boss has put you on notice that if you don't double your repair rate in the next two months you'll lose this job too. Kathy's working full time now, but we still don't have enough money to put our younger son through college, and if I lose this job the bank will foreclose on our house. I've certainly slid down the ladder of success in the twenty years since I last saw Gavin. Across the service bench, Gavin looks prosperous and self assured. Maybe, just maybe, he won't recognize me.

"Yes. I need this VCR repaired", he says.

"No problem", I say, filling out a service order. "This will be \$78 plus parts". We exchange glances as I hand him the service order.

"Joe?", Gavin asks. Then "Joe. Joe Jarvis! It must have been twenty years. Joe, don't you remember me, I'm Gavin Gray. We've known each other since grade school."

I allow a smile to slowly spread, and hope it doesn't look staged. "Gavin, of course I remember you. It's wonderful to see you." Suppressing every emotional defense mechanism, I ask the question whose answer I dread. "How've you been, Gavin?"

The whole neighborhood knows the Gavin Gray story. Graduating college in 1969 he got a sales job with a little computer company, then worked his way up. In 1977 he started his own company, and expanded it to a million dollars a year by 1980. He took it public during the go-go late Eighties. Gavin's worth more than twenty million dollars. While I'm getting twelve dollars an hour fixing old audio equipment, and the boss tells me I'm not worth the money. Yes, I really don't want to hear how Gavin's been.

"I've been fine, Joe, just fine." says Gavin. "The business is doing great, Marcy's doing fine, and Jennifer is a financial analyst. And how about you, Joe? Is this your shop?"

"Naw, Gavin, I'm just an employee here. After having my own business for twenty something years, I cashed out. Now I leave the headaches and decisions to someone else and just collect a paycheck. It gives me the time and freedom to do some of the things I've always wanted to do."

How's that for putting a good spin on a bad situation? Buried deep inside me, a small remaining speck of humor whispers "better roll up your pants legs, it's getting deep in here." I find myself actually suppressing a smile. Looking at Gavin, I realize he's taking that suppressed smile as smug satisfaction, toned down so as not to brag.

Gavin glances at his watch. "Joe, I have a lunch appointment". So much for my self satisfied act. Then he says something unexpected: "When do you get off Joe? Let's get together right after work."

Now picture that. A multimillionaire and a guy a paycheck from foreclosure getting together to swap a few stories and down a couple brews. I'll never know why I said yes. We agree to meet here at 3:00, and Gavin strides out of the shop. Somehow he looks happier. I put his VCR on a shelf, start working on a no-sound receiver, and begin to think about old times.

Gavin wasn't a close friend. I can count the number of times we've gotten together on my hands. But each of those times, well, I changed.

There was our fourth grade walk through a snowy marsh. There was water in our boots, we were soaking wet, frozen, and loving life as we talked and splashed as only kids can do. The conversation turned to school. I suggested since school was so boring, maybe we shouldn't have to go. Gavin pointed out that

we needed the education, or we'd end up ditch diggers. I didn't know what a ditch digger was, so Gavin explained it. It was my first realistic look forward to adulthood.

About that time, my Dad bought me my first radio, a crystal set shaped like a rocket ship. Dad was a disabled veteran. In Italy, 1943, he took a large caliber bullet in the leg and got sent home. Before the war he was a construction worker, but he never was able to work another day in his life. He married Mom shortly after, and I was born in 1947. Mom worked as a teacher, so there was never enough money. But there was love, and that was enough.

Anyway, I can still see him limping into my room, grinning ear to ear, with this little space-ship looking thing. He had Mom hook the antenna wire to a curtain rod and showed me how to tune it, and presto — WJJD. Push the rod down a little and chango — WCFL. I was hooked.

I got my first "real" radio in sixth grade. Aunt Carla's old brown Zenith stopped playing, and she threw it out. Dad snatched it from the trash and brought it home for me. A trip to the drug-store tube tester located the bad tube, and it took over half my \$8.21 life savings to buy the replacement tube. By nightfall Aunt Carla's old radio was playing Elvis, Rick Nelson and the Everly Brothers, and boy did it sound sweet. I still have that radio today.

Fixing the radio was so much fun, I made it a hobby. Every dumpster and trash pile had a broken radio, and I got them all. Cannibalize the tubes from one, chassis and case from another, speaker from a third, and you could build a nice radio free. It was Gavin who first suggested I make it a business.

"Joe, I'll tell you a secret", confided Gavin. "You have a hundred dollars you don't even know about."

We were taking a break from tossing a football in the school playground. The smell of spring was everywhere, and we were floating paper boats down the street gutters in the runoff from the remaining snow. It felt like spring is made exclusively for twelve year olds. I continued the conversation.

"What do you mean I have a hundred dollars, Gavin?"

"You told me you have over twenty working radios in your room. If you sell half at ten dollars apiece, that's a hundred dollars. All you have to do is clean them up with furniture polish til they shine like new. They'll sell like hotcakes."

Two weeks later I was \$235 richer — Gavin had underestimated the number and price of the radios. Like a shark who's tasted blood, I kept going, making more each year. Beatles records flooded the airwaves junior year of high school, and ev-

ery girl in the school wanted a radio. By senior year I'd sold over 500 radios, and had more than three thousand dollars in the bank, even though I had been paying my family's rent for the last year. In those days, rent was less than a hundred a month and you could buy a brand new family sedan for \$2500. Things got even better when I met Kathy.

She was in my third period study hall, sitting on her legs in the way only a petite young girl could. She wore a fuzzy pink sweater. As she smiled at me I saw those pretty blue eyes, and I was gone. That little kitten of a girl stole my heart. Three weeks later we were going steady.

Hitchhiking home from Kathy's one night these two guys with torn clothes and hair down to their shoulders offered me a ride. The driver was a guy in my English class. I opened the door to get in and did a double-take. There in the back seat was Gavin Gray. I didn't figure him hanging around guys like the driver. I jumped in next to Gavin. The guys in the front seat were preaching revolution, calling the United States an imperialist pig power. I told them they were idiots, and just too cowardly to fight for their country. I told them to let me out of the car.

"Wait a minute", said Gavin. "Joe, tell us your viewpoint".

I told them about communism, and how under communism we'd all be equally poor. I explained how Khrushchev had promised to "bury" capitalism, and how they were doing it by taking one country at a time. If we didn't stop them in Vietnam, the whole far east would fall, and it was just a matter of time before the communists would be on the Mexican and Canadian borders.

"You capitalist pig", yelled the front seat passenger. "You're just toadying up to the tools of the military industrial complex."

"He's just scared he won't be able to exploit the people selling his silly radios", exclaimed the driver. "He doesn't care who gets killed, as long as the money rolls in. Power to the people! Jarvis, you really are a pig! You don't care who"

"I've known this guy for a long time", interrupted Gavin. "Yeah, he's a capitalist, but he's no pig. And Phil, many of 'the people' would have no radio at all if it weren't for Joe. He offers a good product for a fair price."

It was interesting how these two belligerent guys would not attack Gavin Gray. Instead, they sort of mumbled 1965 hippie party line rhetoric. How did Gavin command so much respect from these guys? I pressed my advantage.

I said, "You guys are afraid to fight for your country. You're cowards, that's OK. My Dad almost lost a leg in Italy defending this country so you clowns can run it down. I'll follow in my

Dad's footsteps."

Gavin spoke softly, almost soothingly. "Joe, do you really think this is the same situation? This is a civil war, Joe. In the long run, it will be won by those who believe in their cause. In the long run, the world will be ruled by those who believe in their cause. You know what it's like to have a father who can hardly walk. Who can't play football with you. Who can't wrestle with you. If you go to war, for your future children's sake, it had better be worth it."

I squared my shoulders and proudly proclaimed "It's worth it."

But Gavin had planted a seed of doubt. When South Vietnam fell in '75, the seed became a sapling. In 1989, when the Berlin Wall crumbled and an electrician led the Polish People to their first free elections since before World War II, it became a mighty oak.

I never went to Vietnam. I graduated high school in June of 1965 and opened a radio store. I distributed fliers to the dorms in Loyola, Mundelein and Northwestern, and within a year it seemed like every college kid had one of my radios. With the advent of "hi-fi", I included input jacks for a turntable and a tape recorder, and sold them for \$40. Perfect size for a dorm room. Then I started selling turntables and tape recorders.

Kathy graduated in June of 1966 and we married a week later. Joe Junior was born in 1967. I got out of the draft as the sole support of a family. By 1969, and I was making enough that if I had wanted to, I could have bought a house every year. Mark was born in 1974.

Gavin and I met once last time, in 1976. It was at McDonalds. He was with his wife Marcy, and his daughter Jennifer. I was with Kathy, Joey and Mark. He was thinking of quitting his job and going into business for himself, but was uncertain about giving up the steady income.

It was a windy summer day, so the two families finished their meals and walked down to the park. As we watched the ducks I explained everything I knew about business, and how yes, it was tough, but if you could make a good product and sell it, you'd make great money. I didn't tell him my two stores were making over a hundred grand a year — I don't like to brag. But as things turned sour during the Reagan era, I often wondered if I gave him the right advice. That is, until I read about him in the paper.

The article told how Gavin had built a kind computer company, called a VAR, and how he'd taken it public. Gavin became fourteen million dollars richer that day, and he still held thirty

percent interest in the company. The article told of his eighty hour days and his risking it all in the beginning, and of the sweet payoff. My life wasn't so wonderful.

The 1982 recession hurt my business just as it hurt everyone else, but it was the technology explosion and boom times afterward that threw the knockout punch. Nobody wanted used, doctored up radios anymore. College students were buying thousand dollar systems. I offered repair on these systems, but they were too complex to fix quickly and profitably. I could do only two repairs a day on those new stereo systems. Techs I hired did no better, unless they cut corners on repair quality. The customer figured, why pay to fix your system, when you can go out and buy the latest technology.

There had to be a more profitable business. In 1988 I began repairing computers. I hired a tech who said he knew all about them. Within a year it was obvious computer repair was a mistake. We lost money every day. My personal savings went into propping up the business, as well as paying the last 2 years of Joe Jr.'s college. There were half repaired, obsoleting computers taking up space all over the shop. Our stereo and TV repair dried up because the computers were sucking up all our time. We damaged some customer-owned computers. There were several complaints to the Better Business Bureau. I had to sell one of my stores to get the money to pay customers whose computers I'd ruined, and I went out of the computer business. But my reputation was wrecked, and in 1992 my business went bankrupt. I drifted from repair shop to repair shop, almost begging for technician jobs. Other techs could fix more than two units a day, so I've been fired several times.

We've mortgaged our home to pay our bills. Mark is studying computers in a local junior college — the only thing we can still afford. It breaks my heart that he'll never have the opportunities that his older brother has. To make ends meet, Kathy started working as a legal secretary in a high stress law firm. The money helps, but I can tell it's taking its toll on her. I hate what my failure has done to my family.

"Ready Joe?"

Gavin's at the counter. I've spent the last 3 hours woolgathering while I fixed a fried receiver.

"Want to go have a drink?" Gavin asks.

I know I can't afford any place he'd want to go. "Let's just take a walk", I suggest.

"I hoped you'd say that" he answers.

There's slushy snow on the ground, and like a couple fourth graders the tycoon and the pauper trudge through the muck.

The walk goes on for miles, the talk for hours. We talk of raising kids, and social justice. Of global warming, and bowling alley stories. Of the harshness of life in the 90's. Slowly the secrets come out. He's sick of the responsibilities of his work, I'm sick of the financial hardships of mine. We find a schoolyard and sit on the teeter-taughter, toes turning to icicles. The sun is down and the wind is harsh.

"What troubleshooting process do you use?" Gavin asks.

"What do you mean?" is my answer.

"Well, don't you go through a process every time you fix a stereo?"

"Well sure, but the process is different every time", I reply.

Gavin's face takes on a puzzled look. "That's funny. According to an article I read, modern technicians have a specific process they use on every repair. I even saw a website devoted to one such process."

"I don't get it", I say. "How can you use the same process on a radio as on a tape deck? You don't use a process, you just fix it. I'm not on the Internet, so I've never seen that website, but it sounds weird."

"Come to my house and I'll show you the website", he offers. "You can stay for dinner."

I call Kathy to let her know. Kathy's not at all pleased, and lets me know in no uncertain terms. As I said, this job is turning my little kitten into a grizzly bear. It's then that I realize for the last 2 hours I've been happy. Unfortunately, these days that's unusual.

We drive to Gavin's 8000 square foot home in his Lincoln Town Car. Marcy has fond memories of the one time we met, and she's very nice. Jennifer has married and moved out. Dinner is served. Not a fancy dinner, but a good one. Afterward, Gavin and I go to his study and pull up the website.

It has a ten step process:

1. Prepare
2. Get the symptom description
3. Make damage control plan
4. Reproduce the symptom
5. Do corrective maintenance
6. Narrow it down to the root cause
7. Repair or replace the defective component
8. Test
9. Take pride in your solution
10. Prevent future occurrence

I couldn't keep the disappointment off my face. "Well this is just common sense, Gavin. Everybody knows this. I do this every day."

"Are you conscious of it?", he asks.

"Of course not, I do it every day."

"Another part of the website says the key to the whole thing is being conscious of it", he replies.

"I think this website guy is just out to make money", I say. The conversation moves on to other things, he drives me back to work where I parked my car, and we bid a pleasant adieu. I drive home, and the minute I get in the house, Kathy and I argue. We're doing too much of that these days, but there's so much pressure. I drift off to sleep with a nagging question. How could a guy, perceptive enough to tell me how to start my radio business and figure out Vietnam years before Johnson and Nixon, be taken in by that website. Well, nobody's perfect.

The next day, my first assignment is a stereo tape deck. The repair order says simply "one channel out". As I test to see whether it's out on record, playback, or both, and whether it's intermittent or constant, I remember the website's second step: "Get the symptom description". Did the tech who filled out this repair order get a complete and accurate symptom description? Not by a long shot. Ten minutes of testing show that it consistently fails to record or play back in the right channel. Hey, isn't that Step 4: "Reproduce the symptom"? On tape decks sometimes I get lucky using tuner spray on the record-play switch, cleaning the heads and rollers, and checking the wires to the head. This time, no luck. The symptom's still there. I chuckle that the website would call the cleaning and checking I just did "Step 5: Corrective Maintenance". I just do it to catch a lucky break, because Step 6: "Narrow it down", is so tough. It hits me like a ton of bricks that I'm starting to think like the website.

Now I'm in the murderous part of an electronic repair. I haven't caught a lucky break. Now I'll need to find that one defective part in a thousand. I think "OK website smart guy, what do you do now? Or are you just a college professor". Of course, the website guy would tell me this whole train of thought is counterproductive — step 1 is "Prepare", which includes "Get the Attitude". Easy for him to say. And he'd say "don't try to fix it, just try to narrow it down."

OK wiseguy, the problem could be before, inside, or after the record/play switch. I scope the signal coming into and going out of the record/play switch, and it's there. Fine, the problem is after the record/play switch. I scope the hot lead of the head and there's no signal. OK, it's between the head and the record/play

switch. Looking at the schematic, I see the only thing between them is a ten ohm resistor. I scope on each lead — signal's on one but not the other. Ohmmeter reading of the resistor is thousands of ohms. The resistor is bad. I replace the resistor and test. The unit records and plays back perfectly. I test everything else and put it back together. Elapsed time, thirty minutes.

Under my breath, I shout YES!, as I raise a fist in triumph. I revel in the bold, clean steps I took to nail the problem. Then I chuckle as I realize the website's author would call this "Step 9: Take pride".

I begin another unit. I can't help comparing the way I troubleshoot to the website. I start asking why I take the measurements I do. During a break I watch our best technician work. He averages six units a day, triple my productivity. Every once in a while I ask him what he's thinking, why he measures what he does. He looks at me like I'm nuts. The next weekend I go to the library and study the whole website. At home at night I go over the course of some of my repairs, what I did wrong, what I did right. Work becomes a kind of game, and at the same time a serious study. The next weekend brings another visit to the library, long walks and lots of thinking. The next Friday the boss comes by with my paycheck and says "Jarvis, what did you do? You've averaged four units a day this week!"

June, 2012

As our grandchildren somersault on the soft grass, Kathy and I exchange smiles. The yellow summer sun bathes the back yard where we sit in lawn chairs under the big tree. The drone of a distant lawn mower is barely audible beneath the conversation of our friends. It's my sixty fifth birthday. Joe Junior walks up with his wife Monica. They're so happy. Joey's an art professor at the state university, loving every day. Monica's a third grade teacher. I asked them once why they didn't have children — didn't they want to pass on their knowledge and love? Laughing, they said "We teach. We pass it on every day. We've got thousands of children."

Joey and Monica walk to the refreshment table, and I see Mark. Mark, whom I couldn't send to college. Mark, who when I finally had the money, refused it. He said the example I set was more than enough of a gift for any son. Mark, who took that same troubleshooting process I learned and turned it into a successful business. Mark, with his lovely wife Maria and

their four children. I walk over to talk to Mark and his family. After a few moments of conversation, I wrestle with the kids. Mark and Maria beg the kids not to be rough with me. I don't know why, I go to the gym every day. I'm in better shape than I've ever been.

Kathy grabs me and winks. She became a kitten again when she quit that crummy law firm job in '98. She has an arts and crafts store now, although heaven knows, we don't need the money. Within six months of my 1997 meeting with Gavin my productivity doubled again — a shop-high eight units per day.

The boss made me service manager, and I taught all the techs the Troubleshooting Process. I set up the shop to maximize their use of the process. Profit doubled, and we put our main competitor out of business. Armed with a process that works for repairing any equipment, we began repairing computers. A gutsy move considering what happened the last time I tried computer repair. The Process made all the difference. This time we made big bucks.

I quit and started my own computer repair store right by Loyola University. I needed a technician, but I had no money to hire an experienced computer tech. Meanwhile, nobody would pay my younger son Mark' decent money because he had only a couple years junior college computer classes. I hired him and taught him the Troubleshooting Process. It was easy because he had no pre-conceived ideas about troubleshooting. Once he learned the process, his productivity was astounding. I doubled his salary, and still made a ton of money from his work.

I distributed fliers to the dorms in Loyola, Mundelein and Northwestern, and within a year it seemed like every college kid was having us do their upgrades. I hired more techs, taught them the Troubleshooting Process, and opened more stores. I ran the business, Mark managed the stores. Good times were back. Then Mark dropped a bomb on me.

“Dad, I've got to quit”, said Mark.

“Why Mark? Is it the money? I'll give you more. Is it the working conditions? I'll make them better. Whatever you want Mark, it's yours. I need you, son.”

“Dad, I've loved working for you, but there's an opportunity I can't pass up. My friend Jason sells large systems to Fortune 500 accounts, so he and I are teaming up to set up and troubleshoot large corporate systems. And Dad, you don't need me anymore. You've proven the Troubleshooting Process works, and that you can teach it to your people. You proved it at your last job, and in your business. Now you've got the money to hire a top-notch person to replace me, and then train him the way

you trained me.”

Mark was right. The replacement I hired worked out perfectly, and within three years I had six shops all making a marvelous profit. And Mark? He and his partner used the Troubleshooting Process to walk into corporations and fix their toughest information problems. 2001 was their first million dollar year. Then they took advantage of the post-y2k programmer glut and hired great talent cheap, teaching each one the Troubleshooting Process. By 2010 their company was debt-free, and making a 40 million annual profit. Mark attended night school, and got his Bachelors degree last year. We talked after his graduation ceremony.

“Son, I’m so proud of you. I only wish I had been able to provide you with an education myself.”

“You did, Dad. Don’t you understand that? You were a great role model. Through good times and bad, you were there for us. You kept going when most men would have given up. You can’t learn that in college. And you taught me Troubleshooting Process, which I built into a successful business. Dad, there’s no way I’d trade all of that for a paid college education.”

“Are you OK, hon?” I hear Kathy’s voice say. How long had I been daydreaming? My birthday party’s winding down, the sun still high but now to the west. I wipe a tear from my eye, amazed at what life has brought me. I let Kathy know everything’s OK — it’s a tear of joy. People start to leave, and soon Kathy and I are alone. We go in the house. I start getting romantic with Kathy, and then the doorbell rings.

Kathy gently pulls away from me and says, “Joe, I didn’t tell you, but I invited someone else to the party, and I think he’s arrived a little late. Why don’t you spend some time with him? Tonight you and I can pick up where we left off. After all, tomorrow’s Sunday. Go answer the door.”

I open the door and there stands Gavin Gray, looking prosperous and self assured.

“Happy birthday Joe! Sorry I couldn’t get here sooner, but we were interviewing a possible successor today.”

I’ve read it all in the Wall Street Journal. The President wants to give Gavin a cabinet post, but his corporation can’t find a suitable successor, so he stays. Gavin comes in and we all chat. After a few minutes Gavin asks, “Joe, want to take a walk?”

It’s a pleasant summer day with a gentle breeze. There’s a path a block from our house, with flowers and trees and birds and last year’s brown leaves still covering the ground. A couple miles down the path is a school yard, with a swing set, jungle

jim and teeter-taughter, all on a bed of cedar chips.
“I hoped you’d say that”, I tell my old friend.

The Grapevine and the Buick

Author's Note

As you read this true story, notice the professionalism of the mechanic when confronted with a panicked customer.

Rage filled my soul as steam billowed from the engine compartment of my stalled 82 Buick. Only two years before, I had paid \$1150.00 to repair the results of a head gasket busting overheat. Now my car sat crippled less than 3 miles from the top of the Grapevine, a 4000 foot pass in Southern California that served as the grim reaper of cooling systems. Would this cost another \$1150.00?

Beside me stood my new bride. Sylvia held my hand and told me everything would be all right. We were less than 40 miles from home, returning from a wonderful honeymoon along the entire coast of California. The Grapevine, that eight mile stretch of 6% grade, had claimed another in its long line of victims.

The Auto Club towed us to the nearest garage, which sat perched on the peak of the Grapevine. Once there, I started giving the mechanic orders on how to diagnose and fix the problem. After all, I was Mr. Troubleshooter, and he was just some shop unlucky to be near the site of my car's breakdown. In my state of extreme attitude violation, it never occurred to me to realize that this mechanic sees more overheating problems in a week than the average mechanic sees in a year. The mechanic smiled at me, explained that he was a professional, and went to work. Somewhere deep inside of me, the last vestige of a rational person watched the mechanic's diagnostic procedures, and learned.

After letting the car cool, the mechanic started the engine and felt the hoses for evidence of thermostat opening and closing. The thermostat was OK. Then he did a pressure test. He explained that coolant loss causes overheating, and overheat-

ing causes coolant loss, and a pressure test is how you determine which is the root cause and which is the symptom. The pressure test showed no leak.

The mechanic saw thick deposits in the radiator and explained it needed replacement, and that would most likely cure the problem. He didn't have a radiator in stock. He filled up the coolant and sent us on our way. We coasted down the Grapevine and arrived home OK. A few days later I had the radiator replaced with a heavy duty 3 row, and the overheating problems abated.

That was fifteen years ago. My new bride is now the Mother of our twelve year old triplets. The 82 Buick was junked eleven years ago after the tranny gave out. We moved to Florida, so now the Grapevine is 2500 miles away. But I still carry with me the lessons of that long-ago mountaintop mechanic. And thanks to correspondence from hundreds of Troubleshooters.Com visitors, I've added to his knowledge, and placed it on Troubleshooters.Com's automotive overheating subsite.

Sylvia's Bucking Buick

Author's Note

This is a true story. As you read it, notice the excellence displayed by everyone in the story.

Sylvia told me that her car was bucking. On further questioning, the symptom sounded a lot like what would happen on a car with a dirty fuel filter, but I couldn't reproduce the symptom. Finally, while driving home from a restaurant one night a few weeks later, it started bucking. It bucked at 45 miles per hour. It was the same sort of temporary power loss you'd experience from a clogged fuel filter.

In response to my questioning, Sylvia said it had been at least two years since her fuel and air filters had been changed, and her last tuneup.

It was time for corrective maintenance. I took it to a tire-tune to get it tuned up and the filters replaced. After the service, I picked up the car, smug in the belief that the problem was over. Within a mile it started bucking.

This was a problem. The root cause could be almost anything. Well, anything except the three most likely suspects — fuel filter, air filter and tuneup. A local garage checked the fuel pressure. It was on the low end of normal — shouldn't be a problem. A trusted auto tech test drove the car. He reproduced the symptom, and felt the problem was in the transmission, which was something he didn't service.

I took the car to a good transmission shop, where the main tech drove the car and declared the transmission in fine working order. Sylvia had a perfectly serviced car that just happened to buck at 45 miles per hour. Ughhh.

You might wonder at this point why I didn't just bring it to a shop and have them figure out what was wrong. The problem is, shops are even worse at intermittents than I am. They don't have the time to reproduce the symptom. Bringing it to a shop at this point probably would have resulted in lots of replaced parts and no symptom cessation. I was determined to wait until either the problem became constant, or I found a reproduction

sequence.

We continued to drive the car, hoping it wouldn't stall on the freeway.

One cold morning, after signing up for a course at Valencia College, I started pulling out of their parking lot. Shivering, I turned on the heater. The car started bucking. Hmmm!

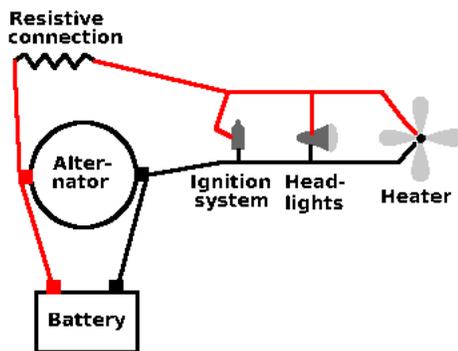
I turned off the heater, and the car quit bucking. On — bucked. Off — didn't buck.

Was it drain on the electrical system, or something else? I turned on the lights, and it bucked slightly. Turned em off and it stopped. On — bucked. Off — stopped. Turning on both the heater and the lights, and the brights for good measure caused the car to buck so badly it almost stalled. Turning them all off restored smooth engine power.

Gotcha Sucker!

I had a theory it was the electrical system. But more importantly, I had a reproduction procedure. The tech at a shop right around the corner measured the battery voltage. 14.0 volts — a little lower than I'd like to see it, but nowhere near indicating a problem. At home I re-measured it with my own voltmeter — 14.0. I had Batteries Plus test both the battery and the alternator. They were both functioning properly.

I started formulating all sorts of weird theories. Perhaps there was a resistive connection between the alternator and the ignition system such that even though the battery voltage read 14.0, the point where the ignition got its power it was more like 10 volts when the lights and heater were turned on:



My resistive connection hypothesis would have explained it, but as it turns out, the real root cause was a whole lot weirder. Read on...

I looked in the car in search of a loose electrical connection and found none. It's not surprising — a 1987 Buick Century with a 3.8 liter engine is packed pretty tight. Armed with

a reproduction procedure, I headed to the best diagnosticians I know: Zych's Certified Auto Services on 436 in Altamonte Springs, Florida.

Arriving at Zych's, I gave them a full, written symptom description, told them verbally about turning on the lights and heater, and then insisted they reproduce the symptom while I was still there. They reproduced it easily; I left the car.

Zych's is a lightning fast shop, but the car was there for two full days — a record. Every time I called they were still diagnosing it — it wasn't an easy problem. Finally they called me and said it was fixed — a bad alternator!

Jim Zych, the owner, said he initially ruled out the alternator based on the nice 14.0 volt reading at the battery, but after he had tried absolutely everything else that could cause it, he swapped in a known good alternator, and sure enough, the symptom vanished. There was something about the old alternator, having nothing to do with the DC output, that was causing the ignition system to malfunction. I paid him for alternator, installation, and a diagnostic fee, and went home knowing I'd gotten great service for a very reasonable price.

Here's what was wrong with that alternator. What do you want to bet the alternator was putting out all sorts of spiky AC that was interfering with the electronic ignition system or the computer system that drove it? What do you want to bet that placing an oscilloscope across the battery, instead of a voltmeter, would have made the problem immediately obvious? Or that placing a capacitor across the alternator would have vanquished the symptom? But of course hindsight is 20/20. The real point of the story is that one of the trickiest problems I've ever seen in any machine or system got solved.

Author's Note

The course of intermittents seldom runs smooth. Absent the ability to reproduce the symptom at will, missteps are frequent and expensive.

Of all the possible outcomes, the outcome in this true story was the best that could be hoped for. A typical, and much less desirable outcome, would go something like this:

Upon discovery of the hesitation, the driver would immediately bring the car to his "local mechanic", who, having absolutely no idea how to reproduce the symptom, would begin a long, costly course of diagnosis by serial replacement. A couple weeks and a couple thousand dollars later the problem might or might not be fixed.

In my case, the driver understood that the chance of solution was slim to none unless he found a symptom reproduction procedure. He spent a week or two driving the car and looking for a reproduction procedure. Once he found it, he understood the difficulty of the problem and brought it not just to anyone, but to the best diagnosticians available. Armed with a consistent reproduction procedure, the shop found the root cause and fixed the problem. Everyone played their part just right.

Luck: Master or Servant?

Author's Note

Here's a story exploring luck, logic and superstition in the context of troubleshooting. The part about the bike ride was true, to my best recollection.

Headwinds smothered me the first nine days of my bicycle trip, limiting my progress to 80 miles a day. A couple days I got only 60. I had ridden to the end of Door County Wisconsin, and was on my way back to Chicago. Accustomed to getting 100 miles days on other bike tours, I kept muttering "give me one day of favorable winds, and watch what I do". Then a darker side of me whispered "The wind's just an excuse. Maybe you're getting weaker as you get older."

I woke up the tenth day in in Manitowoc, Wisconsin, 168 miles north of my home in Chicago. Returning home should have been two easy days of riding, but the way things had been going nothing could be counted on.

Starting my tenth day of riding with my first tailwind, I was surprised to pull into Sheboygan, 26 miles south, an hour and a half later after leaving Manitowoc. I hung around Sheboygan for a couple of hours. I was in no rush....

Setting out again at 11:30am, I peddled 120 rpm in a 100 inch gear (that's about 35 mile an hour). Cars passed me on the highway, but with a gentle whirr, not a whoosh. *THE IDEA* hit me at 3:30pm in the outskirts of Milwaukee. Could I possibly make it home today? Fighting Milwaukee traffic, I exited the city's southern limit at 6:30pm. It was 80 miles to Chicago.

I crossed the state line at 8pm, with 50 miles to go. Now exhausted, the tailwind was still with me, so I cranked, reaching home at 10:30pm. 168 miles! Not on a racing bike in a draft line, but on a Schwinn Continental with 40 pounds of camping gear on the back.

—————*—————

Some people believe luck plays no part, and that the individ-

ual is responsible for everything that happens. Drunk driver run a red light and ram into you? Should have been more careful. Downsized out of a job? Should have managed your career better. Meteorite destroyed your house? You must have caused it somehow. Hearing my cursing the wind, they would have said “don’t use the wind as an excuse, you should do 100 miles per day in spite of it.”

Others believe life depends only on luck. Heart attack? The cigarettes and french fries had nothing to do with it, your number just came up. Lost every cent you had on that Florida land deal? What rotten luck! Lost your license for drunk driving? What a bad break that the cop saw you weaving. Their reaction to my 168 mile day on a heavily loaded bike would be “you were just lucky you caught that tailwind.”

The truth about luck is contained in this story. I had 9 straight days of “bad luck” (headwind). The “no such thing as luck” believer would have exhausted himself trying for the 100 mile day, and would have had to abort the trip. The “luck is everything” guy wouldn’t have prepared physically. After all, it’s all luck anyway. He’d have gotten 30 miles a day the first couple days, then given up.

The successful person prepares as best as possible to ride out the bad luck, then ride the good luck for every last mile. The new troubleshooter needs to know this. Needs to continue studying troubleshooting and technology while looking for a job. Needs to keep on going in spite of the bad luck the job market seems to throw at every job seeker. Thus he is ready when the good break comes and he hears about a job as an entry level repair tech or tech support person. Preparation provides advantage over other candidates and he gets the job, then goes on to work long hours learning on the job. His skill and dedication are recognized, so he moves up the ladder, becomes successful and affluent.

A few years later a friend from the old neighborhood, still working as a security guard, comments that he “sure got a lucky break.” The (not so new anymore) Troubleshooter just smiles.

Part III

Room For Improvement

Some of our clearest lessons come from mistakes — ours and those of others. The stories in Part III explore how things can go wrong while troubleshooting, and therefore by contrast how they can be done right.

All kinds of mistakes are showcased: User mistakes in “Tales from Pacific Stereo”, mistakes of arrogance in “Learn from Michael”, management bungles in “The Man who Banned Corrective Maintenance”, and societal mistakes in “A Legend Before His Time”.

Some of these stories are true, and some are fictional, but all shed light on landmines best avoided.

A Tale of Two Customers

Author's Note

A Troubleshooter is a Troubleshooter, right? How often do we pick our Troubleshooters out of the Yellow Pages, depending on little more than price and the size of the ad to make the decision?

On one level, this fictional is a story of Troubleshooter incompetence. On a deeper level, the story illustrates a customer's responsibility to pick a good Troubleshooter. If a Troubleshooter burns you once, shame on him. If he burns you twice, shame on *you*.

Any resemblance between this fictional story's characters and actual people, living or deceased, is purely coincidence.

Consider Francine Fortunate and Ursula Unlucky, two 32 year old wives and mothers of three, both working as junior accountants at the same firm. Both own the same make and model car, and both have the same local lube and tune shops do the manufacturer's suggested maintenance at proper intervals. But for non maintenance work they use different mechanics.

Francine has a wonderful mechanic whom she typically sees twice a year — once for a checkup/tuneup and once when something goes wrong. Her mechanic diagnoses problems correctly, replacing the bad part, and only the bad part, quickly. He has tons of customers, but he usually manages 24 hour turnaround. On such occasions, Francine can get a ride from her husband, family members or friends. For Francine, reliable transportation is a natural part of life.

Then there's Ursula. Ursula's mechanic is a poor diagnostician. Last May Ursula brought in her car, asking why the temperature was reading higher than ever before (though not in the red). Her mechanic replaced the water pump. Heck, he had to start somewhere. Four days later and \$200 poorer, Ursula drove the car home, noticed the problem still existed, and brought it back to her mechanic. Four days and three hundred dollars later she had her car back, this time with a new radiator. Ursula immediately noticed the problem was still there, at which time her mechanic assured her that "a little temperature fluctuation is normal", and that the problem "could be in

the temperature gauge itself”.

This didn't sound right to Ursula, but she didn't want to spend even more money. Besides, she'd gotten in trouble at work after missing two days due to car problems. But in mid July, the car overheated into the red and stalled. She had it towed to her mechanic, who said the car had simply run out of coolant, and replaced the coolant. He told Ursula to check her coolant before every trip, and to come back if she noticed repeated coolant losses.

But Ursula was very busy with work, and she was scrutinized ever more closely due to her absences and frequent phone calls to her mechanic. Over the next few days Ursula noticed voluminous white smoke in her exhaust, and occasionally upon starting there would be a “klunk” noise, and the engine would stop abruptly. Ursula later described it as feeling like someone threw a big monkey wrench into the engine. She continued driving it for a week, after which it would no longer start. Once again, she had it towed in.

Her mechanic told her she had a broken head gasket, a broken starter, and a broken flywheel. The broken head gasket caused incompressible coolant to leak into the cylinders, which stressed the starter and flywheel to the extent that they were broken. Cost of repair — \$2200. What Ursula's mechanic didn't tell her was that the broken head gasket was a direct result of the overheating which he repeatedly failed to correct.

When her career had been going better, Ursula might have opted for a new car. But now she was worried they might fire her, and \$2200 was a lot less than \$22,000. So she paid the money and got the job done. The car was in the shop 2 weeks.

She missed work the day she brought the car to the shop. The next couple days her husband drove her to work, but when he lost a client due to being late for a meeting after dropping her off, they rented a car at \$24 per day. She missed work to pick up her supposedly repaired car, and the car wouldn't start. The mechanic had forgotten the new starter. She re-rented a car, and three days later got her car back.

When Ursula finally got the car back, she checked the coolant religiously and once again saw it decreasing every day. She called her mechanic, who told her to bring it in. But it was three days until Saturday, and she just couldn't miss any more work. So she filled and drove.

On Thursday, the car overheated on the freeway and needed to be towed. Her mechanic said the head gasket was broken again, but refused to cover it under warranty because it was “caused by an overheat”. Ursula and her husband fought over

his refusal to drive her to work the next day (he had been severely rebuked for being late and blowing off the client after chauffeuring her the last time), so Ursula took the bus and arrived two hours late. She was fired on the spot.

Ursula's car was lost in a mechanics lien. The family has made severe budget cuts in an effort to save the house. Without a car to make job interviews, Ursula's prospects are dim. Ursula has a large extended family and lots of friends, but she's already called in more than her share of favors from all of them. Nobody wants to drive Ursula to job interviews or her children to sports practice. A simple shopping trip requires coordination of bus routes and takes several hours.

It's a real shame, because if Ursula had first taken the car to Francine's mechanic, he would have correctly diagnosed the problem as a leaky upper radiator hose, and fixed the problem in a few hours for fifty five dollars.

Speaking of Francine, she just got a promotion, enabling her to buy a new car. Her oldest son uses her former car to drive all the kids to school. That gives Francine a lot more time these days.

Learn From Michael

Author's Note

This story is loosely based on a massive, long and costly network outage occurring several years ago. All names have been changed. The purpose of this story is not to point fingers at individuals, but to shed light on common causes of such debacles: Arrogance, abandonment of process, and total belief in output of diagnostic programs/equipment.

It was Monday morning at 9:30pm when I got an urgent call from Ned Werkadam, network administrator for The Swagger-son Group, a conglomerate doing a half a billion a year, every dollar of which went through Ned's network. I was a programmer for The Swaggerson Group.

Ned's a good friend of mine, and he knows what I can do with the Universal Troubleshooting Process. His multi-server LAN was down, bills weren't going out, and he couldn't find the problem. Could I come out right away and take a look at it?

Ned knows me. He knows I'm a great Troubleshooter. And he knows that I'm no network expert. I consider it an honor that he asked me in on the case. I came right over.

In the server room, Ned briefed me. Producing a network diagram, he showed the location and results of each test he'd done so far. Looking at his work, it was apparent he'd already isolated it to a single M454 box. But he didn't realize it. I asked him to find a spare M454 to swap, verify that it fixed the problem, then troubleshoot the broken box to the board level while the network continued on its way.

Ned wasn't enthusiastic. Swapping the box would take 4 hours. After I showed him, using Troubleshooting Divide and Conquer logic, how his own work clearly indicated the fault was in the M454 box, he agreed. Then Michael Martin walked in.

Michael Martin was a "network engineer" with Network Expertise, Inc., whom Ned had called right after calling me. Michael

had several professional certifications. Michael was knowledgeable and brash — a take-charge kind of guy. And he took charge.

“No, don’t swap out that box, the problem’s not in that box. My diagnostic software says it’s not in that box.”

Turning to me, Michael said “look guy, no offense, but I’m the network expert here. You’re just a programmer. Why don’t you go back to your cubicle and code?”

Ned turned from Michael, to me, and back again. After a minute’s deliberation, Ned said hesitantly “OK, we won’t swap out that box just now. Thanks Steve”. There was no more I could do for Ned, so I went back to my cubicle and pounded out 300 lines of code. My code didn’t depend on the network.

The network was down all day. And the next. The network was *down an entire week*. After the network came back up, curiosity got the better of me, so I dropped in on Ned.

I closed his office door and spoke first. “I hear it took a week to solve that problem. Are you OK?”

“I had some trouble, but I’m still employed”, was the reply.

I couldn’t resist. “So what was the problem?”

Ned strained to keep a straight face. “It was a circuit board.”

I went in for the kill. “And which box was that circuit board in?”

Ned’s sheepish grin spread from ear to ear. “You know darn well which box it was in.”

We laughed, and the conversation turned to other things.

I never heard a cost estimate on the week long network outage. Just the interest expense would have been several thousand dollars. They probably paid even more for employee overtime to work around the problem. I don’t know whether they lost any business because of the outage, but if they did, that cost could have been in the millions.

Things didn’t turn out so well for Michael Martin. The company he worked for lost its contract with The Swaggerson Group. Soon after that, I heard Michael Martin was pounding the pavement looking for a job.

I never saw Michael Martin again. Sometimes I wonder if he learned his lesson. Probably not. He was too sure of himself. It’s entirely possible he never understood the causes of his failure — arrogance, closed mindedness, and an unquestioning belief in the answers that his diagnostic software spit out.

When your mechanic says he needs to replace your O₂ sensor because his diagnostic computer says the O₂ sensor is bad, remember Michael Martin and question the mechanic further. The O₂ sensor might misbehave because of a flaw somewhere

else in the system — perhaps the air induction system, low fuel pressure, fuel injector problems and the like. Garbage in, garbage out.

Michael's loss can be your gain.

A Legend Before His Time

Author's Note

This fictional tale explores a stereotype that has hurt the profession of troubleshooting for generations. Any resemblance to actual people or organizations, living or dead, is coincidental.

Ron lumbers down his high school hall, looking like a bulked-up James Dean who traded his pointy shoes for blunt brown steel-toes, his peg-leg jeans for baggy grays, and his oh-so-perfect DA hairstyle for something less Hollywood. He's sixteen and looks twenty. Ron's not in any "mainstream" classes. He's one of those "shop guys", invisible until there's a brawl or some rich kid needs good car repair done cheap.

Ron's good with cars. Last month he bought a 67 Dart for \$75, "dropped in" a dual 4 barrel 440 and a 4 speed manual, cut a hole in the hood to fit an apparatus that looks more like the El Segundo Electric Plant than a carburetor, ditched the back seat in the alley, and lost a cop car on the first test run.

The girls love Ron, or at least a certain type of girl. Ron's girls are all high school seniors (some for the second time), who look 30, walk with too much slink and smile with too much smirk. In high school we all learned a name for this type of girl, and they wear the dark roots beneath the bleach as a membership card to that group.

Ron's future isn't so hot. Before the snow next flies he'll impregnate one of those bleached beauties, marry her, and drop out to work in the local garage. In the next few years they'll have three more kids and move to a trailer park. His wife will get fat and sloppy, he'll get drunk and slap her around. Raised in dysfunction, and without even the automotive hobby to keep them out of trouble, Ron's two sons will trade their high school classrooms for a jail cell after robbing a liquor store.

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Parents don't want their child turning out like Ron, so they don't let their teen-ager take shop classes. Instead, they send

their youngsters to yet another semester of imagery, alliteration, iambic pentameter, similes and metaphors, advanced placement Russian, differential equations, frictionless pucks and ideal engines. Ron has done his job well as anti-shop poster boy.

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Of course, Ron is just a stereotype. He starred in a thousand movies before he was born.. He's a legend before his own time. Just turn on your TV and you can see Ron drag-racing, smoking, drinking, brawling, and separating young girls from their innocence.

However, Ron's greatest feat, never shown on TV, has been to keep generations of bright young kids out of shop class. Those kids turn out more like Jim.

No shop or vocational classes for Jim! He went straight through high school and engineering school (EE major), with straight A's. He never soldered a chip. He never troubleshot anything more complex than his little protoboard lab assignments. So his first five years as an engineer he couldn't debug the circuits he designed. Then he went into management, where he couldn't debug his department. Multiply Jim by thousands of college grads per year and you have a recipe for sub-standard productivity.

Don't just teach your child the Universal Troubleshooting Process. Give him something to practice on!

The Man Who Banned Corrective Maintenance

Author's Note

This is a fictional short story. Any resemblance to actual people or organizations, living or dead, is coincidental. That being said, you wouldn't have to look very far to find characters like the ones in this story. On the surface, this story is about the importance of corrective maintenance. But just below the surface, you see the consequences of greed, abandonment of process, and the troubleshooting consequences of management complacency and decay. Enjoy!

Imagine an auto-repair chain, each facility with techs trained to repair everything on the car, including audio systems. The chain's name is Nagle Automotive, in honor of Nagle Avenue, site of the first shop, started by long departed Vince Bassett. CEO Bob Wilson has been at the helm the past seventeen years. Early on, Mr. Wilson decreed that every tech would be thoroughly trained in the Universal Troubleshooting Process. It worked. Happier techs, lower cost of repair, some of which was passed on to the customer, some of which was kept as profit, and some of which went into the technicians' paycheck. Under Bob Wilson's leadership, word spread there was finally a source of competent, fix it right first time car repair, and the Nagle Automotive expanded from three facilities to a hundred twenty one, in three states.

The chain goes public, and soon after, stockholders demand cost containment procedures. After they demand Mr. Wilson turn a scrutinizing eye toward the technician's paychecks, Mr. Wilson resigns. Quite happily, the board of directors replaces him with Clifton Carsliegh. Mr. Carsliegh is "one of their own", a penny-pinching former CFO of an almost-Fortune 500.

Carsliegh's first pronouncement is to eliminate Corrective Maintenance. Corrective Maintenance is simply a costly "gift" to the customer. A "bribe" to remain a customer. Henceforth, the customer would receive the repair he paid for — nothing more, nothing less. A bold step, with bold results.

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Phil Carson is a tech at the Evanston facility. He's been with Nagle Automotive since he graduated high school nineteen years ago. You might say he's grown to manhood under Nagle. Things are great. His paycheck easily pays the mortgage, feeds his wife and two kids, and there's even enough left over to save a little. Unlike his counterparts at other garages, his paycheck is rising with his skill level.

Carson's under the hood of an old Plymouth. The symptom is a loud, ugly sounding hum occurring while driving, and varying with engine speed. Normally, after reproducing the symptom, he spends the next two minutes of every repair checking fluid levels, battery terminals and battery voltage. Not today — the new CEO has declared Corrective Maintenance to be out, and the shop manager is enforcing it. Phil Carson drives the car over to a special bay with a torque load, runs the car at a simulated 20mph, and starts his tests.

He can't make the problem occur except under load, so he suspects either the transmission or possibly a bearing. He does a series of tests on the transmission which indicate the transmission isn't at fault. With the car turned off and in neutral, he takes out the spark plugs to eliminate compression, and turns the crankshaft by hand. Normal resistance, no tight spots, normal play. Bearings probably OK.

Listening carefully, he notices a softer version of the hum even in neutral when revving the engine to about 1800 RPM. He finds a fan belt, a little looser than he'd like, that seems to be vibrating excessively. He doesn't think that's the problem, but he tightens it just in case. Under load, the symptom's still there. Removing all the belts, he runs the engine at load. The symptom's gone. Putting belts back one at a time, he sees he can toggle the symptom with the power steering pump belt. Suspecting the power steering pump, he inspects visually. There's evidence of a slow leak. Removing the cap, he sees the power steering pump almost empty. After filling it, he tests again. The symptom's gone. An hour of work that would have been five minutes if the corrective maintenance ban hadn't prevented him from initially checking fluid levels.

Phil Carson's allegiance to Nagle Automotive is dwarfed by that of the shop manager, Carl Norton. Carl had been a sidewalk mechanic, making a few bucks here and a few there. Carl had gotten in a little trouble, done a little time. Getting out, his parole officer set up an appointment with Bob Wilson, who at the time was manager of the Oak Park facility.

Mr. Wilson was a straight shooter — “you play ball with me, I’ll play ball with you. Otherwise, you’re on the street, and likely back in jail. Norton, I’m going teach you a specific troubleshooting technique, called the Universal Troubleshooting Process, and I expect you to use it every single time.”

Norton had done what Mr. Wilson had said, become a top technician, then become manager of a small shop, then a bigger one, and finally Evanston. The Evanston shop had the highest numbers in the Chicago area. Yes, Carl had a lot to be thankful for.

“Carl, I just had an hour repair that would have been five minutes if you’d let me check the fluid levels first.”

“Just calm down, Phil, and tell me about it.”

“The problem was a low fluid level in power steering pump, causing a loud humming and buzzing sound. Since checking fluid levels is Corrective Maintenance, I couldn’t do it. Instead I spent an hour troubleshooting it down to the root cause. I suppose we could get the customer’s OK to replace the leaky pump, and pad the repair time a little to recover some of that time, but Carl, it’s just bad business.”

“Phil, it’s important that you and all the techs continue our new policy of no Corrective Maintenance. Every time you have an experience like this, you come to me, and I’ll write it up. When the time comes, the information will be there.”

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Larry Mages is the audio tech at the Milwaukee, Wisconsin facility. His boss just resigned over this “no corrective maintenance” thing, and now the District Manager (Southern Wisconsin District) is watching everyone like a hawk. A defective car stereo lies disassembled on his service bench. The soldering on the main circuit board is hideous.

He is re-soldering every connection on the board when the District Manager’s voice croons over his shoulder “That’s against the rules now, Mages. No Corrective Maintenance. No shotgun stuff. The new policy is surgical accuracy in problem removal. I want you to troubleshoot that problem to the one defective solder joint, not waste your time re-manufacturing the customer’s unit for free.”

Mages counts to ten, then says neutrally “OK Boss.”

Mages works an hour and a half pinpointing the first two bad connections. While he’s working on the third, the District Manager again appears over his shoulder.

“Mages, it appears you’re a great solder jockey but I don’t

know about you as a technician. You've been at this thing for an hour and a half."

Cool as ice, Larry Mages begins soldering all connections. The DM is furious.

"You're disobeying direct orders, Mages. You're fired."

Mages continues soldering. The DM is turning purple. "You're fired, Mages."

Larry Mages continues soldering til the last joint's done, plugs in the unit, tests it, and finds it works. He installs it in the car. He's just completed the installation and in-car testing when the police show up.

"Your boss tells me you've been fired and refused to leave", the older cop says.

"Must be some misunderstanding", says Mages. "I thought he said today was my last day. If he wants me to leave right now, that's fine." Mages gathers his tools and departs through the back door, accompanied by the police. His former co-workers furtively look up from their work, then pretend they never saw.

On his cell phone, Mages calls the customer, tells him he can pick up his car, and just for fun tells the customer to ask for Larry Mages by name. Two days later Mages is operating his own automotive audio business out of his van, and making more money than ever before.

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Martin (Marty to his friends) Cash struts the concrete of the East Chicago Indiana facility, hands clasped behind his back. He's clearly on inspection, and the techs are terrified. He calls for silence, then gives them the word. "Yesterday Clifton told me no Corrective Maintenance, no exceptions. Is that understood?"

Cash pauses for effect. He loves the effect of mentioning the CEO by first name. This is the third corporation he's ridden into on Carsliegh's coattails, and everyone knows it. For now he's the District Manager, Northern Indiana District. Soon he'll be corporate.

His first week in Indiana, he'd found resistance to the no corrective maintenance edict from the East Chicago facility, so he'd fired a tech for insubordination. It was a cooked up affair, but he could probably make it stand up in court. The employee had been denied unemployment because of his extensive list of infractions. Will Matson, manager of East Chicago, had signed the paperwork. He's fifty one years old, with three children still in the house. Martin (Marty to his friends) smiled as he

reflected on the ease of controlling a man through his family's welfare.

At first productivity had gone way down. The techs had blamed the no corrective maintenance edict. Martin brushed that aside with an unspoken, unwritten policy — punch in for eight, but work til the work is done. Most employees in his district now work ten hours for eight hours pay. The guys in the East Chicago facility work twelve. His numbers are being noticed at corporate, as Northern Indiana is the only district whose productivity didn't decline after the edict. There had been one small problem. An East Chicago employee had gone out on stress leave. That's OK. Nobody'd believe him about being "forced" to work twelve hours. And nobody'd support him. They all had mouths to feed.

Two Years Later

Martin Cash sits at Clifton Carsliegh's side late one night, double-checking the figures. It will work. Stock price is in the toilet, allowing them to buy Nagle Automotive for pennies on the dollar. The stockholders will take anything. Carsliegh had resigned three months ago, stating the losses were due to the board's refusing his latest cost containment procedures, involving hiring minimum wage "para-mechanics" to supplement each facility manager, the only remaining true mechanic. All training had been discontinued, since employee were supposed to be already trained. Now Cash, who publicly disowned Carsliegh, was CEO, and secretly doing Carsliegh's bidding. Once Carsliegh and Cash owned the company, they would cut costs to the bone, selling off half the stores. If that didn't work, they'd chop-shop the whole thing, then stiff the creditors. They'd done it before.

Coincidentally (or maybe not so coincidentally), a secret meeting is taking place at the Summerdale Avenue Shop. The participants wouldn't have wanted it known that they were there, but I can tell you that Carl Norton, former manager of the Evanston facility, freshly demoted to technician, chaired the meeting. At his side is Phil Carson, who is now a manager but formerly worked under Carl. Phil Carson's wife, the mother of his two children, had told him she could live with any kind of poverty except poverty of the soul, and that he should follow his heart. There are roughly thirty additional participants, mostly old-timers remembering what Nagle had been like when they used the Universal Troubleshooting Process.

Norton's gavel (a wrench) descends, marking the start of the

meeting. “Guys, Nagle’s doomed. We all know it. Nothing can save it. We’re gonna lose our jobs. If we play ball with Martin Cash we might keep em a few more months, but what’s that worth?”

“Easy for you to say, Norton. Your kids are grown, you got no wife, if worst comes to worse you sleep on a park bench. That’s a luxury most of us just don’t have”, came a voice from the middle of the room. It was Chester Carter, husband, and father of six, three of them under the age of ten.

“Hey Chester, do I look like a guy with no wife and kids?” asks Phil Carson. “I got one in college, and one in high school, and a second mortgage on the house to compensate for decreased paychecks the last two years. But ya know what? That’s EXACTLY why I’m up here with Carl. We have a choice. We can die slow, or we can risk dying fast, but maybe come out of this with more money than we ever dreamed.”

“Ya talk big, Carson, but I don’t hear any details. I think you’re full of hot air”, snorts Johnny Borgen. A muttering of agreement becomes a belligerent crescendo. Borgen had said his line exactly as he’d rehearsed with Carl and Phil.

“You want the details, here’s the details” shouts Carl, taking charge. “We’re gonna form a corporation, and make a garage chain like Nagle was in Bob Wilson’s time. We’re gonna pool our money, buy the facilities, and start up. About a third of us will be managers to start out with, the rest soon after. Nagle’s collapse will leave a vacuum in the marketplace, and we’re gonna fill it. We’ll each be part owners, so if we’re successful we’ll make serious money.”

“Pardon me, Carl, but last time I looked I didn’t have fifty thousand dollars hanging around”. That’s Chester interrupting, and he looks really mad.

Carl continues calmly. “We’re each gonna invest three thousand. If ya can’t get it, borrow it. Just get it.”

Jimmy Whittmore speaks up. “Carl, there are thirty people in this room. If they all come in, that’s ninety thousand dollars. How are you going to open up more than one or two facilities for that price? And one or two won’t feed all thirty.” Jimmy has a slow, winning smile, an Oklahoma drawl, and just recently started to shave. Pretty girls come from miles around to visit him at the shop, but he’s way too young and free to take them seriously. It’s hard to realize he’s a Nagle veteran, having joined six years ago at the age of fifteen. When he graduated high school two years later, he came on full time. Jimmy’s smart. He was on the verge of being promoted to manager when Nagle hit the skids. For Jimmy, some day never came.

“Should we tell them now?” asks Phil, creating suspense.

“Yeah”, says Carl. “Guys, I talked to Bob Wilson last night. I tried to convince him to come back and lead Nagle, but he was having none of it. He says Cash and Carsliegh have sucked it dry, and there’s nothing left. He’s having fun where he is, so he doesn’t want to get involved.”

There’s a groan throughout the room. The mention of Bob Wilson brightened things up, word of his non-involvement made the mood darker than ever.

“Hey guys, that’s not the end of the story”, Carl Norton shouts to be heard. “Bob Wilson says if I get twenty ex-Nagle guys, and he says he means guys from the old days who really believe in the Universal Troubleshooting Process, to put up three thousand apiece, he’ll pop for five hundred thousand. For that he wants a one-third ownership of the company. He doesn’t want to run the company, he’ll just take his profits and make his voice heard like any other big stock holder.” Carl stops talking and surveys the effect of his speech. There is five seconds of silence.

“I’m in!”, says Jimmy Whittmore.

“Not so fast” cautions Chester Carter. “How do we know this business will succeed? Three thousand’s a lot of money to me, and as owners we might end up working for free.”

“Let me answer Chester.” says Phil Carson. “Chester, you’ve been a Nagle manager for eleven years, and your shops have always done well. Most of the others in this room have been successful Nagle managers. Knowing how to run our shops is definitely not going to be a problem. Wilson’s backing us, so neither is capital. That leaves just marketing. Chester, remember our marketing before Carsliegh took over. There was none. It was word of mouth. We exceeded everyone else’s performance so much that we put em all out of business. We did it with the Universal Troubleshooting Process, and we still know how to do it. Chester, do you believe in the Universal Troubleshooting Process?”

Chester stands a little taller as he replies: “You bet I do!”

Chester will deny it to this day, but I was there, and I can tell you, there was a tear in his eye.

Chester continues. “OK, I’m in.”

All resistance is gone. Twenty three guys (scuse me, two were women) sign up at three thousand a stake. Summerdale Automotive (named after the street) is born.

Several Years Later

“But Dad, you didn’t answer my question. How did you become CEO of Summerdale Automotive?” asks the boy.

The man replies: “Carl Norton was the first CEO, during the tough years. Lots of the stores weren’t yet profitable. Luckily, Chester Carter’s shop made mounds of money and put all its neighborhood competitors out of business, including a Nagle facility. Carter quickly started three other shops, equally as profitable. Lucky thing, because we were underfunded, and Nagle was still a strong competitor. They sued us several times. We almost went broke. But eventually we won a judgment against them, for restraint of trade. Carsliegh died broke, and Cash went to prison on embezzlement charges. After he got out of prison, he was never the same. Oh, and you remember Chester, the guy who was so worried about his six little children? Well, each of those kids is a multi-millionaire, and three of them own Summerdale Automotive franchises.”

The man continues: “The stress from those early years was too much, and Carl Norton had a heart attack. He resigned for health reasons. Bob Wilson, at age seventy, temporarily took the reigns. He tried to groom Chester Carter as a successor, but Chester said he was making too much money to be CEO. Bob Wilson turned to Phil Carson, who reluctantly took over. Under Carson, Summerdale Automotive blossomed into a national chain with over four hundred facilities. He created the Process Education Committee, headed by Johnny Barga, whose job it was to see that every tech in every shop and franchise followed correct Troubleshooting Process. Johnny Barga is as much responsible as anyone for the success during the Carson era. Two years ago, Phil Carson retired and I took over.”

“And that’s how you became CEO?”, asks the boy.

“That’s how”, Jimmy Whittmore tells his twelve year old son.

Part IV

Intermittents

No matter how vast our technical knowledge, no matter how skilled our use of troubleshooting process, intermittents can throw us for a loop. The stories in Part IV are all true, although the last one, “The Phantom Keyboard Killer” is much stranger than any fiction I could invent.

As you read the stories in Part IV, think of intermittents you’ve faced, how you’ve solved them, and how solving intermittents is different from solving reproducibles.

It Only Crashes Twice a Day

On July 28, 1994 I solved one of the most frustrating and tenacious intermittents that ever squared off against me. You remember the summer of 1994 — All-4-One’s “I Swear” and Lisa Loeb’s “Stay” topped the charts. We were gearing up for what would become one of the most boring and lopsided presidential elections ever staged as Bob Dole tried in vain to upset Bill Clinton. Of course, all of that was drowned out by news of OJ Simpson.

For a couple weeks before July 28 I’d heard anecdotes referring to my application crashing. My application used a 16 port serial card to query 16 different title company databases. No TCP/IP, no hardware or software flow control, my app had to run around the ports, pick up messages, send commands, and circulate back in time that the replies wouldn’t fall off the end of a very small ring buffer. The information obtained by the 16 port serial card was placed in small intermediate files, which were processed by a continuously running app that read them, incorporated them into a database, and deleted them. It was written in C, and worked beautifully 99.99% of the time.

A couple weeks before, the company sales manager brought me on-site to fix this intermittent. We stayed there 4 hours and it happened once. I tried a couple things to make it less likely to crash, and then we had to leave the customer site. But as days went by, it was clear I hadn’t fixed it.

On July 28 they sent me on site with a mandate — don’t leave til it’s fixed. Upon arrival, I told the site manager, who oversaw 30 keypunchers, to stop all work the instant the app crashed. Sure enough, two hours later it crashed, and the site manager immediately stopped all work.

It was a Novell network, so I used Novell’s salvage command to bring back the last 10 deleted intermediate files, marked them read-only so they could not be deleted, and started up the collection app. Sure enough, it crashed. Tried it again,

it crashed again. I had just converted the intermittent into a reproducible.

The next step was to isolate which file caused the crash. I fed in 5 files instead of 10, then 2, and finally isolated it to a single file. Running the collection app in a debugger, I found that a certain variable was “magically” changing value after it had been set by a subroutine designed to set it. Even though the value change happened outside the subroutine, I traced it through the subroutine.

After a couple minutes consideration, it was clear that the subroutine was returning a pointer to a local char array that went out of scope as it exited the subroutine. Yes, the pointer still pointed to the same stack location containing the information, but that stack location was now fair game for any other subroutine’s local variables. When a record contained an extraordinarily long string, it would overwrite that part of the stack, at which time the app would crash.

I placed the word `static` in front of the char array declaration to prevent it from going out of scope. The app never crashed again.

Author’s Note

This intermittent was cured by converting the intermittent to a reproducible — a well known anti-intermittent tactic. As for me, I’ve made a lot of programming mistakes since then, but I NEVER AGAIN passed back a pointer to a locally declared array.

Relapse: The Persistent Intermittent

This intermittent first appeared around the start of November, 2004. It was solved, for good, on February 26, 2005. I solved it twice. The first solution was on November 19, 2004, after which the symptom hibernated until early February, 2005. This intermittent was costly in terms of computer productivity, and in terms of my time troubleshooting it.

It happened on my main desktop computer, which is by no means a simple machine. My desktop had a rather complete Mandrake 10 Linux installation, including Kmail and Mozilla, neither of which has impressed me as especially stable.

Author's Note

To me, Kmail and Mozilla don't seem stable by Linux standards. In comparison with the programs I ran under Windows 98 several years ago, they're rock solid. It should be noted that I rebooted my Windows 98 machine a half dozen times per day.

Hardware wise, this machine had two 200GB hard disks, a DVD reader and a CD reWriter, an AMD xp2600+ processor (they run hot), 1.5GB of 400Mhz DDR memory (the AMD website says one should use 333Mhz memory, not 400Mhz). It has one inblowing and one outblowing fan besides the fans on the power supply, yet it still runs fairly hot. Its onboard LAN has been disabled in bios, and it's hooked to the local area network through an IDE NIC. It accesses a scanner and camera through USB, and an HP4050 via a parallel port.

In other words, it's not a simple machine.

Author's Note

During the 11/2004-2/2005 period the machine actually evolved. By the end, the 200MB system drive had been replaced with a 250MB. Somewhere during this time period, the DVD reader and CD rewriter were replaced by a single DVD+RW drive.

Somewhere in late October or early November 2004 I noticed that it would lock up. Sometimes for a few seconds, sometimes for minutes or permanently. At first these lockups were rare, but as mid November approached, it happened several times per day. Some of these hangs were accompanied by a stopping of the clock on the taskbar. These hangs seemed to happen more frequently when my computer was under stress, like doing a disk backup or running my prime number generator program.

After a couple days I noticed that these hangs were preceded by a single click. There would be a click, and then one to thirty seconds later the computer would hang. At the time it sounded to me like the click came from the UPS purchased from Sam's Club. I arranged to return the UPS to Sam's Club. They ran a purchase history for me and gave me 7 days to return the UPS.

During that 7 days I ran with a different UPS, and indeed, the frequency of such hangs dropped precipitously. But there were a couple hangs during those 7 days. On the 7th day I returned the UPS. Yes, I knew the UPS wasn't the whole story, but subjectively it made the problem more frequent. Up against a "use it or lose it" deadline, I returned it.

Within a few days it was clear that the problem was nowhere near solved. It came back slowly, and by November 15 it was as bad as it had been before the UPS swap.

I should mention at this point that I had not performed a thorough investigation on this problem, because to do so would have greatly impacted my work. I kept hoping either that a lucky guess like the UPS would fix it, or that the problem would become reproducible. But on November 19 I finally admitted that this problem was preventing me from doing my work. I opened the case and went on in.

If you've read my books or taken my course you know that one of my favorite intermittent busting tactics is "turning the intermittent against itself". An intermittent's power comes from its continual state changes. If you can correlate any factor to those state changes, you've found the root cause — often without any in-depth knowledge of the underlying system or

technology. You look for such correlations with manipulation — physical, thermal, whatever. With the machine running, I wiggled cables and cards.

Some folks say it's irresponsible to wiggle things in a running computer. You can break something. That's true, but look at my situation...

I could replace the entire computer, new and fully loaded with hardware, for less than maybe \$800.00. It's unlikely the whole computer would break — a \$100 motherboard or a \$150 disk would be more like it. So then the question arises — how much extra troubleshooting time should be spent protecting against a possible \$150.00 loss, especially given that I've NEVER broken a computer with on-line physical manipulation. Remember, if the computer weren't already broken, the physical manipulation could not have harmed anything.

I went in and wiggled. One IDE cable seemed to affect the symptom, so I replaced it. Wiggling some more, the symptom recurred. Finally it became clear that the symptom could be triggered at will by wiggling the power connector to one of the drives. I replaced the power connector (with the power off), turned it back on, and wiggled some more. Nothing. Nada. I banged everything really hard. Stressing the system with my prime number generator couldn't reproduce the symptom. I performed a disk backup, which really stresses the system. Nothing. It was fixed. I taped the bad connector shut, labeled it BAD, and buttoned everything up. It was fixed. Time marched on...

Must have been late January or early February I heard a click. A little sound — a harmless sound — most would have missed it. But to me it was the most ominous sound in the world — the sound my hard disk made back in the days of intermittence. Nothing happened, time went on. I started hearing the click more often. Then one day the computer hung, just like the bad old days. Suspecting hard disks, I sought to find which of the two was bad. A hard disk test utility called `smartctl` indicated that my system disk had problems, but my data disk was OK. Booting the Knoppix Linux-on-a-disk, the data disk's partitions could be mounted, but not the system disk's partitions.

I booted Knoppix, archived the data partitions, and used `sftp` to transfer the newly made archives to a different computer. I replaced the system disk and reloaded the operating system on 2/26/2005, fired it up, and it worked perfectly. It's been working perfectly since then (this is being written about eight months later. This computer is now one of the most stable

I've worked with — Kmail and Mozilla never hang.

What happened?

What happened? It's a fair question. How was an intermittent cured, only to pop up two months later?

Obviously this disk was fitted with a bad power supply connector back in October/November. The bad power supply connector turned the disk off and on several times a day, without benefit of any kind of hardware or software "orderly shutdown". It's likely that the power cycles to the disk were not clean, but instead were the spiky type of power cycles you get with a loose connection. My theory is that the power cycling of the disk in November did irreversible damage to the drive and gravely shortened its life.

Now ready to fail, the hard drive could not long sustain the constant demands of a daily driver computer. In February the disk started cutting in and out. It was proven bad and replaced. There's no reason to anticipate further consequential damage.

Author's Note

In both cases of intermittence, the initial intermittent busting tactic was to ignore the problem, because on systems where safety isn't an issue, living with an infrequent intermittent is more cost effective than troubleshooting it. Once it got more frequent, physical manipulation was employed to turn the intermittent against itself in the first case, and diagnostic software was used in the second case. These are both recognized weapons in the war on intermittents.

The Switch that Would Not Stay Rebooted

My main computer kept losing its connection to the Internet, and in fact to all of my LAN. I rebooted the switch it was hooked to (the 16 port main switch next to my IPCop gateway), and BANG, the connection was restored. An hour later the connection was lost again, and again rebooting the main switch fixed it. Because I was researching the grub boot loader at the time, my computer was being rebooted quite often. Every time I rebooted the computer, I had to reboot the main switch too.

After an hour this became too much, and the troubleshooting began. My first step was to look at other computers on the LAN. My experimental computer plugs into a 5 port Linksys switch whose uplink port connects to the 16 port main switch. The experimental computer couldn't see the LAN either. Rebooting the 5 port Linksys switch allowed both the experimental computer and the main computer to see the network. Hours passed with no further problems. Days passed with no further problems. It was fixed.

I'm no network expert, but here's what I think happened. The 5 port Linksys switch got itself into a bad state and was sending out bad packets. These bad packets would in turn put the main switch into a bad state, either as a function of time, or when my main computer was rebooted — whichever came first. Who knows why rebooting the main computer would trigger the symptom, but it did.

Rebooting the Linksys switch got it out of its bad state and eliminated its broadcast of bad packets, thus solving the problem.

Author's Note

Why did this problem seem intermittent? It was a hard failure of the Linksys switch!

The definition of an intermittent is a problem for which there is no *known* reproduction procedure. When first encountering this problem, all I knew was that my computer dropped its LAN connection “every once in a while”. There was no known way to make it happen. Later it became clear that the symptom could be reproduced by booting the computer, but by that time corrective (general) maintenance had already been applied, in the form of rebooting the 16 port main switch and reconnecting network cables with electronic lubricant.

The breakthrough came when it became obvious that switch I rebooted was more of a symptom than a cause — the cause was the 5 port Linksys switch.

The Power Supply Event

April 2005

I was merrily working away when my computer shut off. Powered down. At first I figured the power went out — our local power company is surprisingly unreliable, at least for a power company in a developed nation. But my computer was on an uninterruptable power supply. The lights in the house were still on. Oh Oh!

Repeated attempts to press the power button did nothing. I plugged a known good power supply into the motherboard, and the machine counted memory. Good, probably my power supply had gone bad.

Just to be sure, I plugged the old power supply back into the motherboard. It counted memory and booted up. Oh Oh!

When you can toggle a symptom by repeatedly replacing and restoring a part, it's a reproducible problem. When you replace the part and it works, and then restore the original and it still works, you have an event — the sparsest type of intermittent.

Leaving the old power supply plugged in, I buttoned it back up, vowing that if the same symptom happened even one more time, I'd perform the following tests:

1. See how hot the power supply is, and if hot, blow on it with the blowing part of a shop vac for several minutes
2. Wiggle the power supply to motherboard connection, and see if the symptom goes away
3. Make absolutely sure the computer is getting power
4. Turn off and then back on the switch on the power supply itself
5. Disconnect and reconnect the power supply to motherboard connection
6. Swap in a known good power supply

- If #1 fixes it, the power supply is overheating and shutting down. Investigate why. Do the fans turn OK?
- If #2 fixes it, there's a loose connection in the power supply lead or the motherboard, and I'll need to find out which.
- If #3 fixes it, find out why the 120V connection to the computer wasn't working.
- If #4 fixes it, either the computer or the power supply got itself into some illegal state requiring power recycle
- If #5 fixes it, either it's a loose connection or a weird illegal state.
- If #6 fixes it when the others didn't, I'll assume the power supply is bad and replace it.

FINAL NOTE: April:

Extensive experience made me retest the original power supply. At each stage of the troubleshoot, I constructed diagnostic tests to be quick. Therefore, when it came time to “swap” the power supply, I merely removed the power supply connection to the motherboard, and replaced it with that of a known good power supply. I neither unmounted the old power supply nor mounted the new one, but instead just disconnected the old power supply from the motherboard and drives, and connected the new power supply to the motherboard and drives.

When it counted memory after the temporary replacement, it looked mightily like a simple case of bad power supply. But strange things happen in troubleshooting, so just to make sure, I restored the original power supply connection. The symptom did NOT reappear, meaning there was something odd going on.

There was not, at that moment, sufficient evidence to replace the power supply. The root cause of this problem could have been outside the power supply, in which case it would have recurred later (after spending \$100.00 for a new high quality, 2 fan power supply).

So far, this mishap was an event — the sparsest of all sparse intermittents. It happened once and never again. If this had been a safety critical system, it would have needed to be taken offline and extensive tests performed to ascertain the root cause. However, because it's not safety critical, by far the best course of action is to continue using it. Either the event will never

recur, or it will recur (hopefully more often) and I'll be able to troubleshoot it to a root cause.

September 2005

Murphy's law says "Anything that can go wrong, will go wrong." Litt's addition to Murphy's law is "and it will happen at just the wrong time."

In early September 2005, my backups exceeded one DVD, and because my backup scripts hadn't been coded with that possibility in mind, I had to rewrite my backup scripts. Meanwhile, my DVD recorder went bad, so I had to replace it, and still had no backup. I was fooling around with backups when I should have been working.

I finally got a backup, and was about to get back to work (now delayed by 3 days), when POOF, the computer shut down. I instantly recognized it as the same event that happened in April 2005. Not having time to mess with it, I just kept working. POOF, it went off again. And again.

I looked for my writings on the April event, but couldn't find them, so I started (almost) from scratch. Due to the need to quickly get back to work, I prioritized a quick repair over finding the exact root cause. In one fell swoop, I lubricated the power supply connector to the motherboard, replaced the AC cord to the computer, and plugged the computer directly into the UPS instead of connecting it to a power strip connected to the UPS. Then I subjected the computer to a workout designed to make the symptom reappear.

The old cord and the power strip were set aside. If, after several days, the problem didn't recur, the conclusion would have been that either the power supply/motherboard connection was bad (and cured by lubrication), the AC cord was bad, or the power strip was bad. The AC cord and power strip would have then been disposed of — it's not worth my time to fool around with possibly intermittent components.

I used the computer heavily the rest of the day. The computer was left on overnight. In the morning it was still running, so I used it all day, and left it running overnight again. The next day I used it for hours, and then POOF, it shut off. I made a list of the likely causes:

1. Bad on/off switch
2. Bad Motherboard
3. Bad UPS
4. Bad power supply

A bad on/off switch would have been very difficult to research, requiring removal of the computer's front panel. Front panel removal often breaks plastic mounting hooks or wires. This was too difficult to prioritize. A bad motherboard would have been even more difficult, and very expensive. This would be left as a last resort. A bad UPS was easy to test, but I didn't have another UPS. While troubleshooting, I don't mind plugging a computer into a simple surge protector for a few minutes, but being a sparse intermittent, this could have required days. A brownout during that time could have caused much greater damage than what was already there.

So I swapped the power supply. The old power supply was hotter than normal, further casting suspicion on the power supply. There was a known good 400 watt power supply lying around, so that's what went in. After the swap, the computer ran 24/7, with heavy usage during the day. It took it like a man. After a few days I put the cover back on the computer. It kept running. After a few more days, I took the old power supply, wrote "Known Intermittent" on it with a permanent marker, and threw it in the trash. Repairing the power supply wasn't worth it because I don't have the time to fool around with intermittents. So even though the problem was probably as simple as sticky fan bearings, it was thrown out.

As of this writing, the computer has run flawlessly for 20 days. Case closed!

FINAL NOTE: September:

Tradeoffs are everywhere. Do I find the exact root cause, or shotgun and quickly get back to work? Once everything's working, do I evaluate the replaced component(s), or dispose of it to minimize the likelihood of future time consuming intermittents? What do I swap first, and how many things should be swapped at once?

In hindsight, the moderate overheating of the power supply should have been a dead giveaway. Regardless, I did a pretty good job of fixing this tough intermittent.

The Phantom Keyboard Killer

Author's Note

If there's a supernatural ghost story in this book, this is it. If there's has ever been justification for saying a problem was caused by voodoo or astrology, the problem in this story has such justification.

This true story is in the Intermittents part of this book, but as you read this story, notice the steadfast adherence to rationality displayed by vendor and customer alike, and their commitment to work through the problem, together, through thick and thin. In that respect, this story could have been in The Attitude section or the Excellence section.

“Dad — my computer won't boot.”

So began my gruelling bout with a relentless intermittent.

The cause seemed obvious — the words “keyboard failure” were on the screen, and the computer beeped continuously. The operating system was ruled out because it didn't have a chance to load. I reseated the keyboard cable connector, rebooted, and the symptom was gone. The keyboard cable connector had probably come loose over time — maybe my son had kicked it. The problem was fixed and time marched on.

“Dad — my computer won't boot.”

Days had passed and the symptom cropped up again. This time re-seating it didn't fix it — every third or fourth reboot the problem cropped up again. Looking at the keyboard cable connector, the large DIN keyboard connector was adapted by a solid DIN to PS/2 adapter, and that adapter and the mouse cable connector pushed against each other. I replaced his keyboard with a genuine PS/2 keyboard, rebooted several times to verify that the symptom had vanished. Done! I made a note not to use DIN to PS/2 connectors anymore, unless they included flexible cable so they wouldn't push on the mouse cable connector. My son's computer was fixed, I went on to other things, and more time marched on.

“Dad — my computer won't boot.”

Different keyboard, same symptom. I called the vendor who sold me the computer. They told me it was probably a bad keyboard connector on the motherboard, and to bring it in. Not being able to bring it in on that particular day, I gave my son a new keyboard, once again fixing the problem. Two weeks went by.

“Dad — my computer won’t boot.”

That’s it. I brought the computer, and two of the offending keyboards (one DIN and one PS/2) to my vendor. Amazingly, at the vendor’s place, the symptom occurred the instant the computer booted using my PS/2 keyboard. Symptom reproduction saved me from withering looks and sympathetic words reserved for those reporting strange symptoms that can’t be reproduced.

The vendor then began to experiment. He plugged in one of his keyboards — no symptom. Not to be outdone, I plugged in my other keyboard, and the symptom occurred. He plugged in another one of his keyboards, no symptom.

My vendor then plugged my keyboard into another computer, also sporting an Asus board, and the symptom occurred on that computer. Common sense would say “defective keyboard”, except I had two similarly defective keyboards and assured him I had a third at home. I mentioned that each keyboard took about a week or 2 to “go bad”.

I then voiced the words that would eventually change the focus of the hunt: “It’s almost like the computer is damaging the keyboards somehow.”

We looked at each other and chuckled. That was just too weird to contemplate.

We agreed the vendor would not change out the motherboard until we found the root cause, and left it cooking with one of his keyboards, to see if it would “damage” his keyboard. I drove home.

But a question, once vocalized, works on your subconscious. Mix that with some opportunities, and the plot can thicken...

The Plot Thickens

One month before buying my son’s computer, I had purchased a computer with an Asus motherboard similar to my son’s. Both computers displayed a symptom which I would have missed had my attention not been drawn by my son’s no-boot situation — a very short beep on bootup. Interestingly, the beep was shorter sometimes than others. Sometimes it was little more than a click, and once in a while it was a double or triple click.

The sound reminded me of a stereo with a dirty volume control or tape monitor switch. Out from my subconscious came a stereo repair corrective maintenance technique — clean all switches and controls with contact cleaner. Occasionally when I ran out of contact cleaner I'd use WD40 — it worked great and the switch or control really performed smoothly.

Could my keyboard problem be an oxidized keyboard cable connector? Maybe there was galvanic action (electrical current caused by dissimilar metals) between the motherboard's keyboard connector and the keyboard cable connector, and the galvanic action was causing corrosion. If only I hadn't left my computer at the shop, I could have tried WD40 in the keyboard cable connector.

Then my other Asus equipped computer started exhibiting the same keyboard failure no-boot symptom, and I jumped for joy.

I sprayed WD40 into my keyboard cable connector, inserted and removed it 30 times to clean it, and turned on the machine. The symptom still occurred, but subjectively it occurred less. Remembering a long ago problem where a seemingly defective keyboard turned out to be a mouse problem, I sprayed WD40 into the mouse connector, inserted and removed it 30 times, and turned on the machine. The machine booted solidly many times in a row.

If this had been a reproducible problem, my work would have been done. But with an intermittent, it's not for sure whether the problem disappeared because of the WD40, or whether it disappeared just by the luck of the draw. I needed info. I described the problem on the mailing list of my local Linux group, and crossed my fingers. This sounded so crazy it wouldn't have surprised me if people started calling me nuts.

Then a guy responded with the most reassuring phrase in the English language: "This is actually a known problem". He went on to describe something called "fretting corrosion" occurring on tin connectors, and mentioned that the AMP connector website contained two white papers, one called "The Tin Commandments" and one called "The Golden Rules", describing design and maintenance of tin plated and gold plated connectors. I read both white papers, and the pieces began falling into place.

The Wisdom of the Experts

AMP's white papers describe something called "fretting corrosion", which happens to all tin plated connectors. It's worst when one of the mating connectors is gold and the other is tin, but occurs even when both are tin.

Tin reacts with oxygen and other materials to form a thin layer of oxide. This thin layer is not enough to significantly reduce conductivity, but it's more than enough to prevent further oxidation or corrosion.

However, when the tin is "plugged into" another connector, any movement or vibration chafes away that protective oxide, leaving bare metal which itself oxidizes. Over time more and more oxide forms and is chafed away, and this excessive oxidation product starts to separate the two connectors. Resistance rises, and eventually functional conductivity is lost. "Eventually" can be as little as a few hours with excessive vibration.

The AMP white papers went on to say that fretting corrosion can be minimized by placing a lubricant between the mating surfaces. The lubricant will minimize chafing off of the protective oxide, and thus minimize production of new oxide.

IT MADE SENSE!!! Now I understood why this was happening, why WD 40 stopped the problem, and why merely reseating the connector produced only a very temporary improvement, if any. Now I strongly suspected a legitimate answer to remark that "something must be damaging the keyboards". That something was fretting corrosion.

The WD 40 allowed the machine to boot perfectly for a couple weeks, then things went bad again. Subsequent investigation revealed that some, but not all, of the keyboards I'd tried had less pins than normal keyboard connectors, which would certainly make the connection less stable and more subject to fretting corrosion. Lubrication plus a connector with the normal number of pins corrected the problem long term.

Author's Note

It's been well over a year, and my son's computer boots perfectly, every time, aided by lubrication of the mouse and keyboard connectors. Following this long, drawn out battle, electronic contact lubrication became one of my standard preventive maintenance techniques. Over time I abandoned WD 40 and settled on Lube Job Electronics Lubricant from blowoff.com. Lube Job is designed specifically for electronic contact lubrication, and unlike some other electronics lubricants, it's very economical.

One complication in this whole mess is that very few computers experience this problem, lubrication or not. Why did I see it on two computers when most people never experience this symptom? A hint came when someone mentioned he'd seen it too, but only with certain kinds of chipsets. I'd noticed this problem only on two essentially identical Asus motherboards, which presumably had the same chipset.

In my digital electronics lab at Santa Monica College, we'd built some "keyboard debouncing circuits". All switches are essentially dirty. Rather than turning from an off state to an on state, they spend a certain amount of time bouncing between the states before turning all the way on. Also, there might be short periods of time when it's neither on nor off, but in a resistive state. By building a "debouncing circuit" with the proper time delays and the proper hysteresis, you can massage the key hit into a clean off to on transition. However, if the chipset's debouncing circuit was based on a clean electrical connection, what would it do upon encountering an oxidized, resistive connector to the switch? Maybe just what my 2 computers did.

I generalized these findings to all connections in a computer. As preventive and corrective maintenance, I now lubricate contacts on daughtercards, memory modules, power supply connections, peripheral connections — any low voltage, low power electronic contact.

Part V

Toolsmanship

Why is this part of the book devoted to toolsmanship, when the book is about the Universal Troubleshooting Process? The answer is that troubleshooting productivity enhancement is a pyramid.

The base of the pyramid is knowledge of the machine under repair — without such knowledge you cannot even devise diagnostic tests. With that knowledge attained, the next step is to gain expertise in the process of troubleshooting — the Universal Troubleshooting Process. Once that knowledge is attained, how does one progress further?

The answer is toolsmanship. Now that the mental part of every repair can be performed in minutes, the bottleneck shifts to efficient use of tools. Part V features two true stories of toolsmanship.

Drilling for Dollars

Author's Note

Many geniuses use their brainpower as a crutch and don't bother with other productivity enhancers. They're not the only guilty party. I've often used the Universal Troubleshooting Process as a crutch and haven't bothered with other productivity enhancers, especially toolsmanship. Fortunately, roll models abound, from whom even the most settled among us eventually learn.

Drilling for Dollars is actually two true stories of people proving the value of using drills correctly.

Drills Become the Rage at Pacific Stereo

Thanks to the Universal Troubleshooting Process, I was a hot-shot tech at Pacific Stereo. Which meant good money. We were paid on commission.

One day a tech at a different store bought a cordless drill and screwdriver bit with his own money, and used the contraption to take the top and bottom off each stereo he repaired. Keep in mind that stereos aren't like computers — the bottom has between 6 and 12 screws, and the top has 4 to 6.

This tech, and the fact that his drill sped his work, became legend at Pacific Stereo. But I wasn't about to pay \$39.00 of my own money for the tool.

Then another tech bought a drill and screwdriver bit, and another, and another. Drills were becoming all the rage at Pacific Stereo, and everyone swore by the productivity increase.

So I finally broke down and bought my own drill with screwdriver bit.

Who do you think benefits more from the drill — an average or sub average tech, or a ninja? Put another way, who gains more from the 5 minutes saved screwing and unscrewing — someone requiring an hour for diagnosis, or someone requiring 10 minutes? My income skyrocketed.

After 6 months my drill broke. Did I gripe about the durability of cordless drills and go drill-less? Heck no, I bought a new drill that very day. The new drill paid for itself in a week.

Mr. BabyProofer

After becoming a computer programmer I stopped replacing broken drills, retaining only my good old 1970's corded craftsman. After all, what does a computer programmer need with a cordless drill? Household repairs and bookshelf building aren't exactly challenging, are they?

When our triplets turned 6 months old, my wife and I knew it was time to baby proof the house. Looking around, it was obvious I couldn't do the job in less than a week, so we called Mr. BabyProofer, a Los Angeles based baby-proofing business.

Mr. BabyProofer turned out to be a guy maybe 25 years old who arrived with 2 cordless drills and a box of latches, electrical covers, screws, and other miscellaneous hardware, as well as several gates to install. Mr. BabyProofer talked with us for 30 minutes to find out our exact wishes, then went into hurricane mode and did the whole job in 2 hours.

His drills were his life. Each drill cost well over \$100.00 — no little \$39.00 8 volt drills for him. Each was charged and ready for action, and there were extra batteries. I'll bet his house was full of chargers.

One drill had a small wood bit, and the other had a screwdriver bit. He'd carry his drills and hardware box to a cabinet, measure for a hole, drill it, whip out a screw, then screw it in with the other drill. Elapsed time, 30 seconds. My jaw dropped. Whenever I did wood projects (which was quite often back in those days), I'd always use a single corded drill, and waste mucho time switching between a drill bit and a screwdriver bit. Using his dual drill system, this guy could work 10 times faster than I.

2 hours later he walked out of our house about \$300.00 richer. This was in the nasty recession that still gripped Los Angeles in 1994. He'd installed 16 baby-proof wall outlet plates, 15 cabinet and drawer latches, a couple gates, and other miscellaneous equipment, and also had taken time to explain the ins and outs of a baby safe house to us. For the most part, the equipment he installed that day lasted til the kids were 5, at which time I removed it as we moved to Orlando.

A few days after Mr. BabyProofer's appearance, I went out and bought a cordless drill to accompany my good old Crafts-

man corded drill.

Youth to Burn

Author's Note

Toolsmanship is a component of effective troubleshooting. Did you ever stop to think what kind of people invent tools? This story is loosely based on the factory at which I worked long, long ago.

Wheelabrator is a registered trademark of Wheelabrator Technologies, Inc.

There was a time before I was a parent. Before I'd ever conceived of the Universal Troubleshooting Process. Before I had any skills at all. I was a factory worker. You've met guys like me...

21 years old, 5'9" and 160 pounds of muscle, I boozed and womanized all night, rode my bicycle all over the city, and worked second shift at a factory job where I sandblasted, boxed and stacked 70,000 parts every 8 hour shift. I needed no car — I had a bicycle. If women didn't like riding on the back of my bicycle, I didn't go out with them. But they rode on the back of my bicycle — I had youth to burn.

A ball of energy in the factory, my productivity was almost double that of my counterparts on first and third shifts. Once I took a week's vacation, and as a result they ran short on finished goods to ship. I came back, worked a ten hour shift, and completed the mountain of in-process work beside my Wheelabrator blasting machine. The inspectors downstream from me moaned for a week about the extra workload inspecting that night's production. I had youth to burn.

"Wheelabrator" is a brand name. A Wheelabrator blasting machine is a machine that sandblasts the plastic flashing off parts, such as commutators destined for electric motors. It doesn't use sand — it uses tiny fragments of walnut shells. Sand would damage the parts. You load two 80 pound boxes of parts into the machine, close the door, and turn it on. For 3.5 minutes the parts roll on a belt and get blasted with nutshells. During that 3.5 minutes you weigh the production of the previous run, arrange your incoming and outgoing part boxes, prepare for the next run, and maybe help the inspectors load

five or so 80 pound boxes into their hoppers. You like it that way — you've got youth to burn.

After 3.5 minutes the machine shuts off. You fling open the door, reverse the direction of the belt, and with gloved hands drag the parts out and into metal boxes. Like a dog digging in the dirt, your hands scoop and scrape to get the parts out as fast as possible. Unloading time is the major determinate of your production. You can't speed the machine's cycles, but you sure can make sure the machine's blasting parts the majority of the time. You work fast because you're bored stiff — you've got youth to burn.

John, the first shift guy, was old and fat. He must have been what, 30 years old? He had the beginning of a pot belly around his middle and the beginning of bags under his eyes. I considered him a joke — my production was almost double his.

One day the first shift supervisor and John were waiting for me at the Wheelabrator blasting machine when I came on shift. After an exchange of pleasantries, the first shift supervisor said "Steve, John's discovered a faster way to unload the parts, and we're going to show you."

John produced a 1x8 board cut the exact width of the interior of the Wheelabrator blasting machine. Instead of digging like a dog at the parts, he simply pressed the board on the belt behind the parts, and the belt's action pushed the 1x8 board out of the machine, with the parts pushed in front of the board. The parts deluged into the boxes. This cut at least 30 seconds per cycle. From that moment on I produced even more. But so did John. That fat, tired old man now produced darned near what I did. The big loser was the third shift Wheelabrator blasting machine operator. He became unnecessary.

Old, fat John had done what youthful Steve couldn't — he created just the right tool for the job, and in doing so markedly increased productivity on what had been the factory's bottleneck. All for the price of a piece of scrap lumber.

*_____

Years later I was the father of triplets, all 2 years old. Now older and heavier than "old, fat John" had been, I didn't have bags under my eyes, I had suitcases. And man, I was tired. Oh, so tired. Between work and the kids, I trudged through my waking hours. My transportation was a car, and maybe once a month I rode my bike 10 miles for old time's sake, and limped home exhausted.

Our triplets were 2 year old bundles of energy. They climbed

on everything, knocked things down, scattered things around, and ran endlessly. They kneedropped me as I catnapped on the living room floor. They used the changing table as a trampoline and shattered it. They had youth to burn.

One night the living room was messier than usual. Toys everywhere. You literally couldn't see the floor. Exhausted, my wife asked "how can we ever clean this up?"

"Watch this!", I shouted. Grabbing an old four foot long 1x8 board out of my office, I got on my knees and bulldozed all the toys into a single pile two feet high. Then I surrounded the pile with various toy boxes and a garbage can, and ring-tossed everything into its place. A half hour the room was clean.

John's invention hadn't impressed me much at 21. I had youth to burn, and better things to think about. But my immature mind had managed to store his invention away in a dark corner, so that years later, desperately in need of a solution, I recognized the same relationship between tool and job that John had recognized so many years before.

A four foot board. A simple tool. A 200% productivity increase in a difficult situation. Inventing tools to match the task, and learning to use those tools optimally, is more effective than the fountain of youth. These days "old, fat John" seems much more relevant than he did when I rode my bicycle 35 miles a day.

The kids matured, I lost some weight, and I'm not so tired these days. I ride my bike 40 miles per week, and sometimes I can beat the kids in a game of tag, at least for a few minutes. My little remaining youth is precious, but don't worry, I'm doing fine. And age brings some realizations that pass unnoticed by the young.

It's a funny thing. If you're energetic enough, you can use your youth as a crutch, ignoring the tools that would have made your work so much easier. Perhaps all tools are invented by those "not good enough" to do the job the old way. These days I try to substitute tools for energy. Just like old, fat John, who was several years younger and many pounds lighter than I am today.

Part VI

The Attitude

A person can know the technology like the back of his hand, know the process of troubleshooting from Prepare to Prevent, know all intermittent busting tactics, and every riff to be used with every tool, but without a productive troubleshooting attitude he'll fail miserably.

This shouldn't be surprising. When you compete in athletics, when you sell, indeed when fighting disease, attitude is vital. Why should troubleshooting be any different?

It isn't. Part VI features stories exploring The Attitude. What it looks like, how to get it, what happens if you don't have it. The last story, "The Hallmans Had a Hard Life", explores the attitude-building technique of taking pride, as a necessity in both troubleshooting and in life.

Litt Takes the Nine Count

Author's Note

What's it like to perform a repair with the wrong attitude? Here's how I found out. Learn from my mistakes.

I became a Troubleshooting champ when Muhammad Ali was still had the WBA crown. I've beaten all comers — blown up SAE amps, DEC PDP11-23's with jury-rigged operating systems, errant pointer intermittents in C programs, Windows GPF's and bluescreens. So I wasn't the slightest bit worried about my late 1996 title match against a brash new challenger — a Cyrix 166/Win95/noname-motherboard upgrade. Like Apollo Creed before his fight with Drago, I seriously underestimated my opponent. Would it be as fatal?

Three hours into the installation it changed from a technical fight to a brawl. Windows 95's install CD errored out. I spent the next 8 hours, using the same Windows install CD, other computers and other disks, proving the problem was the motherboard itself, and went to get a replacement. The vendor replaced it, and even installed Win95 on a disk hooked to the new motherboard. Round 2 began with the champ (me) badly shaken.

The challenger took a beating as Win95 installed cleanly. It looked like a victory for the champ. Then the challenger threw a surprise left — file corruption when compressing the hard disk. The brawl continued, round after round, installation after installation, BIOS setting after BIOS setting, Win95 option after Win95 option. The challenger bobbed and weaved — sometimes it looked like compression almost worked, sometimes it crashed miserably. I was exhausted and dropped my guard. The challenger hit me over and over with intermittent disk problems. Finally I hit the challenger with my best right — I got a full refund on the motherboard, CPU, and memory and bought a SuperMicro motherboard with an Intel Pentium 150 and 32 meg from another vendor.

Having industry standard components was like fighting in a smaller ring — the challenger couldn't run away. It looked like

the champ would prevail. Installation and compression went smooth first-time. The challenger was dizzily swinging in the air. Then one of those wild shots hit. The printer didn't work!

I went to pieces. Frustrated tears filled my eyes as I threw things around the room. Other problems have beaten me, but nothing could prepare me for this kind of brutality. Like Muhammad Ali in his 1974 fight with George Foreman, the aging master went back to his one remaining asset — experience. Putting the project aside, I forced myself to re-adopt The Attitude. I then discovered my printer port wouldn't work if configured as ECP. Switching it to an EPP cured the problem — the champ wins the round!

Next the motherboard hit me with inability to assign and keep a drive letter for the Zip drive. Dead on my feet, I managed to hang on to the last thread of The Attitude, and finally cured the problem with a `Lastdrive= config.sys` command, and properly pushing in the Zip Drive's cable. Exhaustion made what should have been a 10 minute Corrective Maintenance fix into a day-long affair. The slugfest trudged on.

Microsoft Backup smacked me with inability to restore original file dates. A drawn-out restore from floppy fixed that. Then the challenger mounted a brutal attack with a vanishing CD drive letter. The champ countered with a BIOS config change of the CD between drivetype 3 and auto. Then swapping the IDE cables. Then switching between master, slave and neither on the CD drive. Then all combinations. Nothing helped. Exhausted, I thought of giving up. The champ was down and the ref was counting. On the count of 9 I somehow got up and continued troubleshooting. Repeatedly, I chanted my Attitude mantra, "just narrow it down one more time".

The fight continued. The bios setup contained an option called "failsafe settings". I enabled that option and rebooted. It was a weak jab at best, but it hit the exhausted challenger squarely on the jaw, and he went down. Sprawled unconscious on the canvas, the challenger was counted out. The computer worked perfectly. The computer has worked perfectly ever since. The champ retained his title.

After the Fight

I won. Retained the title. The computer had absolutely no further problems. So why did it seem like a defeat? My friends said things like "that motherboard made you look real bad", and "looks like your Troubleshooting Process didn't help you

that time”.

My wife got closer to the problem with “you were a walking Attitude violation that whole time.”. My confidence was deeply shaken. Step 9 of the Universal Troubleshooting Process is “Take Pride”, where you debrief yourself on the details of the Troubleshoot. What went right, what went wrong? The thing that went right is that I fixed the computer. What went wrong?

- Too many variables: Hardware, software, bios setup, Win95 setup.
- Too many black boxes: Drivers, peripherals, ports, Win95 setup.
- Too much pressure: I had cannibalized my primary business machine to do the upgrade.
- Overconfidence

How could I prevent future occurrences? I would reduce pressure from now on by not touching my main machine before the new one was fully functional and tested. I would get diagnostic software to deal with the black boxes. “Smart manuals” (often part of the diagnostic software) to help with the overload of variables. And I wrote complete instructions on building a Windows 95 machine from scratch (available on Troubleshooters.Com), so next time my confidence would be a little more justified.

Perhaps the most valuable learning experience was seeing how the other half live. Those poor souls who try to troubleshoot without The Attitude. It’s awful! I learned The Attitude must be kept no matter what the challenge. Bosses can threaten termination, customers can threaten to take their business elsewhere, dead processes can shut down the business, but The Attitude must be retained. Because without The Attitude, all is lost.

Trouble Trouble, Miles from Home

Author's Note

This is a true story.

Holy @@@! A quick glance at my car's temperature gauge showed one tiny notch before the red. I was 450 miles from home!

Cutting off several cars, I did a quick exit, pulled into a rest area, shut it down, and organized my mind.

The car was probably low on coolant. No big deal. I could refill the coolant and be on my way, checking regularly for any leakage.

But a look at the coolant reservoir told a different story. It registered full-hot. Just in case, I put another couple quarts in the coolant reservoir and waited 15 minutes for the engine to cool slightly, in the hopes it would suck in some of that coolant. None was sucked in. Low coolant would have been a convenient immediate cause, but I wasn't that lucky.

There's nothing you can do at a rest stop, so I fired it up and cruised down I75. Within 5 minutes the temperature had climbed back up to the 3/4 mark. I turned on the heater full blast, and after a few minutes it descended back down to the very livable 1/2 mark. Maybe the car could limp back to Orlando with the heater on full blast. But after buying gas, the "equilibrium temperature" rose to the 3/4 mark, even with the heater on full blast. I reduced speed, and the temperature fell slightly. This was a textbook case of an inadequate cooling capacity.

An ugly situation, to say the least. Repair by an unknown shop far from home isn't a pleasant thought when your trunk is filled with your business's main desktop computer, backups, clothes, personal items, and your best skateboard. In central Georgia, my Florida license plates told the shop owner that I was far from home, out of options, and in no position to negotiate price, repair time or quality. If at all possible, I had to get

home, and fix the problem there.

Heater blasting, all windows open to disperse the heat, my car limped back toward my home in Orlando. As miles rolled on, I continually reduced speed in order not to exceed the 3/4 mark temperature mark. For a while the overheating seemed cyclical — rising and falling several times. Cyclical overheating is often caused by a broken head gasket — isn't that just wonderful! But after a while it became clear that the temperature raises corresponded to long shallow uphill, while the temperature decreases corresponded to long shallow downhill. I quit giving it extra gas on the uphill and the variation decreased. Toward the end, 55 was the fastest I could go without overheating. But I made it home without going into the red.

Driving through Northern Florida it occurred to me that the the water pump was ruled out as a cause because turning on the heater decreased the temperature. If the root cause had been a deficient water pump, the heater plus radiator wouldn't have disbursed any more heat than the radiator itself. On the contrary, I'd proven that the radiator was failing to disburse heat. Thinking of the mechanisms by which the radiator could fail to disburse sufficient heat produced the following alternatives:

1. Clogged radiator
2. Thermostat fails to open
3. Collapsed bottom radiator hose
4. Insufficient coolant

4 was unlikely due because the reservoir coolant wasn't sucked back during cooldown. #3 was unlikely because visual inspection showed the bottom hose to be full and round. Because of the sudden onset of symptoms, the thermostat seemed likely. But then again, the symptoms weren't all that sudden...

In fact, 6 months ago I noticed temperature increases from 1/3 to 1/2 scale, combined with smell of antifreeze in the passenger compartment and drops of coolant on the floor of the passenger seat. I had the heater core replaced and the coolant changed, but the stable driving temperature remained at near the 1/2 scale mark. Then, a week ago, I set out on a trip from Orlando to Chicago, and noticed that the temperature went to 2/3 scale going up the Tennessee mountains. That's unusual for this car, which in better times could take all but the longest, steepest grades without noticeable temperature increase. On the return trip it once again went to 2/3 going up these mountains. But this time, it stayed there even on the far side of the

mountains. I watched the gauge like a hawk the rest of the trip. That's probably the only reason I didn't redline south of Atlanta.

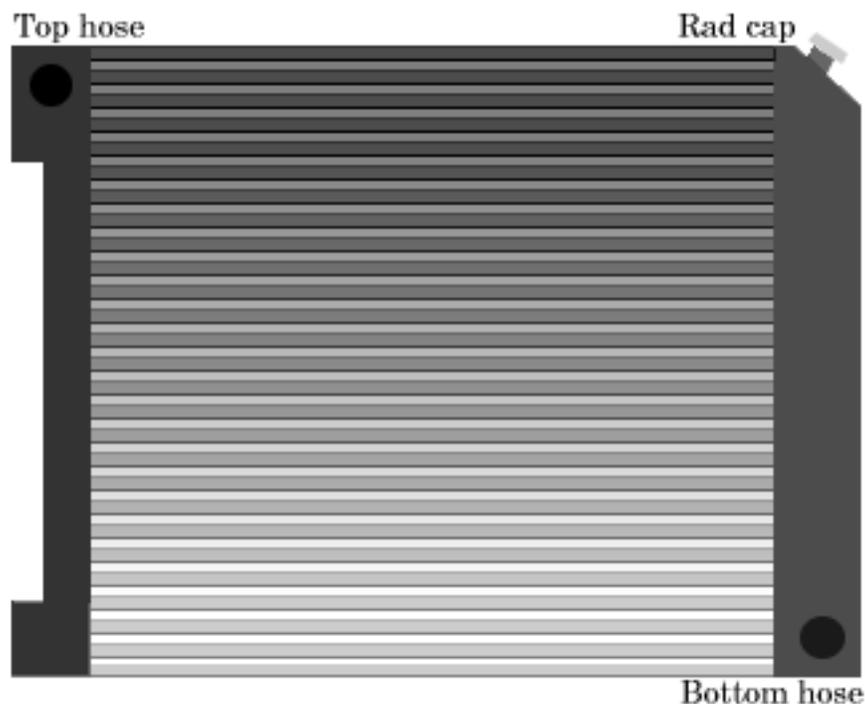
Home at Last

Arriving home at 7PM, the temperature was above $3/4$ and approaching redline. Pulling into the driveway, I gratefully shut it down and unloaded all my possessions. Now I could diagnose on my own terms.

The next day, I verified that the radiator was full, and then drove in order to reproduce the symptom. Within 15 minutes it reached the $3/4$ mark, and once again turning the heater full blast reduced the temperature.

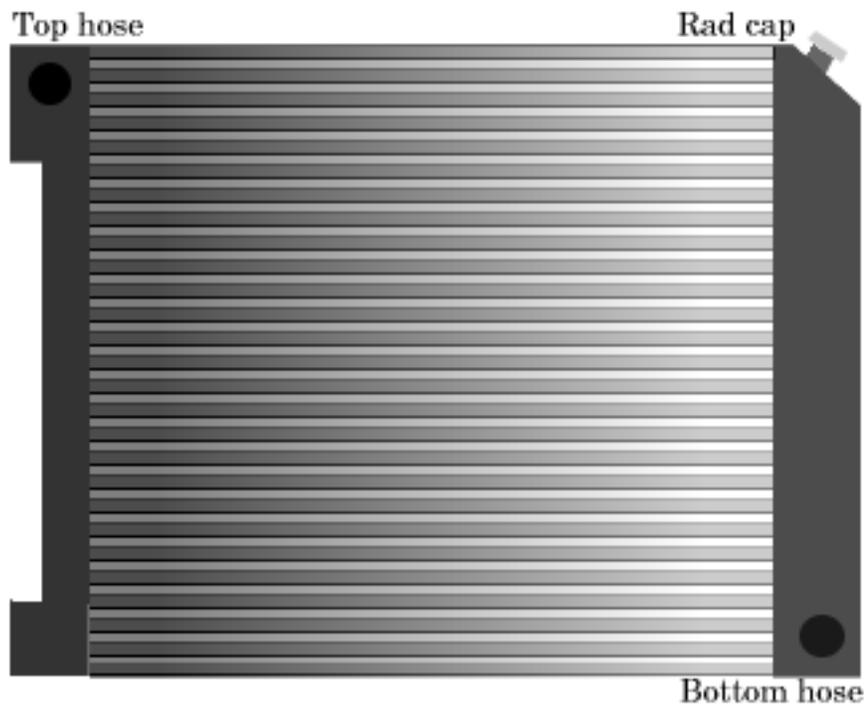
I took the car to one of my favorite automotive technicians, who verified the fan worked, verified the bottom hose wasn't collapsed. He felt the radiator and proclaimed "your radiator's clogged." I asked him how he knew, and he said the bottom of the radiator was cold and the top was extremely hot. MAN, WHY DIDN'T I THINK OF THAT!!!

I felt it myself. The bottom was cold, all the way across. The top was hot, all the way across. The temperature gradient looked like this, assuming darker areas are hotter:



The bottom was downright cool — not normal for a radiator in an almost redlined cooling system. Obviously those lower

tubes weren't conducting coolant. The following temperature gradient diagram is more like what you'd expect from a properly functioning radiator, again assuming darker is hotter:



Note the difference. In the properly functioning radiator, the gradient is horizontal instead of vertical, although it might have a slightly vertical component because of the placement of the top and bottom hoses. But for the most part, the farther the coolant moves horizontally across the tubes, the cooler it becomes. Note also that in a car that's fully warmed up, there are no spots that are totally cool. Totally cool spots come from a lack of coolant in a tube, not from normal cooling.

So if you find a temperature gradient that varies in a direction perpendicular to the tubes instead of parallel to the tubes, it's likely you have a clog. Note that the cold part could just as easily be at the top.

Author's Note

Anyone can troubleshoot under easy conditions. What separates the Ninja from the Wimp is their effectiveness when the pressure is really on. When you're miles from home, with your valuables in the car, far from the shops you know, without tools or bargaining position — when you have nothing but your wits and your knowledge. — that's pressure!

When the going gets tough, the tough ask "How can I narrow this down just one more time?". Fortunately, even in the worst of situations, there are usually ways to narrow it down if you calmly think about it, as this true story shows.

Jerusalem B

Author's Note

This story is based on an actual virus infestation of a 400+ node LAN. I've related the events as best I can recall, although this happened a long time ago. Many of the dates are based on old invoices I was able to find.

Thursday, 6/1/1989, 3:30pm

Robert Morris had released his "Internet Worm" November 2, 1988, bringing the Internet to its knees. It was the first "computer virus" (term used loosely) to get wide attention.

Less than a year later, viruses were still very new. We all talked about them, but nobody I knew had actually seen one. Then, on Thursday, 6/1/1989, at about 3PM, a programmer at one of my clients found a virus.

I was skeptical. There are millions of computer problems. Many can look strange enough to be viruses. Add that to the fact that none of us had ever seen a virus before, and you can understand my skepticism. So I set out to prove it wasn't a virus. Unfortunately, I proved the opposite.

Diff commands were proving that executable programs on the computer were changing when executed. Whether .exe or .com, they were changing. It was a virus.

I reported my findings, and like a row of falling dominoes we all panicked. I panicked. The programmer who found it panicked. Our IT manager panicked.

I knew better. I'd already started writing "Troubleshooting: Tools, Tips and Techniques", and knew THE ATTITUDE was a prime component of troubleshooting productivity. I knew better, but couldn't help it. We had a network of over 400 computers, and an unknown virus was loose. I panicked.

Perhaps the most fearsome aspect was that our IT manager panicked. I've seen her handle immense pressure on must-do projects, with only 4 hours of sleep, and not blink. This woman

was the personification of rationality. But she couldn't help it, she panicked. That drove the rest of us even further into panic land.

5:30pm: The Moment that Meant Everything

Just then the Chief Financial Officer walked out of her office and saw us standing in the hall, vibrating with confusion and indecision. She asked a few questions, and once she understood it was a virus, she said "OK, first shut down all networks so it doesn't spread. Get everyone to stop working on computers. Then figure out what has infected us."

Like a video playing backwards, the row of dominoes stood up. Armed with the CFO's plan, we were ready to get to work. The CFO's pep talk made all the difference in the world, as I'll discuss later. By 6pm we had a plan and were working it hard!

7:30pm: Researching the Virus

I called another programmer at home, told him what was happening. This programmer was a genius. He dialed in, and together we began working with this virus on an infected computer the way a scientist would study a human virus in a cell culture. Remember once again, this was less than a year after the Morris Internet Worm — anti-virus programs weren't generally available.

I created an assembler program that did nothing except execute. It was created as virus bait. It compiled to a 49 byte .com file. When executed on the infected computer, it grew about 80 bytes. Using editors and file compare commands, the other programmer deduced the virus's signature.

Using the signature he'd found, I tested various .exe files and found that signature there too.

We still didn't know what was attacking us, but we knew how to recognize it on the hard disk. Four hours had passed since we discovered it, and so far the infection was known only to a few programmers and a few management people. The management people were made very aware that the programmers had identified it, and knew what they were looking for. That was a good thing.

Conspiring to Kill a Virus: Friday, 6/2/1989, 9:30am

I worked all Thursday night building a recursive program that would scan every file on the hard disk, for that signature, delete any files containing it, and writing a log of the deleted files. I worked on it until 3:15 in the morning, at which time the other programmer took over.

Friday morning, 6/2/1989, I arrived at the customer site at 9:30am. I once again took over my virus scanner program, and quickly finished it.

Yet another programmer, who was a genius, began reverse engineering an infected copy of the my 49 byte .com. She found that it replicated using unused software interrupt 35 (can't remember if it was 35H or 35 decimal). She wrote a terminate and stay resident program (TSR) that tied up interrupt 35 and wouldn't let another program take it over. In other words, she had written a birth control program for the virus.

3:30pm: The Decision

24 hours after the virus's discovery, the IT manager and programmers briefed senior management. This was the point where things could have gone bad fast. How many times do you see senior management debate for hours, maybe days, the best way to handle a problem. In this case, every minute of debate would have been one more minute for the virus to spread.

Instead, we IT people quickly laid out our perfectly formulated plan. We'd install the birth control program on every computer, then run the scanner on every program, print out the deleted files and tape them to the monitor, so that later any corrupt files could be replaced. We'd hire a body shop to bring in 50 people to perform these operations on every computer. Our training department was busy creating instructions to do so. Our programmers would provide guidance. The disinfection could be completed over the weekend.

The IT manager had already contacted a body shop, and gotten a reasonable price for an army to come in and perform a Saturday eradication. All that was needed was the OK from upper management to write the check.

Upper management didn't understand most of the technical issues. What they understood completely was that an IT manager and a few programmers had formulated a plan to eradicate the virus over the weekend, and keep it from coming back

(birth control). They had arranged for manpower, training, and documentation. It was a complete package deal with a reasonably fixed price, and it was probably the best and last chance to control this virus. Within a few minutes Management gave their blessings.

Saturday, 6/3/1989 at 9:30am: The Deed is Done

I got there at 9:30am, conferred with the trainers and other programmers in anticipation of the horde of techs about to arrive. They arrived shortly later.

They were intimidating. All Geek, almost all male, these guys were ready to rumble. Most had never seen a virus before, and were excited at this opportunity to see one close up and personal. We gave them instructions and set them to work. Machines were birth-controlled, cleaned and tagged. My invoice records show that I stayed until 7:30 that night. I'd imagine the Geek Horde probably stayed until 6pm.

The Geek Horde completed maybe 98% of the computers. A few were too complex, and some contained information too confidential for outsiders to mess with. The important point is this — by the time the Geek Horde left, the rest of the eradication was manageable by in-house people.

We in-house people returned Sunday to finish the job. My records show I was there from 3:30pm to 1am.

Monday, 6/5/1989 at 7am: Business as Usual

Most employees had been impacted minimally or not at all. You couldn't tell there'd been a virus problem, except for the file lists taped to the monitors. There was a little cleanup work to be done. My records showed I worked about 13 hours on the virus during the week starting 6/5/1989. Nevertheless, it was business as usual. We had completely eradicated a major virus outbreak in 3 days.

Upper management was ecstatic with their in-house IT department. We'd obviously saved their bacon. Many companies outsource IT functions. Upper management realized how fortunate they were to have IT people on their payroll, instead of having a contract with a service provider.

Based on the signature, one of our programmers did some research and put a name to the virus — Jerusalem B — a virus that had presumably originated in Israel. One of its earliest infections had been at the University of Jerusalem. My understanding is that it took the computer scientists at the University of Jerusalem longer to recognize and fix the problem than it had taken our little crew of programmers. We done good!

Alternate Endings

Many DVD movies provide alternate endings — other ways the story could have ended. To illustrate the point of this story, I'd like to present two alternate endings:

1. No internal IT department
2. The CFO didn't give us a pep talk

No Internal IT Department

Imagine for a second that the company had outsourced most or all of its IT functions. At 3:30 on Thursday, the programmer did not discover the virus. Instead, over the course of Friday and Monday, trouble calls started coming in saying that computers were slowing down and that glitchy behavior was starting to occur.

On Tuesday a tech support guy is dispatched, de-fragments a few hard disks, and goes home. You can't blame him — he's not a programmer, or even a skilled sysadmin. His main job is installing hard drives and operating systems.

On Wednesday, management calls their service provider on the carpet, and a higher level technician is sent out. He discovers that executables are changing when run, and calls his company with the news that there's a virus infestation.

Negotiations begin on the price for eradication. Things are complicated when one member of the company's upper management champions the hiring of a computer security firm.

Finally, on Friday, a week and a day after the infection, management gives in to the service provider's seemingly extortionist price. Management asks for the cleanup to happen over the weekend, but the service provider says that's impossible — they need to study the virus first.

Indeed, the service provider's programmers are no more familiar with the virus than the in-house programmers had been

in the real ending. The main difference is that the service provider's programmers had very little stake in the outcome — it was just another job to them, and they resented working on the weekend.

In the end, the service provider licenses a very expensive anti-virus program (please remember, this is less than a year after Robert Morris' Internet Worm, so anti-virus programs aren't a commodity. They find out it's Jerusalem B, and kill it. Because the infection has had a week to settle in, most executables are infected, requiring re-installation of DOS and the corporate executables on every computer. This re-installation is much slower than a quick scan and installation of a birth control program, so it's another week before the corporation's computers are working again.

Speaking of birth control programs, there isn't one in this ending. The service provider sent their best programmer for one day, but then he had to help another client. The corporation's problems were fixed by mid level programmers who didn't know assembler.

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At this point you might be wondering what this ending has to do with troubleshooting. Isn't it a thinly veiled anti-outsourcing diatribe?

Yes it is. If you make the decision of whether to outsource, please remember that in-house programmers are loyal and motivated if treated reasonably. In-house programmers know your company's business, technical and political setup. In-house programmers have a stake in the outcome. In-house programmers don't require a contract addition and negotiations to troubleshoot a problem. In-house programmers can start troubleshooting before the problem gets worse.

The CFO Didn't Give Us a Pep Talk

Turn back the clock to Thursday, 6/1/1989 at 5:30pm, but make just one small change. The CFO is out at a satellite office, so she can't give us the pep talk. The IT manager and programmers stand in the hall, vibrating with confusion and indecision. How can we fix this thing? We don't even know what it is.

We debate in the hall. One guy wants to start reloading DOS on every computer. Another says we need to research viruses. One guy goes off in search of an anti-virus program — he's heard they exist. Not knowing what to do, we go home.

Except for one guy, who goes to a member of upper management and tells him the story.

The next day we all come in with ideas on how to fix it. Our panic is over. We have a meeting and decide to make a scanner to scan for the virus signature after we find out what it is. Our resident genius programmer wants to reverse engineer the virus to find a way to keep it from replicating. We're just starting to get a plan when the member of upper management walks in, demanding to know our plan.

We explain that we're making it right now. He phones the CEO and several vice presidents, and we're summoned to a conference room. The executives debate what to do. Several want to call in outside experts. There are several questions about why we didn't inform upper management yesterday. Somebody asks if this thing is still replicating, and we answer that we can't stop it without shutting down the network. He demands we shut it down, and is then overruled by another executive.

They send us out to do a study of the ill effects of this virus. Not knowing its name, we have nothing to study. Finally, a couple programmers make a tiny assembler program, get it infected, and deduce the signature. Based on that we know it's Jerusalem B, but by this time the workday is over.

Monday comes, and we're called on the carpet again. Several employees were slowed by the infection over the weekend. One proposal didn't go out. The executives spend the rest of the day debating, and eventually decide to hire an outside expert. The outside expert takes a week to cure the problem, and charges \$100,000 to do so.

—————*—————

In this alternate ending, our panic went on only one extra day, but it was enough to cause upper management to distrust us, and go into debate mode. That added a week to the fix.

A fundamental rule of troubleshooting is that when you get stuck or panic, you ask yourself "how can I narrow this down one more time." That is basically what the CFO told everyone to do (after shutting down the network as a damage control plan). But in this alternate ending, we panicked and thrashed around 24 hours too long.

The moral of this story ending is that you can't count on the timely arrival of a cool and calculated CFO. You must understand from the bottom of your heart that when you start to panic, ask yourself "how can I narrow this down one more time."

The Hallmans Had a Hard Life

Author's Note

“Take Pride”, step 9 of the Universal Troubleshooting Process, prevents Troubleshooter burnout. This fictional story explores how and why it works, and how far its power extends. Any resemblance to actual people or organizations, living or dead, is coincidental.

“I don’t need any religious mumbo jumbo, Rabbi.”

Rabbi Benjamin Russell looked into the tortured face of Sean Hallman, son of Phil and Debbie Hallman, long time members of the congregation, and financial donors back in the days when their finances had been better. Phil and Debbie had suggested Sean see the Rabbi as a last resort. Psychiatry had failed, antidepressants had failed, and a new-age family therapist had failed.

Rabbi Russell idly wondered how to help one so psychically wounded without, as Sean had put it, “religious mumbo jumbo”. Knowledge gained from six years of rabbinical seminary school made it exceedingly hard to help this man without “religious mumbo jumbo”. It was like asking a carpenter to work without his hammer.

Not just a carpenter, but an apprentice carpenter. Rabbi Russell had graduated the seminary last year, and was now an assistant rabbi here at the congregation. Rabbi Russell was 28 years old, just five years older than Sean. Sean’s parents had wanted Sean to see the head rabbi, Rabbi Goldman, but Sean said that “an old man with a beard” couldn’t understand his plight. So Sean came to Rabbi Russell.

Rabbi Russell knew Sean would walk out the door the instant the conversation turned religious. As a stalling tactic, the Rabbi asked Sean to tell the whole story of his problem. Fighting back tears, Sean began his story.

Sean's Story, 9/16/2002

Rabbi, I'm 23 years old. As a college graduate I had a 3.8 grade average, but my lot in life is to work as a junior sales associate. I'm educated, smart and hard working but I crumble under pressure.

I graduated high school in June 1996, and started college in September. The Internet Boom was just beginning, and computer guys like me were going to own the world. I took lots of computer programming courses, aced almost every one, and did extra credit projects. By the end of my junior year, computer programmers ruled the world. There were stories of computer programmers whose bosses asked them to work overtime, so the programmer used his lunch hour to find another job, and never came back. My life would be golden when I graduated in June of 2000.

Freshman year in college I met Jennifer. We fell in love. We were inseparable throughout college. We planned to marry the minute I got a good job.

I love my parents. They're wonderful people and I admire them so much. I loved my parents before loving your parents was cool. You know, like in high school.

I was my parents pride and joy, especially after my older brother Jeff dedicated his life to booze and drugs. Jeff flunked out of his first year in college, and lived with my parents ever since. He's never had a job, and he doesn't care. My parents love him and care for him because he's their son, but I'm their hope for the future. I'm the one they brag about when their friends speak of their Harvard graduate kids. Or at least I WAS the one they bragged about.

As you've probably read, the Internet Bust started in early 2000. The number of IT (that's Information Technology, Rabbi) jobs were decreasing for the first time in 5 years. That wouldn't have been so bad, but in 1999 and 2000 the job market was so distorted that secretaries were recruited to be programmers. College students dropped out to take programming jobs. Teachers quit teaching and became programmers. Salesmen became programmers. There were a lot of programmers around, and now jobs were being removed like chairs in a game of musical chairs. This was the world I graduated into.

So a month after graduation, I felt lucky to get a job with Keystone Consulting as a help desk guy. I was the smartest guy they had on the phone bank, so two months later I got promoted to an on-site network administrator at one of their customers. I got a good raise.

I was ecstatic. My parents were ecstatic. Jennifer was ecstatic. I asked Jennifer to marry me, and she said yes. Jennifer wanted a perfect wedding, so we decided to be married September 28, 2001. A week after my marriage proposal, Jennifer and I found an apartment together. Fall of 2000 was the best time of my life. I had Jennifer. We were young, and our future was bright. We were in love.

It was a good time for my parents too. They could finally point with pride to the success of at least one of their sons, and occasionally forget that Jeff was a hopeless drug addict.

The economy slid as 2000 ended. The Dow Jones average had peaked at 11,722 on January 14, 2000. It flittered between the high 10's and mid 11's most of 2000, but always on a downward trend. Unemployment was on the rise, especially in the IT industry. Employers expected more of their employees, and let them know it.

The company started pressuring me to work faster. I worked faster. I got all my work done. But the environment started taking its toll. I was nervous all the time, and sometimes a little ill tempered. 2000 rolled into 2001, winter into spring into summer. All this time I worked harder and faster and under more pressure, unaware of what it was doing to me.

On June 23, 2001, I had a nervous breakdown. I walked into work, set up to troubleshoot a server, and suddenly just stopped. My brain asked "what is the meaning of this?" The server looked like a hunk of moon rock. The network looked like a foreign planet. My mind could no longer fathom anything about computers. I got nothing done that day or the next. On the third day, I didn't even get out of bed. I called my boss and quit.

The next week was a fog. I'd sleep until noon, then sit on the porch until four, then go to sleep again. The next week my parents helped me check into the psychiatric wing of a local hospital.

Three days in the mental hospital were followed by two weeks of daily psychiatrist visits, complete with antidepressant drugs. Over the next six months my visits to the psychiatrist went from twice a week to once a week, but I knew I was all messed up. In August of 2001 Jennifer broke off our engagement, moved out, and started dating other guys. It was just one more nail in my mind's coffin.

At the start of 2002 I switched from a psychiatrist to a therapist, mostly for financial reasons. My parents were reasonably well off, but they weren't bottomless pits, and now they were supporting both Jeff and me, money was tight. I felt horribly guilty

about what I was doing to my parents.

I read self improvement books, learning conflicting theories about human motivation couched in oh-so modern sounding concepts. I went to group therapy sessions.

I played lots of video games. Hours and hours of video games.

By April of 2002, the therapist, my parents and I all agreed on one thing. I needed to get back to work. Not a great job, and certainly not a high pressure job — just something to give some focus to my life, and make me a meaningful part of society. I started work for a fast food restaurant.

That lasted a week. They made me talk on the headset, punch in orders, and make change simultaneously. Oh, I could do it — my boss said I was good and could get promoted. But after a couple days the same old feelings of pressure and nervousness overwhelmed me, and I quit.

She didn't say as such, but my therapist was disappointed. She used words like "self empowerment", "self-esteem", "self-worth", "reinforcement", "defense mechanism", and "transference". She hauled my parents and brother into a session, and belittled my parents in the most polite and professional manner imaginable, using long sentences of multisyllabic words. I saw my parents' broken hearts through their hurting eyes, and with my last vestige of self respect I fired the therapist.

That's how, after over a year of therapy, I was right back where I'd started, sleeping 18 hours a day and sitting on the porch and playing video games for four, while my brother Jeff drank himself into oblivion in the basement. My father tried against all odds to put his mind in working order to bring home a much needed paycheck, and my mother dutifully tended to her two mentally crippled boys. The Hallmans had a hard life.

A week after firing the therapist, I summoned every last bit of guts, and got a job in a home improvement warehouse. My job was to bring shopping carts in from the parking lot, and to help anyone who needed something carried or put in their car. All I had to do was follow direct orders. There was no pressure and no challenge. It was therapeutic. Life was still depressing, but at least it was tranquil.

Two months later I was promoted to a floor associate position, where I had to deal directly with the vagaries of customers' moods and needs. I did a good job, but I've slowly felt the old pressure and nervousness returning. I came home crying after work one day, and my mom suggested I talk to the head rabbi, Rabbi Goldman.

The last thing I wanted to do is tell yet another person, in excruciating detail, what a miserably deficient person I am. But

my mom has aged 20 years in the last 5, and a lot of it's my fault. I told her I'd go, but asked that I see the young assistant rabbi instead of the Rabbi Goldman. So Rabbi Russell, that's why I'm here.

The Rabbi's Dilemma

Rabbi Russell was speechless. What could he say? He wished Rabbi Goldman was handling this. Another thought that crossed his mind was that if Sean thought *he* had pressure, just try being responsible for the mental well being of somebody you'd just met today.

So the Rabbi simply told Sean he understood the facts, and would talk to him in greater length on Thursday, which was three days in the future. The rabbi had Tuesday and Wednesday off. Sean shuffled out of his office, to an existence Rabbi Russell shuddered to contemplate.

The Rabbi's Days Off

Benjamin Russell hadn't always been a rabbi. He'd been a high school football player, an A student, and a fraternity man. In college he'd supplemented his finances as a junior mechanic at a local auto shop, and had developed a reputation as a good diagnostician, and in fact an automotive genius.

Ben graciously accepted the complements, never bringing up the fact that his apparent skills were due entirely to his following something called the Universal Troubleshooting Process. He had learned that process from a website called Troubleshooters.Com, written by a guy named Steve Litt.

Ben's auto mechanic days were long gone, but he still did his own repairs, and used Litt's Universal Troubleshooting Process when he did so. In fact, three months ago he bought a 1967 Dodge Coronet for \$2000.00. The thing barely ran, but the paint job was pure, original white that shined right up when cleaned and waxed.

So far Ben had gotten the engine running reasonably well, although the compression was low and sooner or later he'd need to do a ring and valve job. The point is, the engine ran well enough to go on short trips, even at highway speeds. Ben had planned to fix a troublesome steering problem this weekend. The steering was loose and unresponsive until you turned the wheel far enough, after which the car would veer off in the direction you steered. Steering was a full time job on this car.

He'd already tightened the steering gear box, but there was no setting for which the steering would be tight and yet the steering wheel would turn freely.

Monday night, the last thing on Ben's mind was the car. What was he going to say to Sean Hallman on Thursday? How could he help someone with mental problems so severe that he couldn't work? So severe that neither psychiatry, medication nor new-fangled therapy helped? Ben tossed and turned most of the night, thinking about Sean. Sleep finally showed its mercy at 4am.

Ben woke at 10, had breakfast, and ran 3 miles. Throughout breakfast and the run, and afterward, he thought exclusively of Sean Hallman's problem. Finally, realizing that further thought would be counterproductive, Ben began troubleshooting the Coronet's steering problem. By 4pm he'd narrowed it down to the car's Pittman arm. He ordered a new Pittman arm from a Mopar specialty shop 80 miles away, and miraculously, they said it would be ready for pickup the next day.

Ben woke at 7 on Wednesday, ran 3 miles, had breakfast, and drove to pick up his Pittman arm. After a rather frustrating fight with several 35 year old rusty bolts, Ben had installed the Pittman arm by late afternoon.

He test drove the car. It worked perfectly. He raised his hand in triumph and shouted to the heavens. He pulled to the side of the road, got out, and did a little victory dance. Bystanders looked at him like he was crazy. That's OK, those bystanders didn't understand that *Step 9* of the *Universal Troubleshooting Process* was called *Take Pride*, and required the very actions that made Ben look so strange.

On the Troubleshooters.Com website, Universal Troubleshooting Process author Steve Litt hammered home the point that taking pride after completion of each repair prevented burnout. Ben performed this step on every repair. He didn't want to burn out. If he did, he'd be like Sean Hallman.

The thought hit him like a 300 pound lineman. Sean Hallman burned out. Taking pride prevents burnout. Could taking pride be part of a successful therapy?

Ben congratulated himself on this excellent series of thoughts. In celebration, he did a little quick step.

He couldn't wait for Thursday.

9/19/2002: The Second Appointment

At 5:30pm, Sean Hallman slouched into Rabbi Russell's office. He'd had a miserable day at work, and said he couldn't go on much longer. He mentioned a customer screaming at him and calling him stupid.

"Tell me, Sean", asked the Rabbi, "what was the best part of the day?"

Sean thought for a long time. "Well, I helped this guy figure out how to fix a leak under his sink, and set him up with the stuff to do the job."

Rabbi Russell took out a brand new spiral notebook with a pen stuck in its binding. The name SEAN HALLMAN was written on the front cover. He casually tossed the notebook to Sean, who easily caught it.

"Write that experience on the first page, together with today's date." commanded the Rabbi.

"Why?" asked Sean.

"Because I'm your coach, and I say so." said the Rabbi.

Sean dutifully wrote the incident in the notebook.

"One more thing." said the Rabbi. "Come see me Monday at 5:30, and bring this book. Between then and now, each day I want you to write down the best thing that you do during the day."

Sean looked disgusted. "I'd expect better than that from you, Rabbi Russell. That 'self-esteem' stuff is pure psycho-babble, it doesn't work, and it certainly doesn't work on me. Believe me, it's been tried. No intelligent, realistic person can make himself feel more worthwhile when the facts of his life point otherwise. The worst thing about that self-esteem stuff is that it causes people to keep doing the wrong thing, because only the recognition of failure can change the way they do things."

Sean was on a roll. "And you, of all people Rabbi, should know that pride goes before the fall!"

Rabbi Russell was now on his home turf. *This* is why he had become a rabbi. Not to conduct services or run a temple, but to apply his religious training to real, significant, modern problems. Sean had misquoted what, in the King James bible, would have been the book of Proverbs, chapter 16, verse 18: "Pride goeth before destruction, and an haughty spirit before a fall." Of course, in the Hebrew bible it was chapter 16, verse 18 of the Mishlei (Proverbs) book, the second of the three poetic books, and in the Hebrew bible it was phrased a little differently: "Before destruction comes pride, and before stumbling

[comes] a haughty spirit.”

Either way, Rabbi Benjamin Russell had heard this anti-pride argument (usually phrased as a question) many times before, both in his seminary training and as a rabbi. He also knew that the response must be tailored to the situation. In this situation, even though Sean had chosen to couch his argument in religious terms, Sean had made it clear that he wanted no religious argument as a response. Sean probably didn't want any statement as a response. Rabbi Russell chose to frame his response as a question:

“Sean, you've asked an excellent question. In preparation for the answer I'll give you Monday, I want you to explore this question: What do you do to the thermostat when your house is too cold, and why?”

Sean's eyes narrowed, as he considered the pretentiousness of this rabbinical wannabe.

“That's pretty obvious, Rabbi” Sean said in a voice dripping with sarcasm. “You turn it up to warm up the house. Do I get my extra credit?”

“Not yet, Sean”, Rabbi Russell said neutrally. “You haven't really answered the question *why*. Sure, you obviously do it to warm up the house, but there's a deeper question. You think about it over the weekend, and please remember to write your best accomplishment in this book every day. I'll see you Monday.”

Sean was furious as he left Rabbi Russell's office. He'd never come back.

Sean's Weekend

At the home improvement warehouse store Friday, Sean couldn't help keeping an eye out for what he did well. He helped several people, but most went away without buying anything. He helped one older lady with a constantly running toilet, explaining how to install a replacement flapper in her toilet. He explained how the toilet handle pulled a chain, which lifted the flapper, allowing the water to flow out of the tank. Once the tank emptied, there was nothing for the flapper to float on, so it fell down and covered the hole to the toilet bowl, after which the tank filled again. He then sold her the flapper. He wondered if she'd been successful when she'd gotten home. If she had been successful, that was certainly the best thing he did that day.

On the way home, Sean pondered the rabbi's question, *what*

do you do to the thermostat when your house is too cold, and why? Thursday's bitter anger had turned to Friday's curiosity. Of course you turn up the thermostat — what else would you do, turn it down?

That night Sean had dinner, wrote about the old lady and the flapper in his notebook, and then went to sleep. For 2 hours he tossed and turned, pondering the importance of the rabbi's question. Then he slept fitfully.

In a dream, Sean and his brother Jeff were in a house, in Alaska, in the winter time. They were shivering uncontrollably. Sean went to turn the thermostat up, but Jeff knocked his hand away, saying "if you turn it up the house will be too hot."

The next morning Sean went to work, tired and disoriented. A customer needed to fix a broken irrigation pipe, and had brought in a piece of the old pipe. Sean explained how to make a U shaped repair, which joints to glue in what order, and then sold the customer the necessary pipes, elbows, pipe glue and pipe cutter. The customer thanked Sean profusely for the detailed instructions. Sean knew this would go in his book tonight.

On his break, Sean sat on a bench overlooking the parking lot. The guy collecting shopping carts was incredibly slow. Customers were actually bringing carts out to the lot faster than this guy could bring them back. Sean was always amazed at the success of people with half his drive and intelligence. Then the guy came and sat next to Sean.

"Whew, it's hot out here." said the employee.

"Is that why you're working slowly?" asked Sean.

"Oh, no!" exclaimed the employee. "I want to make absolutely sure I don't lose control of a cart and scratch a car."

"Good thinking." said Sean, as inwardly he pondered what was wrong with that explanation, because obviously something must be wrong with it. The guy was so slow that he wasn't doing his job.

Sean's break ended, and he went back in. That night, he wrote in his journal about helping the man with the irrigation repair, and also about selling a toilet to a customer and explaining how to install it in place of his old, stained toilet. That night Sean again dreamed of the house in Alaska, and Jeff demanding he not turn up the heat.

Sean had Sunday off this week, so he had breakfast with his parents, and then took a long, meandering walk. He visited his old elementary school, middle school, and high school. At each, he reminisced about the good times he had when life was simple and expectations were reasonable. He walked around

the track at his high school, where, so many times, he'd felt like he was going to die as the PE teacher made the class run a half mile.

Walking the track, it occurred to him that this week had been the best in a long time. The rabbi's advice was bizarre, but for some reason writing his best accomplishments did seem to make him feel better. In fact, it even seemed to make work go better.

But of course, it was an exercise in futility. Writing these "best accomplishments" was just pandering to his "self-esteem", and Sean was smart enough to know that sometimes negative self esteem adjustments were necessary in order to steer one away from bad behavior. Imagine a murderer writing in his journal, "I chose *just* the right knife to stab the guy." Was that a prescription for a bad society, or what?

Of course, Sean wasn't a serial murderer. He was just an ordinary human being — no, a very smart human being — trying to rise above the character defect of extreme nervousness. Actually, Sean realized, his self-esteem could probably be raised just a little bit without harm.

Sean walked on and on, a stiff breeze cooling what otherwise would have been a stiflingly hot day. His self-esteem could probably be raised just a little bit without harm. Perhaps his self-esteem was a trifle lower than optimal. Maybe he should turn it up a notch. LIKE A THERMOSTAT!!!!

"I'll bet that's what the rabbi was trying to tell me!" Sean shouted as he smiled. A group of teenagers looked at him, pointed and laughed. Sean blushed and walked away from the teenagers.

Then Sean remembered the slow employee at work. The employee worked at a turtle's pace out of fear of damaging a car, when the more rational fear would have been fear of getting fired for non-production.

Sean then got a *deja-vu* feeling. His head felt dizzy, his stomach queezy. He thought of his brother Jeff and shivered. In his mind's eye he saw Jeff slapping his hand away from something. Something he dreamed last night. Something on the wall. Sean concentrated on the image in his mind. The thing on the wall was a thermostat. The house was freezing. Sean had gone to turn up the thermostat, but Jeff forbade it because doing so might make the house too hot.

Everything has a happy medium. Temperature, work pace, and pride, they all had a happy medium. Err too far to one side and you'd get one kind of negative consequence, err to far to the other and you'd get a different consequence.

	Too little	Just right	Too much
Thermostat	Shivering	Comfort	Sweating
Shopping cart speed	Non-production	Good production	Destruction
Pride	Nervous burnout	Happy productivity	A fall

Sean walked with a bounce in his step. The wind blew flags, leaves and his hair. Sean memorized every sight, every sound. He knew he'd remember this moment forever. Psychiatry, drugs and "therapy" had failed, but an assistant rabbi only five years older than himself had given him the secret. Sean was ecstatic. Not as a figure of speech, but literally.

After a couple more miles, doubts crept in. Sean remembered many times where the psychiatrist or therapist had voiced something that seemed so true and valuable, only to have it prove inadequate later. Sort of like a placebo effect of self-help. He hoped this wasn't a repeat.

But there was a difference. The psych and the therapist spoke of broad concepts puffed up with important sounding phrases. The rabbi just gave Sean a couple simple instructions and told him to think about it. The miles went on, ecstasy turned to tired satisfaction, and finally Sean arrived at his parents house. It was six in the evening, and he'd walked 18 miles.

Entering the house, he told his parents he'd walked 18 miles, he was too tired for dinner, and he was going to sleep for the night. Then, he hugged his parents, and said "I love you guys. Thanks for sticking with me."

His pleasantly confused parents watched him brush his teeth and go to bed.

Just before turning out the lights on what would become the best ten hour sleep he'd ever had, Sean wrote in his spiral notebook:

9/22/2002: I discovered the secrets of pride and productivity today. More later...

9/23/2002: A Meeting of the Minds

Sean bounded into Rabbi Russell's office at 5:30 sharp with a paper in his hand. On the paper was written these words:

EXCESSIVE pride comes before the fall.

Rabbi Ben Russell and Sean Hallman looked at each other

and smiled the smiles of men who knew they would know each other for a long, long time. They sat down and began to talk.

“When did you discover that?” asked the rabbi.

“Sunday afternoon.”

“Did you write it in your notebook?”

“Sure did!”

“Yessssss!” Exclaimed the Rabbi, extending his fist upward in triumph. Sean mimicked the rabbi’s gesture, then both men gave each other five.

“Do you know what transpired here just now?” asked the rabbi.

“What?” asked Sean.

“We took pride.” said Rabbi Russell, now more serious. “You see, writing your best accomplishments at the end of the day is taking pride, but it’s not real time. Real time taking pride requires an immediate celebration.”

The rabbi continued. “Say ‘yeah’, or raise your fist, or do a little jig, or if you’re fixing something, say ‘gotcha sucka’. Sometimes you’re in an environment where such visible gestures just aren’t cool. Make up some little, inconspicuous gesture that only you will know is a gesture of triumph, and make that gesture the instant you do something good.”

Rabbi Russell was on a roll. “So keep writing your best accomplishments down — heck — write down several accomplishments every day if you have several, but be sure, in some little way, to celebrate every victory the second it happens. We humans have a tendency to focus on our failures and forget our successes. That’s why it’s vital to indelibly mark each victory in our minds. By immediately celebrating all victories, we permanently add those victories to our mental balance sheets.”

“How about meeting a week from today at 5:30?” asked Rabbi Russell.

“Sounds great.” said Sean.

Sean walked out of the office and down the hall. Sean issued a tiny grunt and placed his right fist into his left open hand. Rabbi Russell closed his office door, and unseen, danced a jig for a couple minutes. Then he prayed, thanking God both for the wisdom that had been revealed to him, and for the good fortune that had befallen Sean.

9/30/2002: Third Meeting

At 5:30 sharp, Sean bounced into Rabbi Russell’s office. Good news, more good news, and even more good news.

Sean had recorded several accomplishments each day, including days he didn't work. Better yet, his sales department supervisor complemented his work. Best of all, the customer he'd helped with the irrigation problem last week had written the store manager complementing his assistance.

"So Sean, do you feel a little less nervous at work now?" asked Rabbi Russell.

"Not really less nervous", answered Sean, "but more proud and excited."

"Proud and excited is a good thing." responded Rabbi Russell. "Tell me why you still feel nervous."

"First of all, Rabbi, I sometimes get the feeling that I just got lucky, or maybe this is just a kind of placebo effect and once it wears off, I'll go back to the way I was."

Rabbi Russell jumped all over that. "Let's say for argument's sake that it's some kind of placebo. What you can't argue against is the fact that you *feel* differently now. Remember, your performance wasn't the issue, your nervousness was. You didn't get fired from your computer job, you quit because the job made you too nervous. When you and I started this experiment, the goal wasn't to turn you into a world-class employee, it was to give you the mental fortitude to work under moderate pressure. I think that's happened. You look forward to work. You look forward to taking pride. Work is starting to be fun. Mission accomplished."

The rabbi continued: "If improving your mental outlook had the fortunate side effect of making you more effective at work, that's just an added bonus. I'm not surprised, because most authorities believe your mental outlook affects your results. But look at it this way — if your newfound productivity gains go away, you still have your better mental outlook, so it's still mission accomplished. Do you see what I mean?"

"Sounds reasonable." said Sean, who was still digesting the information. "But there's one more problem. I really screwed up Wednesday. I sold a customer a hundred dollars of low pressure pipe when what he needed was high pressure. That evening I got a talking to from the department sales manager. He didn't fire me, or threaten to fire me, but he let me know that mistakes like that aren't acceptable. That's exactly the type of thing that gets me nervous."

"Nowwww we can discuss Proverbs 16:18." exclaimed the rabbi. "Do you remember Proverbs 16:18? You quoted it to me the other day, sort of."

Sean wondered for a second, then asked "Oh, is that 'pride goes before the fall?'"

“Close enough for government work.” replied Rabbi Russell. “Taking pride isn’t all fun all the time. It’s a responsibility too. Because every night, as you go home, you should ask yourself two questions:”

1. Where was I brilliant today?
2. Where could I have improved?

“Sean, did you notice how that second question is phrased? It’s not ‘where did I screw up’, it’s ‘where could I have improved’. Or maybe ‘how can I do it even better next time’. Your goal isn’t to beat yourself up, it’s to improve. You’re human. You’re going to make mistakes. Everyone makes mistakes. Your department sales manager makes mistakes, although of course he isn’t going to keep you apprised of them. You will make mistakes. Your goal is to avoid making the same mistake twice. If you take pride right, you’ll be much less likely to make the same mistake twice.”

Rabbi Russell was really on a roll now. “After going over those two questions on the way home from work, write them in your journal. Up until now you’ve only written the answer to the first question, because your house was so cold that the proper move was to crank up the thermostat as high as it would go. Now that you’re nearing the right temperature, you need to fine tune your thermostat setting a little bit. By asking both those questions, you lessen the likelihood of your pride swelling to the point where you’ll take a fall.”

Rabbi Russell gave Sean a list of Internet addresses of Troubleshooters.Com web pages dealing with taking pride. Sean thanked the rabbi profusely for helping him. They both agreed to meet monthly, not as Rabbi and Congregant, nor as counselor and client, but as friends.

They talked a few minutes more and agreed to meet a month later.

10/28/2002: Good Times

They greeted each other like old friends. No, not exactly like old friends. All too often old friends are inwardly jealous of each others’ success. When Rabbi Russell and Sean Hallman met, for the third time, on October 28, 2002, they were two people working on the same project — the success of Sean Hallman. The project was going well.

Sean was doing well. The customers loved him. The store employees and management loved him. Sean had been told

that he was on track for quickly becoming a sales specialist in the plumbing department. The plumbing department sales manager told him privately, and very off the record, that if Sean kept up the good work he could go far in the company. For the first time in Sean's working life, he felt some job security.

Sean described his reaction at reading Steve Litt's formula for burnout — the combination of overwork and disappointment. Taking pride had burnout-proofed him by adding daily rewards to his work, and to his life. These rewards acted as a disappointment resistant suit of armor.

As if that wasn't enough, the daily act of asking how he could improve had led to better performance, and therefore less pressure.

Toward the end of the meeting the rabbi launched into a monologue:

"Remember all the video games you used to play during the bad times?" Rabbi Russell asked Sean.

"Sure," said Sean, "I hated doing it but I couldn't stop."

"Could it be that you played all those video games because that was the only thing that you could take pride in?" asked the rabbi. Then he continued. "Work had kicked you in the teeth. Then your various psychiatric, therapeutic and medicinal adventures kicked you in the teeth. The only thing you could 'do right' was video games, so that's what you did. It's not hard to understand — it's a normal response to the situation. Once you started taking pride in your daily activities, the need for video games went away."

The rabbi continued. "Look at all the really excellent choices you made during that time. You graduated into a truly horrible economy, but you tried for the best job possible. A lesser man would have driven a cab. In April of 2002 you were still very badly shaken, but you went ahead and got a job at a fast food restaurant. A lesser man would still be hanging out on his parents front porch and sleeping 18 hours a day. When that job didn't work out, you quickly got another job."

"And your most impressive action", continued Rabbi Russell, "was to fire the therapist when she dissed your parents. As hurt as you were, and as desperate your need to find a solution, you refused to let your therapist use your parents as punching bags. A lesser man would have, and in fact hordes of lesser men do, blame their failure on their parents, and then seek some sort of therapy to "undo" what their parents have "done to" them. You loved your parents too much for that. Sean, throughout that entire horrible time, you stood as a giant of a man. You need that in your notebook."

Rabbi Russell added that he was now counselling another young man on taking pride, and thanked Sean for helping him learn how to teach that subject.

They wound up the conversation, and agreed to continue meeting monthly, because they both benefited from the meetings.

As Sean walked out of Rabbi Benjamin Russell's office, the rabbi glowed in the fact that his work with Sean Hallman was complete.

He couldn't have been more wrong.

2003: Uninteresting times

The old curse goes something like this: "May you live in interesting times." Throughout 2003, Sean's life was calm, and he liked it like that.

Sean read all the Internet addresses Rabbi Russell had provided, and then read most of Troubleshooters.Com's 600+ pages. He found the Linux and computer programming content fascinating, and briefly considered going back into IT with his expanded knowledge.

In the end he decided against making the switch. He enjoyed his job at the home improvement warehouse store. It was nice to feel secure in a job, while at the same time knowing he had a real future at the company. Besides all of that, early 2003 wasn't the ideal time to be a software developer. The stock market had tanked after two companies, Enron and WorldCom, went down in flames. Enron went first, taking Arthur Andersen Accounting and several banks with it. When Worldcom fell in June 2002, stocks retreated below 9000, and stayed there for a year. In October 2002 stocks went below 7300 — a 39% drop from the market's high almost 3 years before.

The economy tanked, the IT industry needed to cut costs, so programming jobs were emailed off to India. One of Sean's old friends, a hardware engineer, said that all the programmers had left Silicon Valley.

Just for fun, Sean started doing a little IT consulting on the side for small businesses. He made good money, but he liked his day job more every day.

On December 31, 2003, Sean made a new years resolution to use the Take Pride principle to help his brother Jeff.

Jeff

Jeff had flunked out of college in the spring of 1995, after a six month college career notable only in consumption of alcohol, marijuana, LSD and ecstasy. He'd made a small room for himself in his parents basement, promising to get a job. Almost 9 years later, that promise was unfulfilled.

Jeff spent his life in a haze of marijuana and occasional alcoholic binges. For the first few years after college, he'd had an active social life, with his druggy friends and an ever lengthening array of druggy girlfriends, starting with cute and perky, if tipsy, young girls, and descending through the ranks of older and more decrepit female drug addicts.

By the turn of the century, Jeff had no visitors at all. He was the man the world forgot. He'd lost his friends, his muscle, his personality, his hair, and his appreciation of anything not involving chemical alteration of the brain. His entire contact with the world became the sad ministrations of his loving parents, and Sean's thinly veiled scorn.

Jeff refused any kind of twelve step program. To Jeff, such programs were for "losers". Jeff steadfastly maintained that although he liked drugs and alcohol, he didn't have a drug or alcohol problem. He said it was just entertainment.

As Sean began planning to help Jeff, the first question Sean had to answer was whether Jeff was happy. If drugs made Jeff happy — if Jeff was truly happy with his miserable life, the job would be much harder. To help answer that question, Sean found and brought over one of Jeff's old girlfriends, a coked-out little blond named Tiffany.

Tiffany had cleaned herself up considerably in the last few years. She understood Sean's request for her to visit with Jeff. Tiffany's only requirement was that Sean chaperone the visit, because she didn't trust Jeff.

The visit was one of the most depressing things Sean had ever seen. Jeff really tried to clean himself up. He took a shower. He got on clean clothes. He tried really hard to clean his room. He used lots of air freshener. He even installed a brighter light bulb than the 40 watt job that normally provided all the lights his drug addled brain could take.

The visit began well enough, with Tiffany hugging Jeff. Then they began to talk. Tiffany now worked as a receptionist in a doctor's office. She regaled Jeff and Sean with funny stories in the office.

Jeff couldn't keep up his end of the conversation. His knowledge of the last 3 years was limited to the fact that a guy

named Bush had beaten Vice President Gore for the presidency, and that somebody had blown up a huge building in New York September 11, 2001. He was obviously uncomfortable, so to give himself some comfort, he started drinking whisky, offering some to Tiffany and Sean, both of whom declined.

The more Jeff drank, the less understandable he became. After an hour Tiffany said she had to leave to pick up her mother. Jeff tried to walk her out, but was too drunk to get up the stairs. In the end, Sean walked her out.

Once outside, Tiffany burst into tears. “That could have been me!”, Tiffany sobbed. “I snorted coke every day. I’m just lucky I was able to quit. Your poor brother — how can he go on like that? This is the most depressing thing I’ve ever witnessed. I’ll never, ever drink or take drugs again!”

Tiffany was as good as her word. 10 years later, when she had three young children, she repeatedly told them the story of “Jeff, the cute and funny guy that drugs destroyed”. None of those children ever had a drink, nor did their children.

But none of that solved Sean’s problem. Sean went back down to see Jeff.

Jeff’s Tantrum

Jeff was throwing things around his room. He had broken the new light bulb, so only drab afternoon sun lightened the dank room. Jeff was sobbing, crying that nobody cared for him. He would never have a girlfriend, nobody cared. He fell face down on his bed and sobbed. Sean tried to comfort him.

Jeff lashed out. “Get away from me. If I can’t have a girlfriend, I sure don’t want you. Mom and Dad don’t care about me. They keep me in this little room instead of giving me rent money to have my own place. I hate my life.”

A million responses came to Sean. Mom and Dad didn’t give him rent money because, without their watching over him, he’d probably die from an overdose or some other misadventure. Jeff’s parents loved Jeff to the point of heartbreak.

And of course, there was the big Kahuna of responses — Jeff’s life was miserable for exactly one reason — substance abuse.

None of these responses would have helped. Instead, Sean cleaned up all the broken glass that could hurt Jeff, then put Jeff to bed. Once Jeff was asleep, Sean hid all the booze and drugs. For Sean to help Jeff, Jeff must remain alive.

As Sean climbed the stairs out of the pit of depression oth-

erwise known as the Hallman family basement, one of Jeff's phrases repeated itself joyously over and over again in Sean's mind: "I hate my life."

Jeff could be helped.

Trading Addictions

Sean spent a big chunk of his January salary buying two new computers — one for Jeff and one for himself. He brought both down to the basement, just outside the door to Jeff's room. Every night, for about an hour, Sean came down and played his simplest game, a game where you shoot alien ships in the sky.

After a couple days, Jeff got curious and came out to watch Sean. "Hey man, that's pretty cool.", said Jeff. "Can I try it?"

Sean fired up the game on the new computer he bought Jeff, and played side by side with Jeff. Jeff played just like you'd expect a druggie to play. Sean encouraged Jeff with the occasional "nice shot" and "nice move". Jeff proclaimed the game "awesome", borrowing a phrase last seen in the wild around 1999.

The minute Jeff tired of the game, Sean gave him a brand new spiral notebook, with a pen tucked into the spiral. Sean instructed Jeff to write his "best moves of the day" into the notebook, and to include the date. Jeff wrote in a rambling scrawl. Once finished, he swigged some whiskey and went to bed.

That night Sean wrote joyously in his own journal. His entry began with the phrase "A journey of 1000 miles begins with a single step."

Jeff the Gamer

Over the next few weeks, Jeff got better at the alien invader game. Then Sean taught him a slightly harder game. Then a harder one. Sean made sure Jeff won each game consistently before moving on to a harder one. Sean made sure that Jeff wrote his "best moves" in his journal every night. Knowing Jeff, Sean scanned Jeff's new journal pages into a computer every night, so that if Jeff lost or destroyed his notebook, he wouldn't be back at square one. When Jeff got really good, Sean and Jeff started playing multi-user games.

Jeff had seemed to notice he played better straight and sober. His alcohol and marijuana usage dropped considerably. The other thing that happened is that Jeff got *very* good at the

games. He was writing some pretty incredible techniques in his journal.

Sean knew a couple gamers, so he started bringing them home to play Jeff. Jeff held his own, then started beating the others.

Snowstorm Memories

March comes in like a lion and goes out like a lamb. Wednesday, March 3, 2004, was a day off for Sean. The morning was consumed by a marathon bzFlag game with Jeff. By noon Sean was starting to feel the same old tense feeling he used to feel when he spent the day doing the “wrong” thing. He had to get out of the basement.

“Hey Jeff, I gotta get out and take a walk. You wanna come along?” asked Sean, who expected a resounding NO for an answer.

“Yeah,” said Jeff. “I wanna discuss a new idea for a bzFlag strategy.”

Sean put on his warm winter clothes. He found some winter clothes for Jeff, who literally didn’t get out too much. Together, they stepped out their parents door and into a blizzard.

Sometimes snowflakes float like a million ballerinas. Sometimes they pour like a thick, milky haze. March 3, 2004 they flew horizontally, face-stinging needles so thick that you could see only a few feet ahead. When the brothers started their walk, the snow was just starting to stick to the ground. By the time they got home eight hours later, there were 20 inches on the ground.

Like a couple schoolboys, the brothers tromped through the snow. They visited their old elementary school, their middle school, and their high school. The discussion started with bzFlag strategies. Jeff had some strategies Sean had never thought of. Whatever flaws Jeff might have had, stupidity wasn’t one of them. If he could ever focus his intellect away from games and onto something that made money, then assuming he could give up the dope, he’d be in good shape.

At the middle school, several kids were having a snowball fight.

Jeff threw a snowball at Sean. Sean threw one back. They both ducked behind trees and started throwing. They ran, they ducked, they rolled, and they threw.

Sean’s mind went back to another snowball fight, another time. Sean was in fifth grade, and four bullies had cornered him

after school. One of them had pushed him into a snowbank, and two others were diving to grab him, when Jeff had walked by. Jeff, his tall, strong, freckle faced older brother with straight, thick blond hair. Jeff was accompanied by two pretty seventh grade girls.

“Hey guys, can anybody join in?”, Jeff asked, just before diving in and throwing the bullies around like scraps of paper.

The girls giggled, and the bullies went running after a few suitable insults and threats. Then Sean, Jeff and the two girls got into a half hour snowball fight. Sean looked at his brother with love and awe. He wanted to be just like Jeff when he grew up.

Sean snapped back into the present. His brother was still an inch taller, but a decade of dope and booze had made him weak and skinny. Jeff was breathing hard, coughing almost like an asthmatic, as he dived and shot a snowball. Sean winged one back, catching Jeff on the arm.

Jeff was exhausted after 15 minutes, so they stopped the snowball fight and began the 2 mile walk to their old high school. On the way they discussed high school subjects — girls, fights, and yes, drugs.

“When did you start doing drugs?” asked Sean.

“In eighth grade.” replied Jeff.

“Why?” asked Sean.

Jeff pondered that question for a second. It had been years since he thought of drugs as anything but an ever present fact of life.

“It started as a way to be cool and meet girls.” said Jeff. “Everyone in the school knew me. Some liked me, some hated me, but I was never one of those invisible guys.” Then, a second later, Jeff said “no offense.”

“None taken.”, replied Sean, who was well aware that he was as shy as Jeff was precocious. Jeff was the center of a large crowd, and he always had plenty of girls around him.

“When did you start liking girls?” asked Sean.

“In fifth grade.” replied Jeff. “Everywhere I went, Heather Marx and Jenny Taylor followed.”

Sean vaguely remembered two older elementary school girls who wore makeup much too early.

“Then in middle school there were girls all over the place, and a lot liked me.” Jeff reminisced. “In fact,” he said, with first time realization, “I could have had a lot of girlfriends without drugs.”

Sean resisted the temptation to hammer home the point. Talk went on to other things — great teachers, mean teach-

ers, Sean's college experiences, Sean's work, and Sean's nervous breakdown.

"I felt like I was under so much pressure," said Sean, "that I finally cracked. After that, the slightest pressure set me off."

"I think I know what you mean," said Jeff. "Social situations were always a lot of pressure for me. I think one reason I started drinking was to relieve the pressure. It was easier to be cool when you were drunk or wasted, at least in school."

"What happened when you got out of school?" asked Sean.

"You know what happens. There aren't any girls around. Your buddies are all working. They're thinking of other things. It's just not fun any more. So you get wasted even more."

They walked in silence for a mile or so. Then Jeff spoke.

"You know, Sean, I haven't smoked weed, drank or anything else all day. At this rate, this might be the first day in twelve years when I didn't smoke weed."

"Now THAT'S a move you should put in your notebook!" Sean shouted as he gestured for Jeff to give him a high five. "You know Jeff, I didn't tell you this, but that notebook helps for a lot more than just games. It will help with anything in your life."

"Sean," Jeff interrupted, "do me a favor. The instant I get home, let's you and I gather up all my liquor, beer and drugs, and you hide them, so at least for one day I stay clean. Can you do that for me?"

"You bet I can, Jeff. Put that in your notebook too."

In fact, Jeff went four days without asking for his booze and drugs back, then on the fifth day, in the evening, he asked for them back. Sean dutifully brought the box out, and Jeff reached for some marijuana.

"Jeff, before you end your streak, let's talk to the rabbi." Sean quickly called the temple, verified that Rabbi Russell was there, and asked him to stay, telling him the circumstances. Sean convinced Jeff to put down the joint, and hustled him off to the temple.

The Gang's All Here

Sean and Jeff sat on one side of the table, and Rabbi Benjamin Russell sat on the other. Sean and Jeff explained recent history — the video games, Jeff's journal, the snow walk, and Jeff's five dry days. Rabbi Russell's first concern was for Sean.

"Video games Sean? Are you sure you're all right?"

"Yes Rabbi, I'm fine. I have plenty of other sources of suc-

cess now. The video games are just a way to hang out with Jeff.” What Sean really meant, and everyone in the room silently understood, was that the video games were really a way to *help* Jeff.

“I hope you’re right Sean. You’ve come a long way.”

Then the rabbi turned to Jeff.

“Jeff, glad to see you. How do you feel about your five days of sobriety?”

“Actually, Rabbi, I’m kind of proud of it.” said Jeff.

“Do you think your life would be better without drugs and alcohol?” asked Rabbi Russell.

“I don’t know.” Jeff said after a pause. “I always thought weed was fun, but the last couple months, when I’ve taken less drugs and done less drinking, were nice. The past five days felt, well, exciting. Scary. Panicky. But exciting. And I’m proud I could do it.”

“You really should be proud.” replied Rabbi Russell. “There are people who never have five sober days. You’ve done something tremendous. But here’s the thing guys. Alcohol and drug use is a very serious matter requiring professional help. I really appreciate how far you guys have come, but I think Jeff should get into a twelve step program as soon as possible, like tonight. Jeff, are you willing to give sobriety a real try, and go to a twelve step program?”

The question hung in the air. Jeff pondered while Sean and Rabbi Russell silently prayed.

“Yes.” came the reply from a hesitant Jeff.

Rabbi Russell contacted a friend who was a social worker, and everything was arranged. Jeff went to Alcoholics Anonymous the next day. He joined Narcotics Anonymous a week later. He became involved. He stayed sober for 2 months, then drank after seeing some high school friends in a bar. He drank all night and into the next day, and then got help from his sponsor, the rabbi, and Sean.

The Rabbi and the Ex Druggie

By July 2004, Jeff had been straight and sober for a couple continuous months. He was beginning to feel awkward about never having a job. When nobody was around, he called the rabbi and asked for a secret appointment. The secret appointment was set up for 5:30 Thursday evening, July 15.

“Rabbi, what did you do to help Sean get and keep a job?” Jeff asked nervously.

Rabbi Benjamin Russell looked across his desk and saw a scared man. This man was 27 years old, but looked older. He'd had a hard life. He was facing a daunting task. An American male is supposed to get his first job at 16. By 27, he's supposed to be well along in his career path, because ages 35 to 45 are supposed to be the peak earning years. Here was a 27 year old man who had never had a job. He'd need to start in fast food, or hospitality, or some sort of "flunky" job.

It was demeaning, and worse yet, it would be difficult. One needed to learn how to *have* a job before learning how to *do* a specific job.

Rabbi Russell and Jeff stayed up until 2 in the morning. The rabbi explained how Jeff would need to start small, and savor every victory while taking the defeats as lessons learned, he would ultimately succeed. He showed Jeff the Troubleshooters.Com web pages on taking pride. He helped Jeff understand the power of taking pride.

He showed Jeff how Sean's game move journal had really been a Take Pride journal, and worked with Jeff to eliminate any feelings of manipulation. Sean did it out of love, and Jeff understood that.

Rabbi Russell explained the two sides of taking pride — celebrating what one did well, and thinking of what improvements can be made. With knowledge gained from working with Sean, the Rabbi even discussed the problems caused by pride run amuck.

Last but not least, Rabbi Russell pulled a few strings, and a week later, Jeff had an entry level job at a fast food place. He did well, and was promoted, then promoted a second and third time. During that time he also wrote and self-published a book on gaming strategies. It sold well enough to be picked up by a publisher, and eventually sold a quarter of a million copies.

The End of a Decade

Party hats, balloons and streamers festooned the Phil and Debbie Hallman's New Years Eve party. It was December 31, 2009, the end of a decade. And what a decade it had been. Ten years ago one of their kids had been a hopeless drug addict, and the other a college kid. What a difference a decade makes.

In the room's center, Jeff danced with Valerie, his wife of three years. Beside them danced their two year old daughter. Jeff had been clean and sober over 5 years, during which he'd moved from fast food to an outside sales job, where he'd done

well. Two of his books had been published and he was writing a third.

Sean and his wife Lorna couldn't dance. Lorna was 7 months pregnant, with their first child. At work, Sean was being considered for a store managership. He was confident that he could rise to District Manager, or maybe more, in a few more years.

The toasts began 10 minutes before the new year. Out of respect for Jeff, the hardest drink served was grape juice, but that didn't dampen the growing happiness.

At 11:59, Sean called for a toast. "To the greatest family on earth. Eight years ago the Hallmans had a hard life. We were down and all but counted out, but against all odds we came back better than ever."

Then, as the ball started to descend on the television, Sean unwrapped and hung a large framed canvas adorned with plain text:

12/31/2009: Today the Hallmans celebrated and took pride in our triumph over adversity. In the 00's, we didn't know it, but we were giants. We're poised for greater triumph in the 10's!

The View Down the Road

Author's Note

This story is set in the near future. The main character is you. Right now it's fiction, but you can make it happen.

You lean back after reading the last page of “Twenty Eight Tales of Troubleshooting”. The book makes sense. You understand the Universal Troubleshooting Process (UTP). But how does it help you in your life? In your career? Will it make a difference, or is it just fluff? You lean back and daydream. Pick the daydream appropriate for your job...

The Technologist's Daydream

At work the day after finishing “Twenty Eight Tales of Troubleshooting”, you feel let down. You're not instantly more productive. You're the same guy you were a week ago. Easy problems are still lightning quick, and difficult problems still take time. Actually, all problems take a little more time, because during each repair you're going through the checklist of UTP steps. Your boss and co-workers notice nothing different about you. The book was a waste of time! Fluff!

But you give it some time. After all, “Heather's Revenge” taught you about IMMERSION and CHALLENGE REDUCTION. As you begin getting used to the Universal Troubleshooting Process, one nice side benefit is the way you feel after taking pride after each solution.

It's a week before you notice. You're not troubleshooting any faster, but you've had substantially less of those problems where you go around in circles or get lost in sidetrack tangents. Although your productivity on most problems is the same or maybe even slower, the toughest problems don't slow you down to a crawl the way they used to. Still, your co-workers notice nothing.

A month later your boss calls you into his office. Your heart pounds and your mouth turns to sand as you walk in to meet

the man who can cut off your paycheck and health insurance with the stroke of a pen.

But today the news is good. Your boss says the accounting manager specifically requested that YOU be sent to fix a problem with their accounts payable module. Your boss thanks you and encourages you to do an excellent job. Accounting has disrespected IT in the past. Your performance can begin to change all that.

You go to accounting, follow the ten steps, and keep the accounting manager apprised of all diagnostic tests and results. You steadily narrow the root cause scope, find the root cause, and fix it. The accounting manager calls your boss with a glowing report.

The next few weeks bring repeat performances. You're not all that much faster with easy problems, but word is out that you're reliable, and you always get your bug. It's noticed. Co-workers call you a genius. Your boss regularly consults you. Promotions are discussed. Professionally, you're happier than you've been in a long time.

And it's not just professionally. You're actually not working as hard as you were in the bad old days, so you have more energy for friends and family. One week you need to take a couple days off to handle a family emergency, and ask your boss. His answer is "of course", with a smile. He knows when you get back you'll quickly clear the backlog caused by your absence.

Indeed, your absence brings a backlog, and highlights your huge contribution. On your return, as you travel between departments, you regularly hear "why can't everyone in IT be like you?" You quickly clear the backlog. You're a hero.

This Universal Troubleshooting Process stuff is great. You take the next step and read "Troubleshooting Techniques of the Successful Technologist", a dense, advanced and rather dry text that is the ultimate authority on technical troubleshooting. Reading that book gives you understandings that you quickly turn into techniques, once again boosting your troubleshooting productivity.

Five Years Later

Yet another suggestion to outsource IT has been shot down by upper management. Your boss, the CIO, gives you the news personally, thanking you. You're the CIO's go to person, the #2 manager in IT, and the person responsible for bringing Troubleshooters.Com's UTP training to the IT department. You and your boss know that UTP training has helped IT with tech

support. It's helped software developers with debugging, and therefore with development. UTP training has given IT consistent language and practices for excellence.

Upper management isn't as conscious of the UTP training as your boss and you. Upper management knows one thing — their IT department is unique, and gives their business a competitive edge. No way they'll outsource that.

You look back fondly to the day five years ago when you finished "Twenty Eight Tales of Troubleshooting", hoping that it might help your career. Your hopes came true with flying colors.

The Auto Tech's Daydream

You've just finished "Twenty Eight Tales of Troubleshooting", and you're hoping it will give you a competitive advantage. Would-be replacements knock on the door daily asking your boss for a job. Your job! Many applicants have lesser needs and lower expectations than you. Bluntly, you need help in order to stay employed.

The past couple days you've used the Universal Troubleshooting Process at work. You like it because it reduces the mental exertion of repairing cars all day. So far your productivity hasn't improved, but from reading "Heather's Revenge" you know it takes a little practice before the UTP bears fruit. It had better bear fruit. Today, two different people came off the street asking your boss for a job. You overheard one of them tell your boss he's worked at Jenkinson Chevrolet for the last three years.

The first hint that the UTP has helped comes with an old Buick that intermittently stalls at high speeds. In the last five years, the owner has taken it to three different shops. Two replaced the computer, one replaced the EGR valve, but the problem keeps coming back. Using the UTP, you isolate the problem to an intermittent lead coming into the computer, and indeed are able to see that the lead is so short that it's regularly stressed enough to compromise the contacts. You replace it with a longer lead, laughing at the chuckleheads who had replaced the computer because what came out of the computer was bad. They eliminated the symptom when they reconnected everything, but soon enough the too-short lead caused an intermittent connection again.

A couple months later your boss mentions that less of your repairs come back under warranty. When you fix them, they

stay fixed. He asks you how you do it. You say you do it by being careful. There's no way you're telling him your competitive advantage. Your boss mentions that for someone being so careful, you sure are fast. You just smile.

Five Years Later

You banter with Benjie after giving him advice and encouragement. Benjie's your latest tech, and he's working out splendidly. All your techs are first class, and every one of them looks to you as a mentor. A couple of your techs were in the auto repair business when you were in diapers, and they *still* look to you as a mentor. Word is out all over the city. Customers flock to your shop, and already employed automotive techs beg to work at your shop. Your shop is the best, and everyone knows it.

You smile as you look back on the last five years. Soon after finishing "Twenty Eight Tales of Troubleshooting", Freddie Phillips started coming to you for advice on hard to understand repairs. Back then, Freddie was the top producing tech (there were only three, counting you). He was short, skinny, and flexible enough to slither into even the tightest of engine compartments. His small hands and 20/10 vision made him lightning quick. You and Freddie made an "off the books" agreement — you took his technically difficult repairs, and he took your physically difficult repairs. Both of your productivities skyrocketed.

Then Freddie moved to Northern California, and you had to stand on your own. You devised tools to take the place of Freddie's physical skills, and continued diagnosing problems with pinpoint accuracy. You read the advanced book, "Troubleshooting Techniques of the Successful Technologist", and your productivity spiked yet again. A few months later the service manager was fired, and the boss asked you to take his place. You accepted.

Now the other techs weren't competition — they were your opportunity to excel. You bought them each a copy of "Twenty Eight Tales of Troubleshooting". They were skeptical. One said "Heather's Revenge" would make a good "chick flick". Your response was "Yes, but what did you think of Heather's troubleshooting techniques?"

The tech had no opinion, so you suggested he try Heather's 10 step process, which of course you knew to be the Universal Troubleshooting Process. You even promised the tech you'd cut him slack on timing. He accepted, and within a few weeks his productivity increased, and his repair quality skyrocketed. By the time you left that shop, you were in charge of five techs.

One day you got a call from Mr. Lindskoog, whose Mercedes your shop had repaired. Mr. Lindskoog was impressed with the way you ran the shop and wanted to open an 8 bay garage with you. You'd each be half owners. He'd put up the money and then be a silent partner. You'd manage the shop.

Your momma didn't raise no fool. Sure, you'd be doing all the work for half the money, but it would have taken you years to work your way up to owning an 8 bay shop. You accepted on the spot. You hired automotive techs willing to learn a new way, and then gave them the Troubleshooters.Com UTP course. You taught it yourself, licensing the courseware for \$60.00 per trainee. The result was a spectacularly productive and accurate workforce. Word got out. The shop began to operate two shifts, and every bay was in use throughout those two shifts, yet there were still more customers than time. You raised your prices, but they kept on coming.

Yesterday Lindskoog came to you with an idea. Lindskoog wants to franchise the shop, making lots of copies. He'll do all the legal paperwork; you'll set up all the training and manuals. You'll be a millionaire in three years.

The Manager's Daydream

You smile as you read the last words of "Twenty Eight Tales of Troubleshooting". You've just found a nugget of career gold.

A few months ago, Glen Pytchley, a rival in the company, pulled some strings and got you transferred to manager of tech support. Tech support is reputedly the worst department in the company. The *dumbest* department. The laughing stock of the company. You got the widowmaker assignment. Well, he who laughs last...

You've gotten to know the members of your department. Yes, they're demoralized. Yes, they make dumb mistakes. But who can blame them. They're mistreated, disrespected, and laughed at. Not a day goes by without suggestions that tech support be outsourced.

But you've gotten to know these guys, and beneath it all, they're smart. They just need an even break.

You buy each person in tech support a copy of "Twenty Eight Tales of Troubleshooting". You tell them they don't have to read it, but life will be much better for those who do.

Some read it, then rage at you. "The principles in that book will never be implemented here! Management will never let us deviate from those brain-dead support scripts! They think

we're all dummies!"

You tell them you're going to try to put the book's principles to work in the department. You read "Manager's Guide to Technical Troubleshooting". You persuade your boss read it. You get your boss to OK an experiment where a few of the tech support people abandon their scripts in favor of the Universal Troubleshooting Process, which you train using courseware obtained from Troubleshooters.Com.

Five Years Later

"I'm sorry Glen, but we're going to have to let you go." You voice this with a solemn demeanor, though a part of you wants to gloat in triumph. You maintain the proper decorum, knowing it's not right to rejoice in a man losing his livelihood and his health insurance. Even if that man tried to do the same to you.

Across your desk sits Glen Pytchley, former rival and now your direct subordinate. Yes, you have a grudge against him, but the real reason you're firing him is that in the seven years Pytchley has been with the company, he's accomplished nothing but discord, fear and intrigue. He's a dead-wood morale leech. For everyone's good, he's got to go.

Pytchley storms out of the office threatening lawsuits you know he'll never win. You've been over it a hundred times with Human Resources, and you've done everything just right. That doesn't mean Pytchley won't be a problem in the future. Bad pennies like Pytchley always turn up again, maybe as a vendor, or a customer, or as a contractor — they always come back, they always cause trouble, and you must always be ready. But that's later. Today is a day of peace in the department. A major problem is gone.

You lean back in your chair enjoying the moment, and thoughts drift back five years. Your experiment turned out well. The UTP group vastly outperformed the script group. All the tech support people wanted to join the UTP group. You persuaded upper management to let the entire tech support department use the Universal Troubleshooting Process. Pytchley, naturally, did everything he could to derail your efforts, but numbers are numbers and it was clear the UTP group outperformed the script group 2 to 1. You licensed Troubleshooters.Com UTP courses for every member of your department, and taught the courses, a few people at a time.

With each group taught, you gave them time to adjust to the new way of doing things. You remembered Heather's experience with IMMERSION and CHALLENGE REDUCTION, so you

let them know they could actually go slower for a couple weeks. Soon enough, the tech support department's productivity doubled, and complaints were cut in half. The people who worked for you were grateful and loyal — they'd follow you to the ends of the earth. You took many along with you as you received promotion after promotion. It all started with a book called "Twenty Eight Tales of Troubleshooting".

Your Dream Job

Daydreams are nice. They focus positive energy and help you accomplish things. But if your life is anything like mine, the successes you get are different (and often better) than the successes you fantasized.

The way that the Universal Troubleshooting Process turbocharges *your* career likely will bear little resemblance to the preceding daydreams. But know that if you use the UTP, you'll be more effective, perceived as smarter, better liked, more politically connected, better able to grab opportunities and better equipped to resist layoffs, outsourcing and economic recessions.

You've read about the UTP, now *use* it. Every day. Live it. Read other books such as "Troubleshooting Techniques of the Successful Technologist" and "Manager's Guide to Technical Troubleshooting". Recommend "Twenty Eight Tales of Troubleshooting" as a starting point. Use Universal Troubleshooting Process courses to train groups.

<http://www.troubleshooters.com> is the place to find all these resources.

In five years you'll look back and say "yep, I did the right thing back then."