

Bill Carton's "fix anything, even yourself" Manifesto

1. Troubleshoot problems efficiently.

Divide the possible solution set in half if possible, as long as you can come up with questions or experiments. Is the issue in the source or the measurement side? The income or the spending? The go or the stop? The hard or the soft? The ebb or the flow? The potential or the kinetic? Eliminating half of the possibilities at a time is faster than eliminating the 5% possible causes.

2. Never give up, unless forced to by economics.

There are no mysteries unless you give up. Everything has a root cause. It may not be economic to run all possible tests to discover the ultimate root cause, but problems can and do have a solution, even if it's a compromise. Throwing out, discarding, or recycling an item because it can't be fixed is ultimately an economic decision, not a technical one. A corollary is that designers who design items to not be maintained easily are under orders from bad management, who should take the blame for being bad world citizens.

3. Always get a good case history. Ask questions. Observe. Demand the truth.

People lie, and so do imperfect diagnostics. You may discover more by observing the symptoms, looking at animal tracks in the dirt (historical clues in the problem parts), and asking uninvolved bystanders what they saw or heard.

4. Don't make a problem worse by ill-planned experiments.

The Hippocratic Oath applies to system diagnosticians as well as physicians: "**Above all, do no harm**"

5. Use the Scientific Method.

It works. Make observations; form a theory; design and perform experiments; make conclusions. **Lather, rinse, repeat.** (Run a loop and do the process repeatedly until it works.)

6. Document what you do.

You don't want to forget, repeat experiments unnecessarily, or leave parts out. Remember, if you take something apart and put it back together enough times, sooner or later you'll have enough parts to make two of them. Except the universe won't let you do that, so it's just a joke. But there's a lesson in there. Take notes. Take pictures. Digital film is free!

7. Google can be your friend.

Whatever your potential solution is, some form of it was probably invented before WWII. I learned this from my first technical mentor, and it's even more true today, with the entire Internet to search for hints. Practicing advanced search techniques is like practicing the piano or tennis or cooking. It's a REQUIRED life skill for this century.

8. Use your own experiences cleverly.

Learn to search your own experiences for additional clues, even across disciplines. A car-repair solution may give you a hint for a circuit fix. A power saving concept from one instrument may help you fix an appliance. Who knows what cross-connections are being wired up in the human brain every minute?

9. Keep an extremely open mind.

Don't rule out even the most unlikely theories without compelling evidence. Sometimes the obvious is right – sometimes it's just a diversion from real understanding.

10. Never stop learning and observing.

Never stagnate. Never refuse the chance to learn new things. Boredom is easily put aside by curiosity.

11. The most subtle and satisfying problems to solve have multiple layers.

If there was a one-to-one correlation between problems and solutions, a robot could diagnose everything. Sometimes it's an art, not a science, and the root cause is a chain of improbable events. Practice thinking about cascaded effects, improbable connections, and using that open mind. And the possible layers could be from any discipline – hardware, software, design, users, environmental effects, internal interference among similar or dissimilar systems.

12. Take your own sweet time.

Of course, that's not always economically possible, but as an artist, you can't always predict the hour and minute of your success. Experience can give you guidance if it is going to be a multi-hour, day or week project. But if you knew exactly how long it was going to take, you would also know what part had gone bad, and you wouldn't have to be fixing it personally, now would you?

13. Don't expect to be left alone.

Some managers just HAVE to micro-manage – they feel useless otherwise. And a frustrated manager is an annoying manager. All you can do is point out what your success rate is, and that constant progress reports slow down the progress you're reporting on. Deal gracefully with the interruptions and they'll decrease over time.

14. Take advice, but remain in charge.

A project, product, army, or country can only have one person ultimately responsible for failure or success. If that's your role – embrace it. Don't let somebody else steer the vehicle while you're behind the wheel.

15. Find the bright spots in what looks like impending doom.

Even failed experiments or backsliding results teach you some things – such as what doesn't work. Look for the nuggets of good data in the mass of bad. Extract it with statistics if necessary. But don't give up hope that it's in there.

16. In God we trust – all others bring data.

Data rules. It is necessary to persuade the unbelievers. To prove the fix is proper. And to extract you (the diagnostician) from the stressful situation and let you clear out of Dodge City and get on the train home.