Hypothesis-Based Problem Solving: A Comprehensive Process

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Ever wonder whether your problem solving approach really matters? Here's why it does:

What is Hypothesis-based problem solving?

Hypothesis-based problem solving is, simply, a particularly effective strategy for identifying solutions to any problem.

Whether you realize it or not: *we are always responding to hypotheses!* Except sometimes we believe they are true. Then we dwell on them, analyze them, rely on them.

That's OK if it's the hypothesis has been deeply investigated, and you come to rely on it as truth.

That's not OK if it was simply the first thing that occurred to you. The first thing that occurred may or may not be true. If you are well-adjusted and knowledgeable about your situation, it may even be *likely* your first response will be correct. But you can only be *sure* if you compare it to other possible responses. This is why a hypothesis-driven approach is so necessary—it recognizes that there are multiple possible explanations for any given problem or process flaw, and it examines each one in turn until the problem is isolated and a solution can be identified.

What it isn't: Solution-oriented Problem Solving

Let's contrast hypothesis-based reasoning with a more common technique: solution-oriented problem solving. In this type of troubleshooting, there is typically a pre-defined set of solutions (a “toolbox”), and the problem-solving process involves applying solutions in order of preference until something works. Here are a few examples of this type of problem solving:

Situation	Toolbox

Driving car, hear clunking, notice tire is flat.	1. Put on spare; 2. Call a mechanic.
Surfing the web, everything is much too slow	1. Clear cache and restart browser; 2. Run anti-virus scan; 3. Format and reinstall; 4. Call tech support.
You are on fire	1. Stop, drop and roll; 2. Get an extinguisher; 3. Call for help and hope it comes fast.

In all three situations, the solutions will be effective in the majority of cases. Some comparisons will highlight exactly under what conditions solution-oriented problem solving will be effective:

1. They are common, or foreseeable situations in which a range of best-solutions have become widespread;
2. The effort to fully understand the underlying problem is not worth the effort because a) a fix that is reasonably certain to work is available or b) there is not time to really investigate (e.g., I don't really care why I'm on fire, but I need it to stop right now);
3. The situations occur infrequently enough that there isn't a pressing need to develop a more robust understanding of how to prevent it in the future—i.e., how to really solve it once and for all.

This is a great strategy for fixing a tire, because experts have already devised an easy way to solve that particular problem—the spare. And if the spare doesn't work, the mechanic is a logical next step—if the driver lacks the ability to fix it, call an expert who can. Similarly, with a slow computer—the effort necessary to find, say, a corrupt registry entry or memory fault that is actually causing the problem is so much greater than that of restarting, running a virus scan, or reformatting—all of which are reasonably likely to work on the majority of one of those problems. And if you're on fire, well, you gotta do something and do it fast—stop drop and roll seems to work (or so they told me when I was 7).

In all three cases, the known solution will work the majority of the time, and there are backup plans in the event the first step doesn't work. Finally, with a solution-oriented approach, the terminal step is always to call in an Expert.

What is an Expert?

An Expert is someone who can use hypothesis-based reasoning to isolate the actual causes or drivers of the problem and tune it back into an optimal state. He can actually solve a problem, as opposed to apply a bunch of fixes and try to see what sticks.

Broadly speaking, there are two types of Expert: 1) a specialist in the field, or 2) someone with a critical amount of domain-level knowledge about the drivers of an optimal state, and the ability to apply a hypothesis-based approach.

Among specialists, some may use a hypothesis-based approach, and others do not. I'm sure many of you have experienced a mechanic who you are paying to fix your car say “I think the problem is X” and then a couple hundred dollars later, say “Now I think the problem is Y.” It's possible that this mechanic is using a solution-oriented approach, trying a solution known to sometimes address a symptom, rather than first solidly identifying what the problem is. A better mechanic will use a hypothesis-based approach, allowing him to isolate a problem completely before applying an expensive fix.

Solution-oriented Approach	Hypothesis-based Approach
1. Notice symptoms: Engine is idling very rough, sometimes stalling when cold, and the check engine light is on.	1. Notice symptoms: Engine is idling very rough, sometimes stalling when cold, and the check engine light is on.

2. Think of a fix: a. It's probably not getting enough air, so maybe I should change the air filter. 3. Apply fix: $30 part, $20 labor 4. Problem Persists. 5. Think of a fix: a. Well, I know it's not getting enough air, so maybe there is a bad seal on the intake manifold. Let's change out all the gaskets. 6. Apply fix: $80 parts, $200 labor 7. Problem persists. 8. Think of a fix: a. Maybe it's not airflow after all... Let's try replacing the fuel injectors! 9. A savvy customer will go find a better mechanic at this point.	2. Think of possible drivers: a. Insufficient airflow; b. Fuel line or injector problems; c. Valve timing off; d. Onboard computer is malfunctioning; e. Backpressure from exhaust obstruction. 3. Investigate each in turn: a. Airflow: Check filter—dirty, but not likely to be causing this level of problem. Check gaskets—they show minor wear but are sealing properly; b. Inspect fuel line—no obstructions; pump—operating as expected; electronic testing of fuel injectors indicates they are fine; c. Remove valve cover, investigate each valve in turn with a feeler gauge. 4. Aha! Valve two on piston three is .05mm from the rocker arm, manual specifies .08mm. 5. Adjust to specifications, check remaining valves while cover is off, re-assemble vehicle and call customer to report success. 6. Total bill: $120 labor.
Costs: $110 for parts, $220 for labor **Result**: The car is still broken. At least we know airflow isn't the problem.	**Costs:** $120 labor cost, no parts needed to be replaced. **Result**: Car operates as expected.

Of course, it is unlikely that you will encounter a mechanic as terrible as in this illustrative example. On the other hand it is certain possible (even likely?) that there are people in your organization hat fail to examine their assumptions and waste time, money and effort by chasing solutions for the wrong problem. Why was mechanic #1 so fixated on intake problems? Maybe he had seen fixing different intake systems work in connection with rough idling so many times, he was biased towards that set of solutions. The truly diabolic thing is that, he very likely does not realize this unconscious assumption, yet it is affecting his every decision. What are your unquestioned assumptions, what might you be missing?

Conclusions

One thing we learn from the above example is that too much experience can be dangerous if it isn't coupled with a method to ensure unconscious assumptions don't take over. Even if the Mechanic had a bias towards valve adjustments, he may have fixed *this* car, but what about the next one? Rather, experience in the form of domain-level knowledge is useful to the extent it is paired with an effective framework for problem solving approach. Using this specific knowledge, an Expert formulates a mutually exclusive, comprehensive set of drivers, then analyzes each one in turn until a problem is isolated. From there, the solutions will suggest themselves.

So ask yourself: do you ever lazily default into a solution-oriented approach? Do others in your organization? Are there certain “fixes” for processes in your organization that you seem to be making again and again, or problems that just keep coming back? If the answer to either of those questions is yes, it's likely that a hypothesis-driven analysis, taking nothing for granted, will help to focus in on the drivers of your problem and identify a real solution. It may take longer than simply applying a fix that will get you through the short term, but it will save you time, money and happy customers.

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Views: 76

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