Learning from the Language of Problem Solving

If you're reading this, chances are you're someone whose work entails solving problems. Moreover, you probably would like to get better at it. Reading this document is one way to do exactly that. I make that claim for a very basic reason: "Language shapes thought and thought shapes behavior." Improving your grasp of the language of problem solving is a sure-fire way of improving your ability to solve them. So, read on and enjoy. The balance of this paper is organized into five major sections:

- Problems
- Solutions
- Problem Solving
- Solving Problems
- Solution Engineering

Problems

I associate the following items most closely with the word "problem."

Problem

The difficulty, perplexity, and uncertainty you experience when you are confronted by a situation requiring action (typically because of a gap between "what is" and "what should be") but the action required is not immediately apparent. Alternatively, you might say a problem exists when you want something and don't know what to do to get it.

Presenting Problem

The situation, circumstances, or conditions that indicate or suggest to you the presence or existence of a problem.

Note: *In ordinary usage in the world of work, the word problem typically refers to a "bad" situation, one in which something has gone wrong. This is generally viewed as something that should not have happened in the first place. Further, it is probably the case that someone will be punished if the guilty party can be found. (Which explains why it's often difficult to get people to talk about problems.)*

Problem Label

The name used to classify the problem (e.g., it's a "training" problem, it's a "personnel" problem, or it's a "production" problem). The label you place on a problem invokes a certain worldview or frame of reference and thus places a set of conceptual "blinders" on you as the problem solver. It's a good idea to ask yourself this question: "How is the label we've placed on this problem shaping our approach to solving it?"

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Problem State

The situation requiring action, including all the reasons you believe action is required. Sometimes referred to as "What Is."

Problem Space

That area wherein the problem state can be said to reside. This "area" might be conceptual, physical, or logical. Essentially, it is what you see as the problem's context.

Discrepancy

The difference between what you have and what you want, between *what is actually the case* and *what should be the case.* Essentially, this is the difference between the Problem State and the Solved State, sometimes referred to as a "gap" in results.

Gap

A difference between "what is" and "what should be" - between actual or current conditions and required or desired conditions. Synonymous with discrepancy as defined above.

Business Problem

A situation in a business or organization that requires action but for which the necessary action is not known.

Mess

A set of related but as yet undifferentiated problems. By definition, a mess is amenable to analysis; that is, the set of problems can be sorted out or differentiated from one another.

Well-Defined Problem

A problem for which you have a clear, unambiguous test or measure of its resolution. In other words, there is a way you can tell if it has been solved.

Well-Structured Problem

A problem for which you know and understand all the relevant variables, connections, and relationships.

What Is

A description of some problem situation as you currently see it (see Problem State on page 1).

What Should Be

A description of the situation as you want, desire, expect or demand it to be (see Solved State under the "Solutions" heading on page 3).

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Wicked Problems

Problems marked by no clear end state, no clear measure of resolution, shifting structures, and conflicting views.

Solutions

I associate the following items most closely with the term "solution."

Solution

A course of action that, once you carry it out, leads to the results that define the Solved State. In effect, a solution is a course of action you carry out that closes the gap between "what is" and "what should be" and, in so doing, eliminates the requirement for action.

Solution Identification (see Investigation on page 5).

The process whereby you determine a course of action intended to produce desired results.

Solution Implementation (see Intervention on page 5).

The process whereby you carry out the intended course of action. This is very much a process of intervening (i.e., changing things with some purpose or outcome in mind).

Solved State

A set of required or desired results. These are the conditions or circumstances that would prevail or exist if you solved the problem. Sometimes referred to as "What Should Be." Synonymous with "Goal State."

Problem-Solving

I associate the following items most closely with the term "problem-solving" (which is defined immediately below).

Problem-Solving

The process by which you gather and analyze information in order to reduce your uncertainty regarding the action to take with respect to a problem. In other words, problem-solving is the process of figuring out what to do about a problem.

Analysis

The process by which you break down a physical or logical entity into its constituent elements, connections, and relationships – in other words, taking things apart.

Change Targets

Those elements, connections, and relationships in the structure of the situation in which the problem is embedded that you have selected for change as a way of realizing the solved state.

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Change Goals

The nature of the changes you want made to the change targets (e.g., increase profit, reduce costs, reduce rework, etc.).

Data Collection

The gathering of specific information, by you or someone else, the nature of which you have specified in advance (see Investigation on page 5).

Data "Round-Up"

The indiscriminate gathering of all kinds of information you hope will find something useful.

Disconnect

The disruption of connections between solutions and the problems you intend them to solve.

Note: *Theoretically, this is the result of a misalignment between the problem space and the search space. Practically speaking, it happens when one person defines the problem, another person diagnoses it, and yet a third implements the solution. (Disconnects can occur in the vertical and horizontal dimensions).*

Solving Problems

I associate the following items most closely with the activities involved in actually solving a problem.

Solving Problems

The activities involved in you investigating and then intervening in situations that are characterized by difficulty, perplexity, and uncertainty in order to attain your goals and objectives. It is useful to conceive of two sub-processes or phases: *Investigation*, and *Intervention* (see the Solution Engineering model on page 8).

Define the Problem

The word "define" has several meanings. All apply to your task of defining a problem:

- establish boundaries (isolate or locate)
- enumerate characteristics (differentiate)
- describe the extent and nature of (articulate)
- describe the meaning of (explicate)

Actions

The activities of people, equipment, and other things capable of affecting their environment.

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Cause

Some factor or set of factors that combine in such a way as to produce the Problem State. The most common usage of "cause" refers to a change of some kind, usually an unwanted or unanticipated change, one that results in a previously acceptable situation becoming unacceptable. (Use care here; not all causes can be corrected.")

Diagnosis

The process by which you compare an observed condition against a standard for some further purpose. You might perform comparisons to identify variances, determine the contributing factors or corrective action, or simply to classify observed phenomena, mainly symptoms. Ordinarily, diagnosis refers to figuring out what is wrong and what to do about it. Diagnosis and analysis are often used interchangeably but they are not the same.

Intervention

This is when you change one or more aspects of a situation with a specific purpose or outcome in mind. Your interventions may be planned or unplanned, but they are always deliberate – you always have some end in view.

Investigation

Your pursuit of information in a manner typified by detective or intelligence work; that is, you go where the information leads. This does not preclude you from collecting data in accordance with some predetermined scheme or prefigured set of requirements (see Data Collection on page 4).

Implementation

The act of carrying out a plan of action in accordance with predetermined schedules and assignments. Implementation is always planned and always deliberate.

Solution Engineering

The terms that follow are an integral part of my approach to solving problems. I call it "Solution Engineering."

Solution Engineering

The process by which you skillfully and artfully apply scientific and technical knowledge in crafting and carrying out courses of action that produce the results you desire.

Accessible Variables

Those variables in the structure of the situations that can be affected through your direct, immediate action. Also known as Proximate Variables.

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Connecting Variables

Variables that connect the Accessible or Proximate variables with the Driver Variables and thence the Target or Ultimate Variable. Also known as "Intermediate Variables."

Disturbance

Something affecting the Target Variable independently of any actions you take or might take.

Domain Disconnect

A break in the connections between a problem and its solution that occurs when a problem is in one department or functional area of the organization, the solution appears to be in another, and you lack the authority to investigate or intervene in both functional areas.

Driver Variables

The variables that directly affect the Target Variable. Also known as Penultimate Variables.

Engineer

There are two primary meanings of engineer as a verb. One is for you to arrange or bring about desired results through skillful or artful contrivance. The other is for you to apply scientific and technical knowledge to practical problems.

Frame of Reference

Your worldview is the way you perceive, analyze, and interpret events. Your frame of reference includes your language, your models, your theories, and your concepts. It's your knowledge base colored by your values and your upbringing. In short, it's the filter through which you see the world.

Goal State

Some desired or required condition. Synonymous with the Reference State for a Target Variable.

Goals Grid

A 2x2 matrix formed by the interplay of Yes and No answers to two questions about a particular condition or circumstance:

1. Do we have it?
2. Do we want it?

The Yes/No answers to these questions serve to identify four types of goals: Achieve, Preserve, Avoid, and Eliminate.

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Horizontal Disconnect

The disruption of connection between solution and problem that typically occurs when a problem is defined in one department, analyzed in another, and addressed in yet a third. Information systems development projects offer many instances of horizontal disconnects, as do new product development and roll out efforts.

Intermediate Results

Results between Proximate and Ultimate results.

Intermediate Variables

Variables that link Proximate or Accessible variables with Penultimate or Driver Variables.

Model

A means of representing the structure of the situation in which the problem is embedded, typically in diagram form (e.g., flowcharts, tree charts, cause-and-effect or Ishikawa diagrams, process maps, and schematics). For example see the model of the Solution Engineering Process on page 8.

Operand

That which you seek to affect. Synonymous with Change Target.

Operators

The means you use to change Operands or Change Targets.

Opportunity

A gap between “what is” and “what should be” and for which you know an appropriate action.

Penultimate Variables

Those variables that directly affect the Target or Ultimate Variable. Also known as Driver Variables.

Performance Architecture

The structure of elements, connections and relationships making up the situation in which your desired results are to be realized and in which your interventions must be made in order to realize them.

Point(s) of Evaluation

The place or places in the structure of the situation where you will measure the effects of the solution.

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Point(s) of Intervention

The place or places in the structure of the situation at which you can make changes and from which any changes you make will propagate or "ripple through" the structure of the situation.

Process

The patterned interactions between the inputs to a system and the processors inside the system's boundaries. These processes typically transform inputs into outputs. Another name for these interactions is "routines." The problem-solving process, then, is a label for the interactions between the problem solver (i.e., the processor) and information about the problem (i.e., inputs to the system). By way of illustration, the Solution Engineering Process is depicted below:

Proximate Results

The direct and immediate effects of your actions.

Proximate Variables

See Accessible Variables.

Reference State

Your desired or required value for some Target Variable. Synonymous with Goal State.

Results

The effects of your actions. These may be proximate (i.e., immediate, and direct) or ultimate (i.e., delayed and indirect).

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Search

The process by which you examine the structure of the situation in which a problem is embedded for the purpose of identifying Change Targets. Search also includes identifying ways and means of changing these factors (see Operand on page 7).

Search Space

That area where you will search for a solution. Like "Problem Space," this too might be a conceptual, physical, or logical area. Typically, the search space is defined by the structure of the situation in which the problem may be said to be embedded.

Solution Path

The routes by which the direct actions of your intervention will propagate or "ripple through" the structure of the situation, eventually producing the desired changes in the value of the Target Variable. Typically consists of Accessible, Connecting and Driver Variables.

Structure

A term used to refer collectively to (1) the elements or factors making up a situation, (2) their connections to one another, and (3) their relationships. A flowchart, for example, depicts the structure of an operation.

Structuring

The process by which you factor or decompose a complex problem into smaller or simpler problems.

Synthesis

Your forming of a logical or physical entity from separate elements as a result of establishing or identifying connections and relationships – the act of you putting things together.

System

Any arrangement of resources and routines organized in a way intended to produce results that match a set of requirements.

Note: *Common usage often equates "system" with "computer," a particularly egregious error in thinking, stemming no doubt from the tendency to think of systems in terms of inputs, processes, and outputs.*

Target Variable

Some aspect of the environment over which you wish to exercise control in order to bring the value of that variable to some specified state.

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Ultimate Variable

Same as Target Variable.

Vertical Disconnect

A breakdown in the linkages between problem and solution that occurs in the hierarchical structure of an organization.

Note: *Typically, this is the result of top management defining a problem, middle management analyzing and "solving" it, and line management or supervision implementing the solution.*