First Four Steps: Problem Definition

1. Collect and analyze information and data.
   - List every relevent thing you can think of.
   - Fill in missing gaps.
2. Talk with people familiar with the problem.
   - Look past the obvious.
   - Get clarifications when you don't understand.
3. If at all possible, view the problem first hand.
4. Confirm all findings.

K.T. Problem Analysis

Useful for troubleshooting, where cause of problem is not known.

Basic premise is that there is something that distinguishes what the problem IS from what it IS NOT.

- The distinction column is the most important.

K.T. Problem Analysis

		IS	IS NOT	Distinction	Cause
What	Identify:	What is problem?	What is not problem?	What difference between is and is not?	What is possible cause?
Where	Locate:	Where is problem found?	Where is problem not found?	What difference in locations?	What cause?
When	Timing:	When does problem occur?	When does problem not occur?	What difference in timing?	What cause?
		When was it first observed?	When was it last observed?	What difference between 1st, last?	What cause?
Extent	Magnitude:	How far does problem extend?	How localized is problem?	What is the distinction?	What cause?
		How many units are affected?	How many not affected?	What is the distinction?	What cause?
		How much of any one unit is affected?	How much of any one unit is not affected?	What is the distinction?	What cause?

K.T. PA Example

On a new model of airplane, flight attendants develop rash on arms, hands, face (only those places). Only occurs on flights over water. Usually disappears after 24 hours. No problems on old planes over those routes. Does not affect all attendants on these flights, but same number of attendants get it on each flight. Those who get rash have no other ill effects. No measurable chemicals, etc., in cabin air.

K.T. PA Example

	IS	IS NOT	DISTINCTION
WHAT:	Rash	Other illness	External contact
WHEN:	New planes used	Old planes used	Different materials
WHERE:	Flights over water	Flights over land	Different crew procedures
EXTENT:	Face, hands, arms	Other parts	Something contacting face, hands and arms
	Only some attendants	All attendants	Crew duties

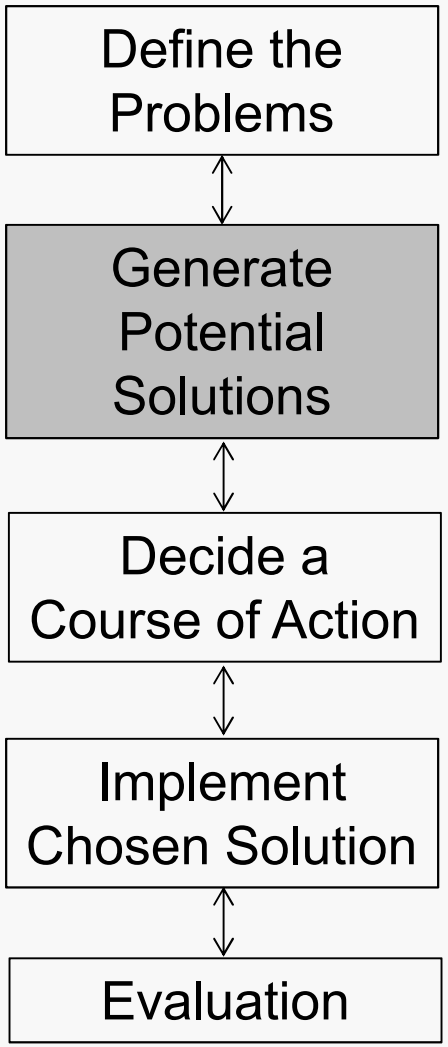
Generating Potential Solutions

To succeed, ultimately you must:

- define the correct problem,
- select the best/acceptable solution for that problem.

You can't select an acceptable solution unless it gets on the list of potential solutions to be evaluated.

You need an effective process for generating potential solution alternatives.



Mental Blocks (1)

1. Defining the problem too narrowly.
2. Attacking the symptoms and not the real problem.
3. Assuming there is only one right answer.
4. Getting “hooked” on an early solution alternative.
5. Getting “hooked” on a solution that almost works (but really doesn’t).
6. Being distracted by irrelevant information (mental dazzle).
7. Getting frustrated by lack of success.
8. Being too anxious to finish.
9. Defining the problem ambiguously.

Mental Blocks (2)

There is a direct correlation between the time people spend “playing” with a problem and the diversity of the solutions generated.

Sometimes problem solvers will not cross a perceived imaginary limit – some constraint formed in the mind of the solver---that does not exist in the problem statement.

Mental Blocks (3)

1. Stereotyping: functional fixedness (einstellung).
2. Limiting the problem unnecessarily.
3. Saturation or information overload.
4. Fear of risk taking.
5. Lack of appetite for chaos.
6. Judging rather than generating ideas.
7. Lack of challenge.
8. Inability to incubate.

Sources of blocks: culture, taboos, environment, inability to express, inflexible/inadequate problem solving skills.

Generating Solutions

Brainstorming

Futuring

Analogy and Cross-fertilization

Generating Solutions: Brainstorming

Free Association Phase

- Unstructured.
- Generate lots of ideas.
- Ideas flow freely for awhile, then taper off.
- How to generate more ideas?

Vertical Thinking

Lateral Thinking

Vertical Thinking

A more structured approach to generating new ideas as part of brainstorming.

- Adapt: How can we use this?
- Modify: What changes can we make?
- Magnify: Add something? Make stronger, longer, etc.?
- Contract: Split up? Lighten?
- Rearrange: Interchange, reorganize?
- Combine: Compromise? Blend?

Lateral Thinking

Random Stimulation

- Select a word from the dictionary or a list of “stimulating” words.

Other People’s Views (OPV)

- Imagine yourself in other roles.

Futuring

Ask leading/stimulating questions, ignore technical feasibility (aka wishful thinking).

- What are the characteristics of an ideal solution?
- What currently existing problem, if solved, would make our lives/jobs easier, or make a difference?

Futuring Example

Cheese/yogurt factory generates acidic waste byproducts. Traditional approach is to “treat” the waste so that it can be discharged.

Futuring: Imagine a successful plant with no waste. All such “waste” has a useful purpose.

- Protein: Food additives/supplements.
- Sugar: Ferment for Ethanol.
- Solid waste: De-icing compound, construction material.

Real problem: What to do with waste?

How to Use Cars in Playgrounds

Painting

- Let kids paint graffiti on cars.
- Paint targets and throw balls at them.
- Paint as something (wagon) for play.

Whole Car

- Make teeter-totter (upside down).
- Turn into a go-cart.
- Let kids drive it.

Parts

- Use seats as swings.

Analogy

1. State the problem.
2. Generate analogies (the problem is like...).
3. Solve the analogy.
4. Transfer solution to problem.

Cross-Fertilization

Much of science is done by combining ideas from different fields.

Imagine a meeting between pairs such as:

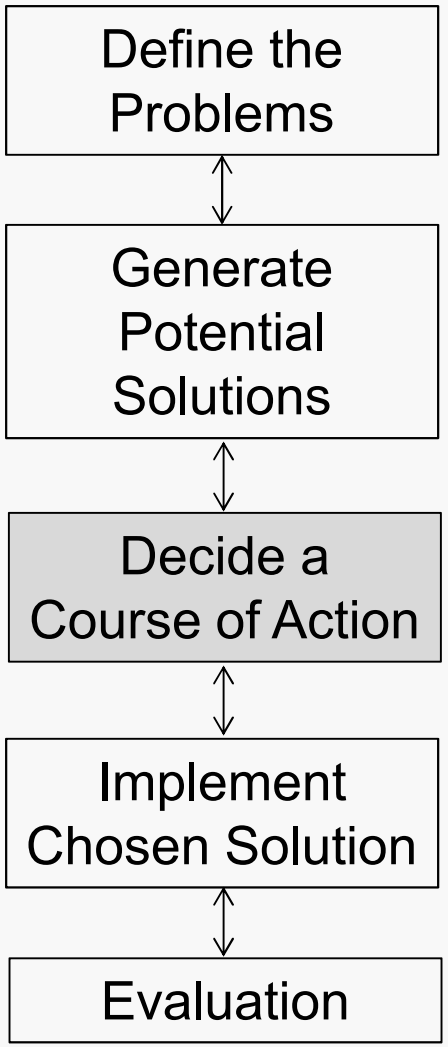
- beautician and college professor,
- police officer and software programmer,
- automobile mechanic and insurance salesman,
- banker and gardener,
- choreographer and air traffic controller,
- maître d' and pastor.

Deciding the Course of Action

Assume we have managed to define a collection of real problems, and we have also generated some potential solutions for each of those problems.

Now, we must decide what course of action to follow:

- decide which problem to address first
- decide which actions to take vs this problem
- select the best solution from our possible alternatives
- decide how to avoid additional problems as we implement our chosen solution



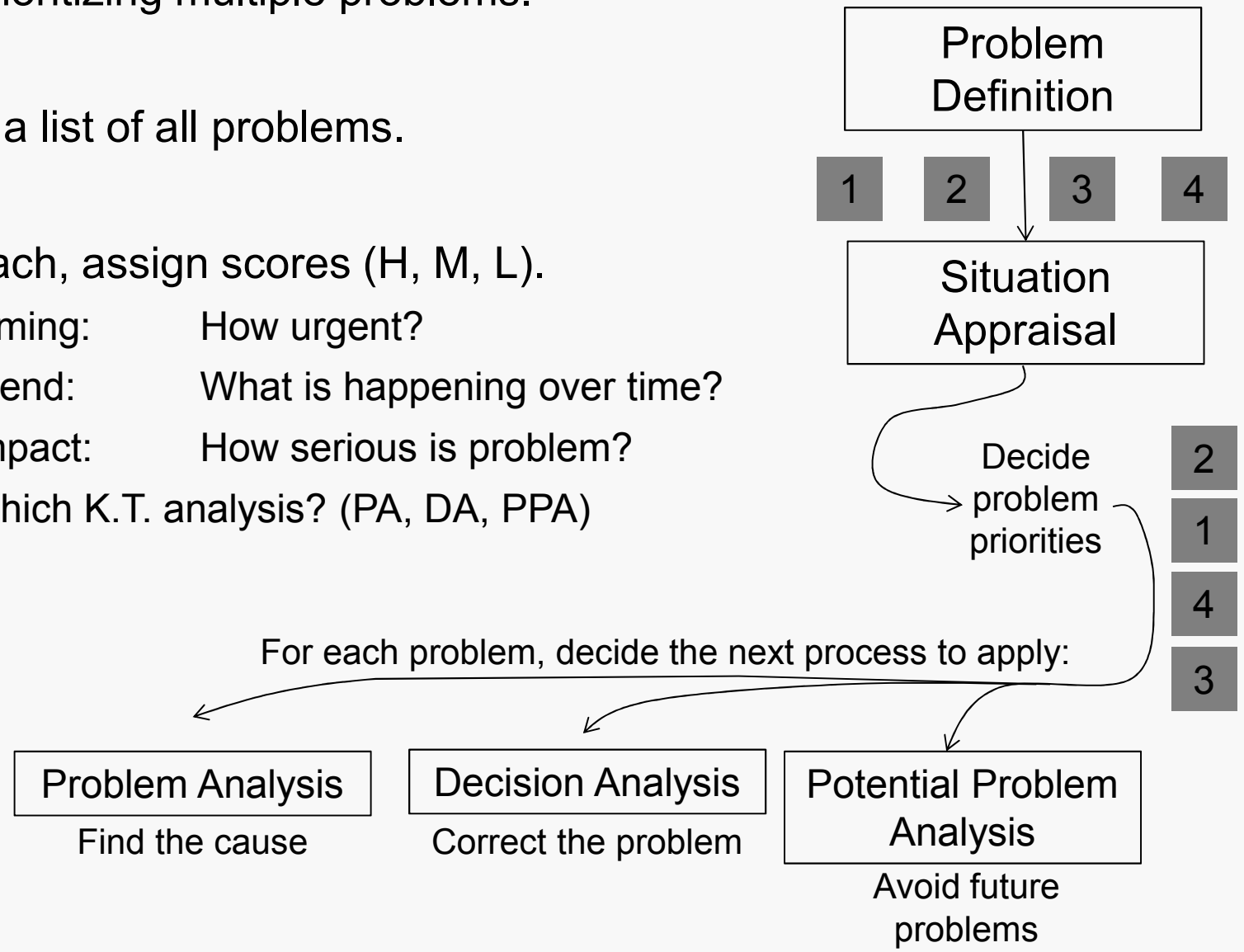
K.T. Situation Appraisal

For prioritizing multiple problems.

Make a list of all problems.

For each, assign scores (H, M, L).

- Timing: How urgent?
- Trend: What is happening over time?
- Impact: How serious is problem?
- Which K.T. analysis? (PA, DA, PPA)

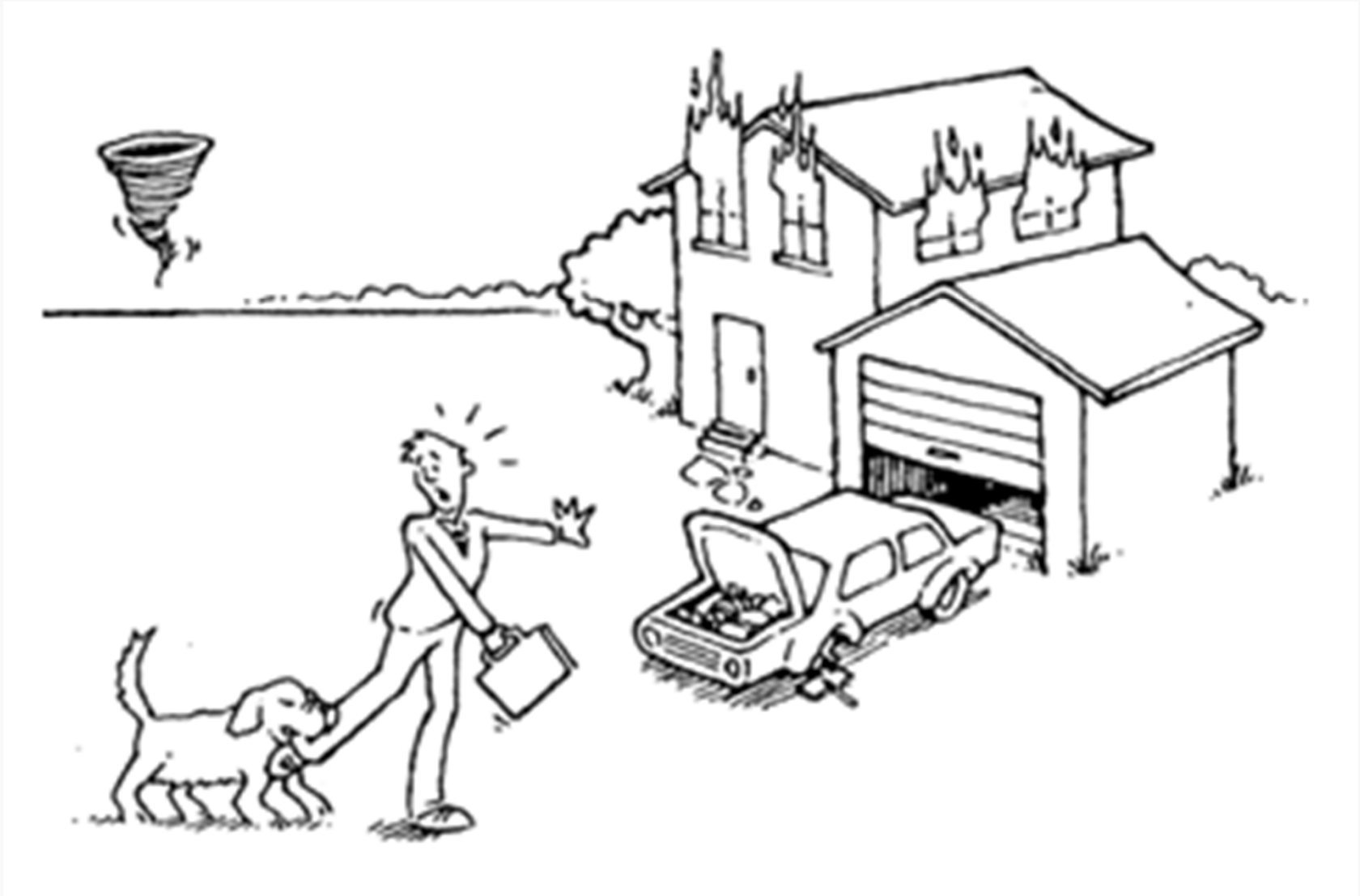


K.T. Situation Appraisal

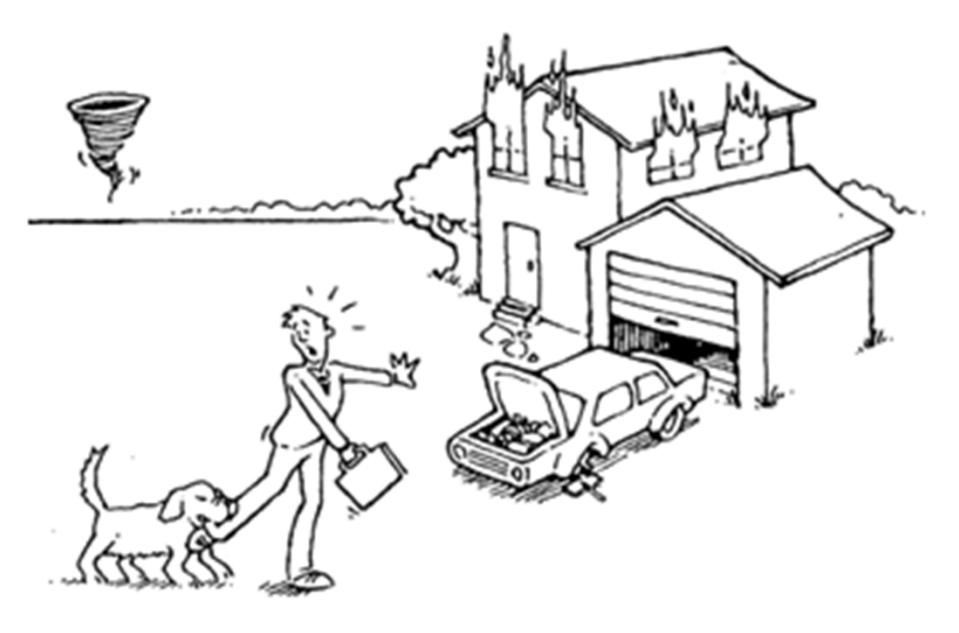
Deciding the Priority for each Problem

timing	How urgent is the problem?
trend	What is the problem's potential for growth?
impact	How serious is the problem?

SA Example: Really Bad Day



SA Example: Really Bad Day



Problem	Timing (H,M,L)	Trend (H,M,L)	Impact (H,M,L)	Next Process
1. Get dog off leg				
2. Repair car				
3. Put out fire.				
4. Protect contents of briefcase				
5. Prepare for tornado				

SA Example: Really Bad Day

Problem	Timing (H,M,L)	Trend (H,M,L)	Impact (H,M,L)	Next Process
1. Get dog off leg	H	H	H	DA
2. Repair car				
3. Put out fire.				
4. Protect contents of briefcase				
5. Prepare for tornado				

1. Get dog off leg:

Timing: Must do this NOW --- high!

Trend: Wounds are getting worse --- high!

Impact: Can't do anything else before this is accomplished --- high!

Next: Decision Analysis --- how does he accomplish this?

SA Example: Really Bad Day

Problem	Timing (H,M,L)	Trend (H,M,L)	Impact (H,M,L)	Next Process
1. Get dog off leg	H	H	H	DA
2. Repair car	L	L	M	PA
3. Put out fire.				
4. Protect contents of briefcase				
5. Prepare for tornado				

2. Repair car:

Timing: This can wait --- low

Trend: It isn't getting any worse --- low

Impact: Might impact my job --- moderate

Next: Problem Analysis --- what's wrong with the car?

SA Example: Really Bad Day

Problem	Timing (H,M,L)	Trend (H,M,L)	Impact (H,M,L)	Next Process
1. Get dog off leg	H	H	H	DA
2. Repair car	L	L	M	PA
3. Put out fire.	H	H	H	DA
4. Protect contents of briefcase				
5. Prepare for tornado				

3. Put out fire:

Timing: high

Trend: high

Impact: high

Next: Decision Analysis --- use hose?

call fire department?

evacuate house?

SA Example: Really Bad Day

Problem	Timing (H,M,L)	Trend (H,M,L)	Impact (H,M,L)	Next Process
1. Get dog off leg	H	H	H	DA
2. Repair car	L	L	M	PA
3. Put out fire.	H	H	H	DA
4. Protect contents of briefcase	M	M	H	PPA
5. Prepare for tornado				

4. Protect contents of briefcase:

Timing: moderate --- can't do it before dealing with dog, less important than putting out the fire

Trend: moderate --- not currently getting worse

Impact: high --- don't want to lose work and affect job performance

Next: Potential Problem Analysis

SA Example: Really Bad Day

Problem	Timing (H,M,L)	Trend (H,M,L)	Impact (H,M,L)	Next Process
1. Get dog off leg	H	H	H	DA
2. Repair car	L	L	M	PA
3. Put out fire.	H	H	H	DA
4. Protect contents of briefcase	M	M	H	PPA
5. Prepare for tornado	M	H	H	DA/PPA

5. Prepare for tornado:

Timing: moderate --- don't know it's headed this way (yet)

Trend: high --- unknown, but this is vital information

Impact: high --- don't want to die

Next: Decision Analysis or Potential Problem Analysis

SA Example: Really Bad Day

Problem	Timing (H,M,L)	Trend (H,M,L)	Impact (H,M,L)	Next Process
1. Get dog off leg	H	H	H	DA
2. Repair car	L	L	M	PA
3. Put out fire.	H	H	H	DA
4. Protect contents of briefcase	M	M	H	PPA
5. Prepare for tornado	M	H	H	DA/PPA

So, what's the prioritized ranking of the problems?

Two problems have three H ratings.

Compare the two problems in each category…

… dog wins on impact and probably on trend as well

After that, it would seem we'd rank them in the order 5, then 4 and then 2.

K.T. Decision Analysis

1. Write a concise decision statement about what it is we want to decide.
   - Use first four problem-solving steps to gather information.
2. Specify objectives of the decision, and divide into **musts** and **wants.**
3. Evaluate each alternative against the musts:
   - "go" vs. "no go".
4. Give a weight (1-10) for each want.
   - Pairwise comparison can help with relative weights.
5. Score each alternative.

K.T. DA Example

Alternative		Distract dog with food	Pry dog's jaws open	Stun dog, then confine him
Musts	Quick Have means	go no go	go go	go go

K.T. DA Example

Alternative		**Pry dog's jaws open**		**Stun dog, then confine him**	
Musts	Quick Have means	go go		go go	
Wants	Weight	Rating	Score	Rating	Score
Painless to me Painless to dog Keep pants	8 2 5	3 7 7	24 14 35	9 1 8	72 2 40
			73		114

K.T. Potential Problem Analysis

Analyse potential solutions to see if there are potential problems that could arise.

Ones not analysed in prior steps.

Particularly appropriate for analysing safety issues.

K.T. PPA Example: Buying a Car

Problem	Possible Cause	Preventive Action	Contingency Plan
Improper alignment	Car in accident	Check alignment	Don't buy
Body condition	Car in accident; body rusted out	Inspect body for rust	Offer lower price
	Car in flood	Check for mold/ hidden rust	Offer lower price
Suspension problems	Hard use, poor maintenance	Check tires	Require fixes
Leaking fluids	Poor maintenance	Inspect	Require fixes
Odometer incorrect	Tampering/broken	Look for signs, check title	Offer lower price
Car ready to fall apart	Poor maintenance	Look for signs	Don't buy