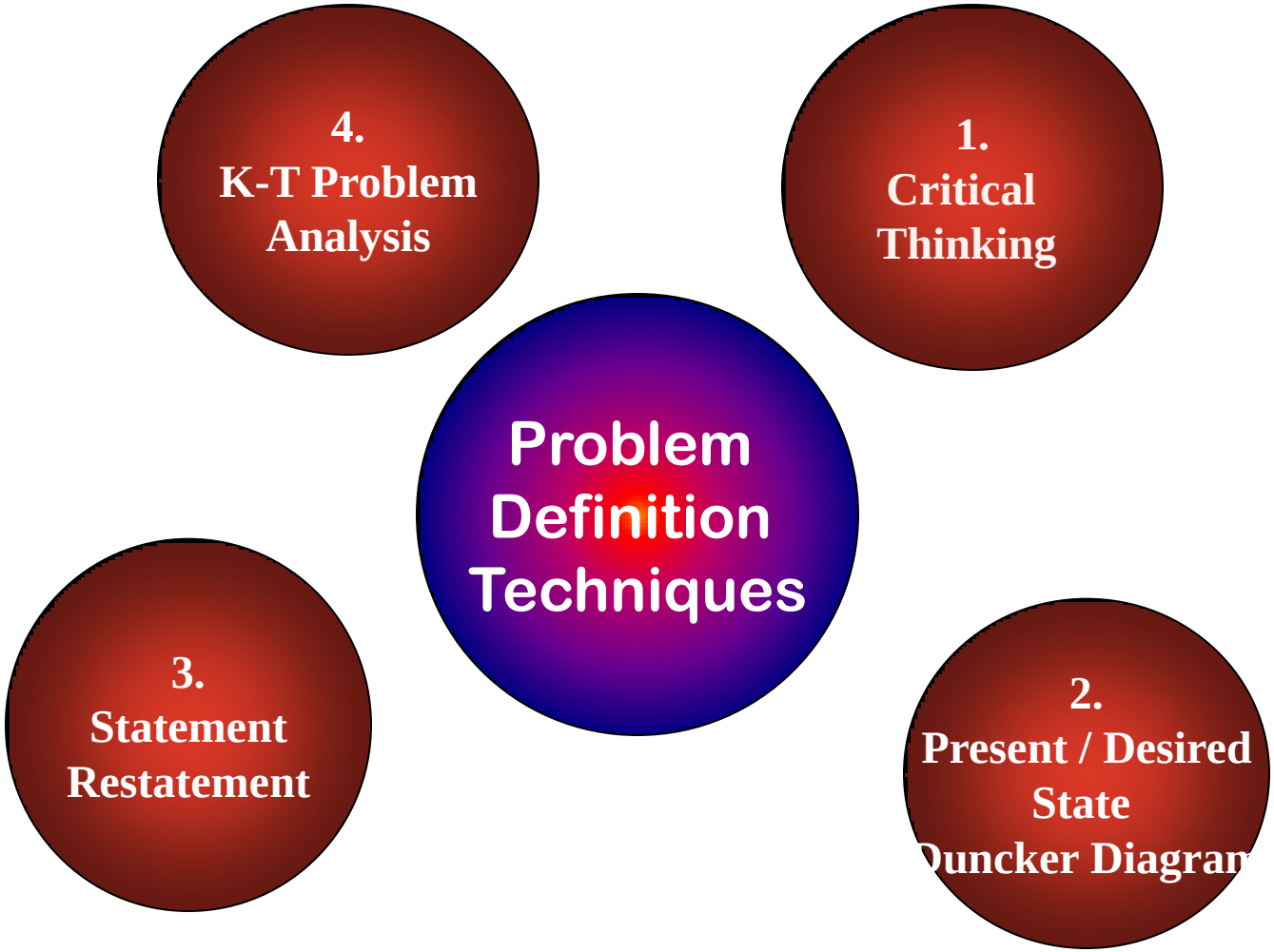
Problem Definition Techniques



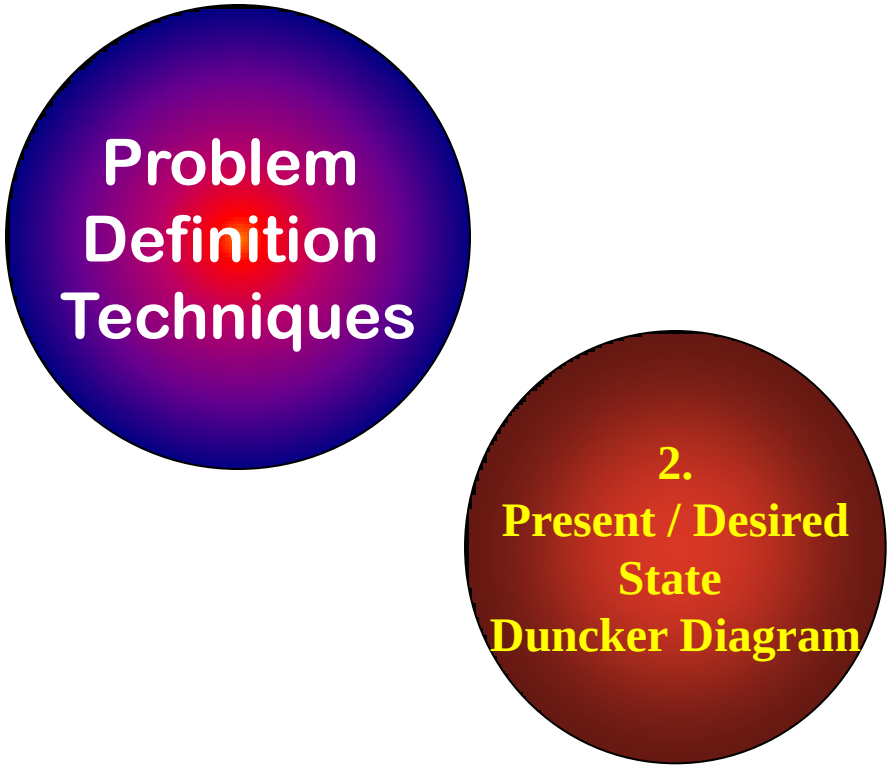
Slides mainly adapted from Dr. Fogler's "Strategies for Creative Problem Solving" book

Problem Definition

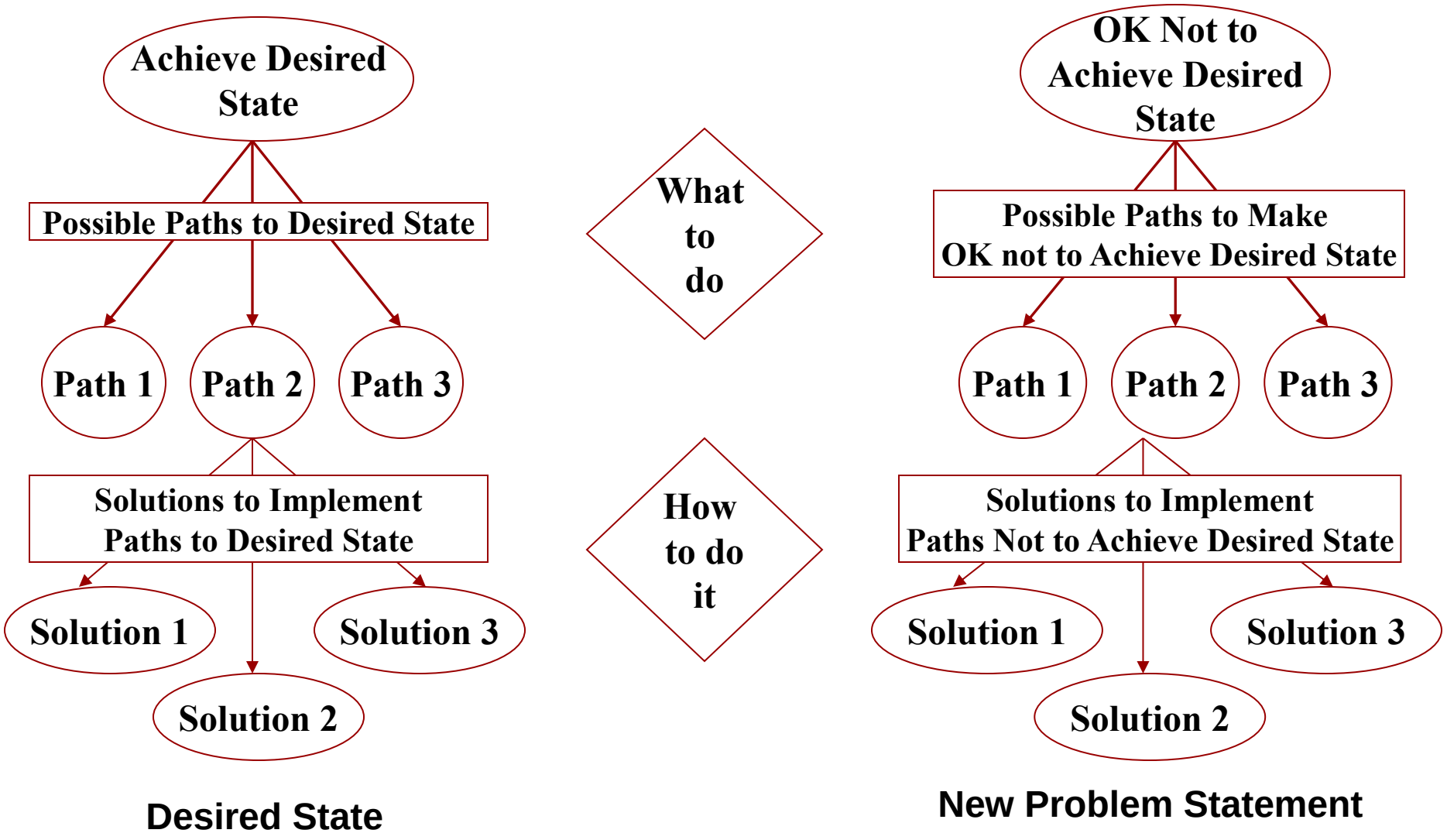
- Check problem statement with Socratic questioning (Critical Thinking Algorithm):
  1. Where did the problem originate?
  2. Who posed the problem statement? Your boss? Their boss? Colleague? Client?
  3. Can that person explain their reasoning?
  4. Are the reasoning and assumptions valid?
  5. Has that person considered different viewpoints?
  6. What are implications and consequences of assumptions?

Socratic Questioning is at the Heart of Critical Thinking

Problem Definition Techniques

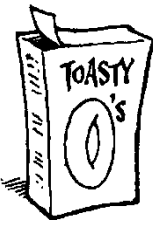


Duncker Diagrams



Desired State

New Problem Statement



To Market, To Market

The Situation: Toasty O's was one of the hottest selling cereals when it first came on the market. However, after several months, sales dropped. The consumer survey department was able to identify that customer dissatisfaction, as expressed in terms of taste, was related to the age of the cereal. Consequently, management determined that they must streamline the production process to get the cereal on the store shelves faster, thus ensuring a fresher product. Engineering had quite a time with this problem - there wasn't much slack time that could be removed from the process to accomplish the goal. Of the steps required to get the product on the shelves (production, packaging, storage, and shipping) production was one of the fastest. However, plans for building plants closer to the major markets were considered as was trying to add more trucks to get the cereal to market faster.

To Market, To Market

Sales of Toasty O's are dropping. Consumer surveys have indicated a dissatisfaction with a stale taste.

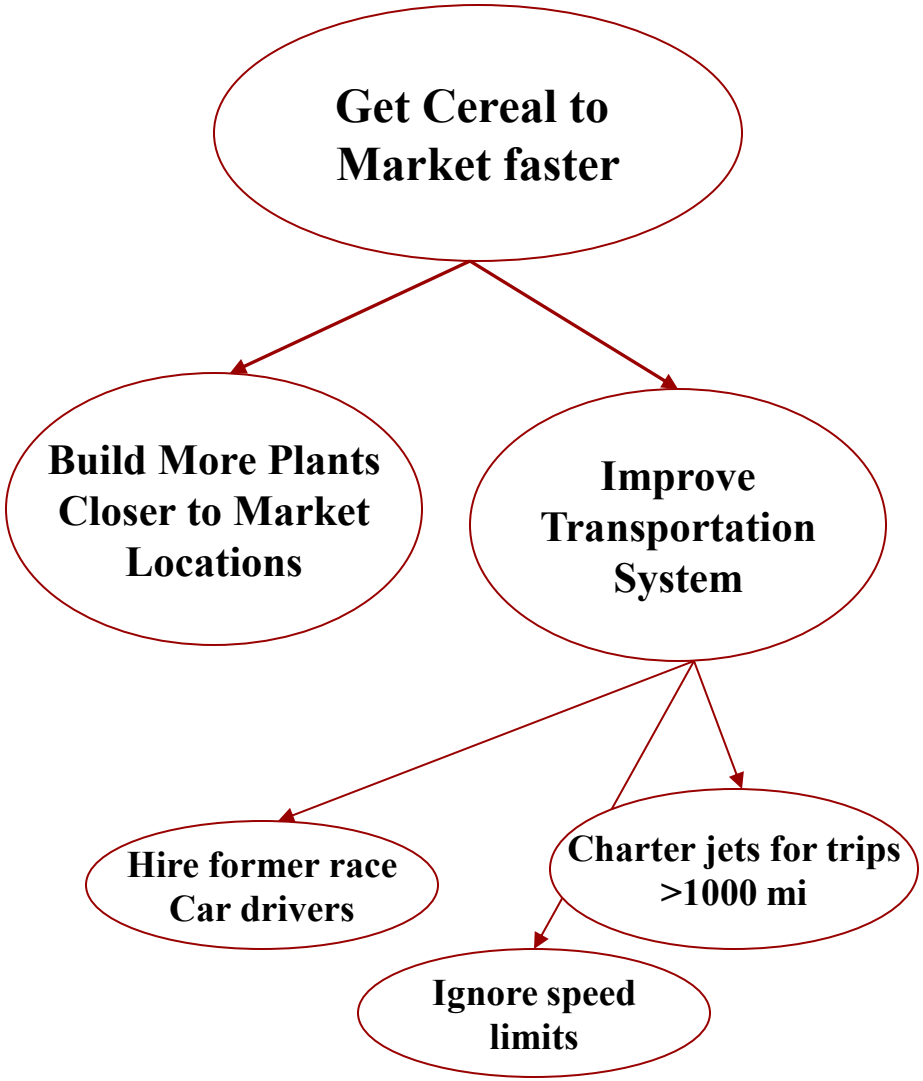
Perceived Problem:

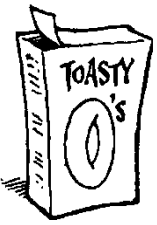
"Streamline the production process to get the cereal on the store shelves faster, thus ensuring a fresher product."

However, production was one of the fastest steps in getting the product to market.

Second Perceived Problem:

Get the Cereal to Market Faster





To Market, To Market

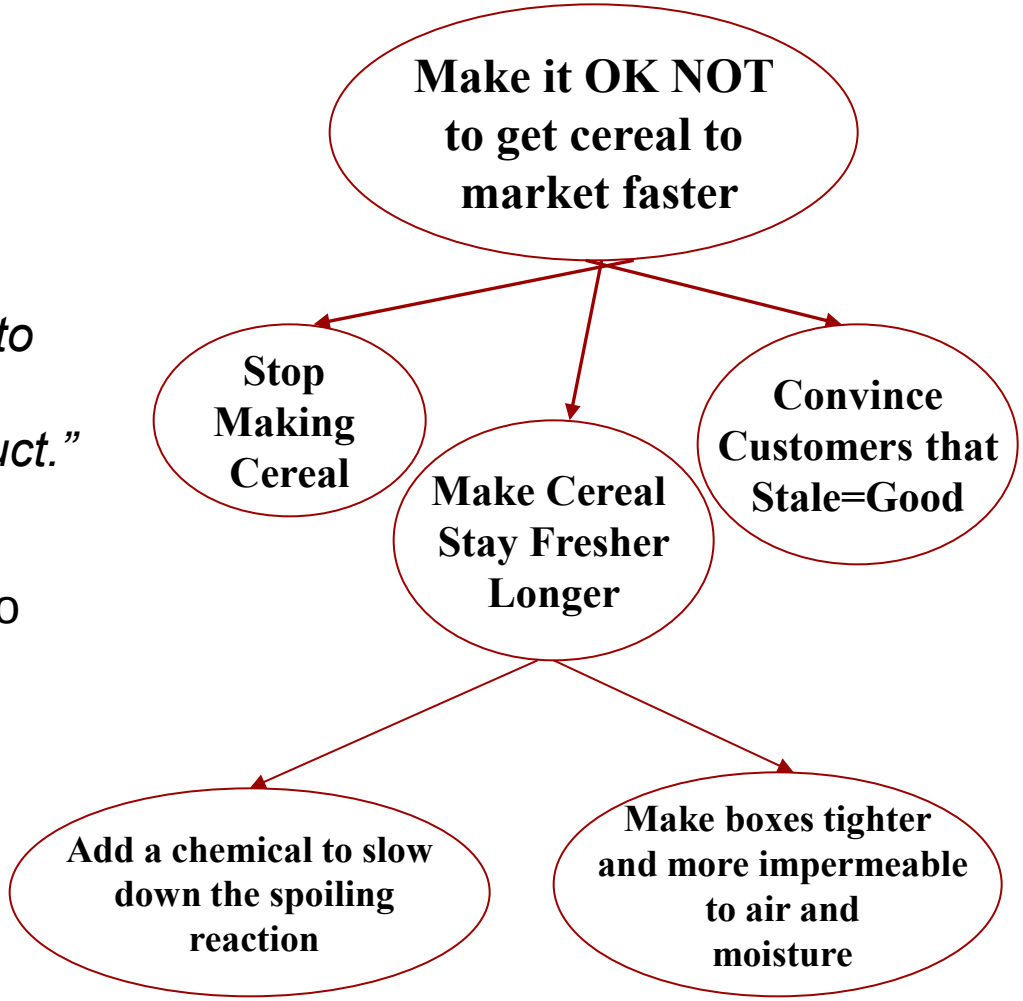
Sales of Toasty O's are dropping. Consumer surveys have indicated a dissatisfaction with a stale taste.

Perceived Problem:

"Streamline the production process to get the cereal on the store shelves faster, thus ensuring a fresher product."

However, production was one of the fastest steps in getting the product to market.

Thus, the following options were considered:
- Build plants closer to market
- Add more trucks



These options require a major capital investment.

To Market, To Market

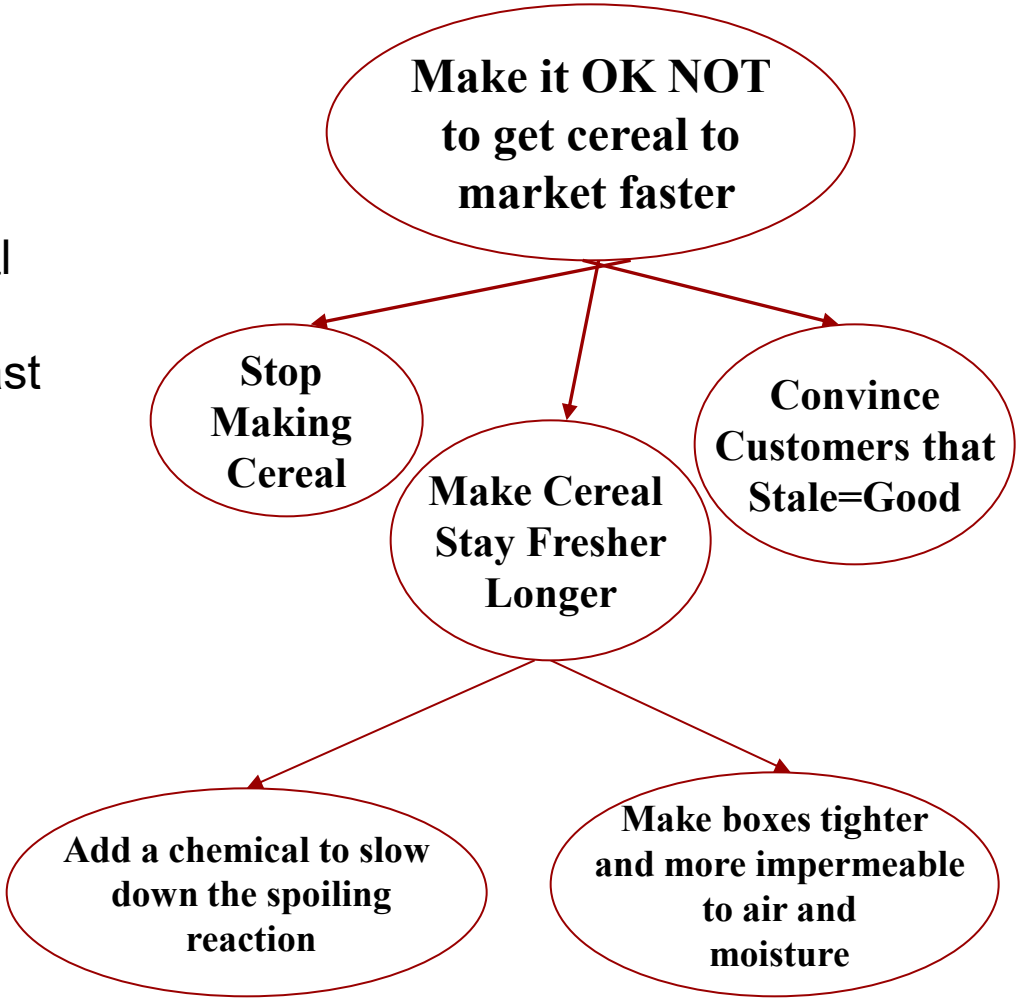
Original Statement

How to get cereal to market faster.

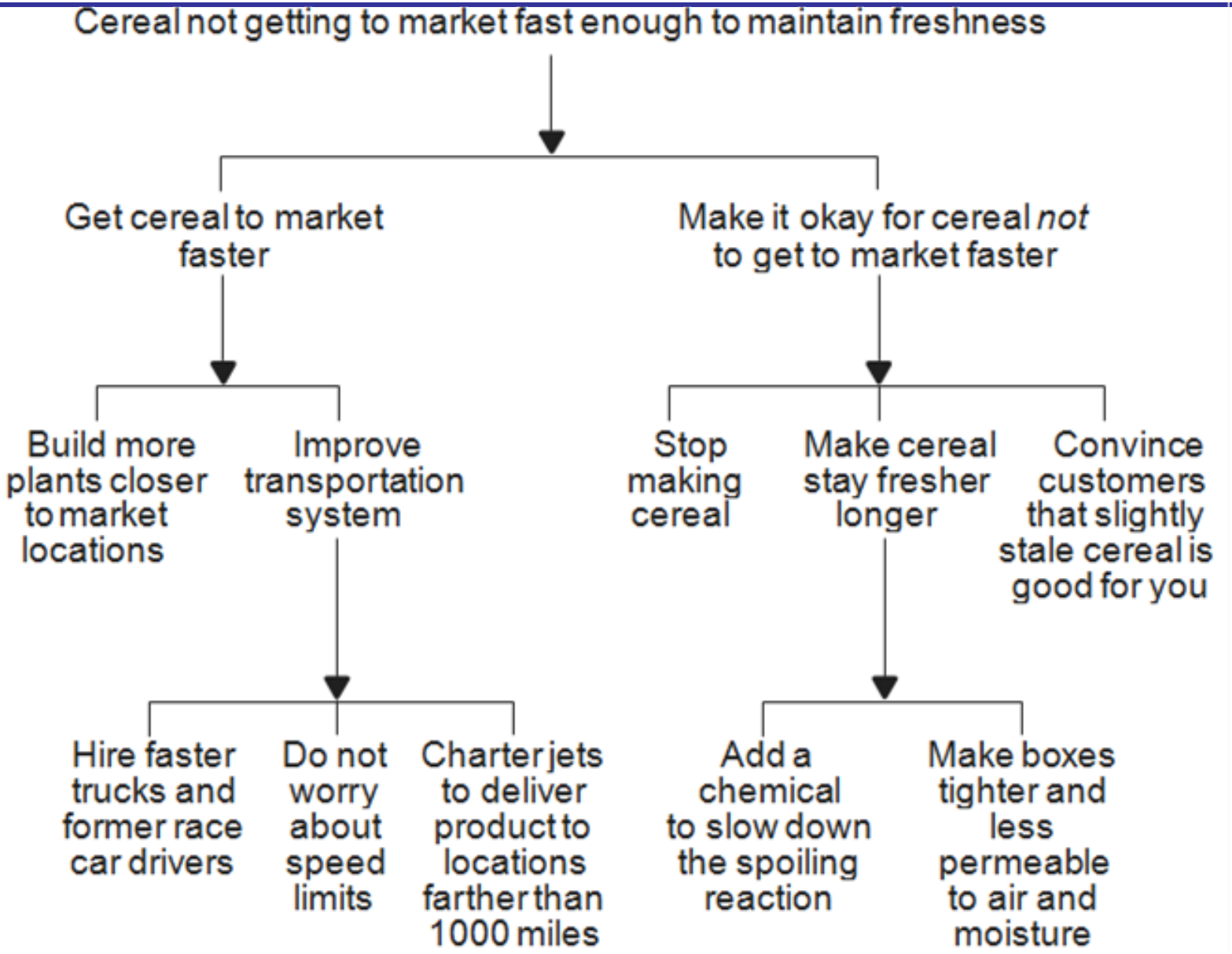
The *real problem* was that the cereal was not staying fresh long enough, not that it wasn't getting to market fast enough.

New Problem Statement

How to make boxes tighter and to determine appropriate additive to slow down the spoiling reaction



To Market Example – Dunker approach



Example: Teaching

- Problem: kindergarten teacher burned out from 25 years of teaching.

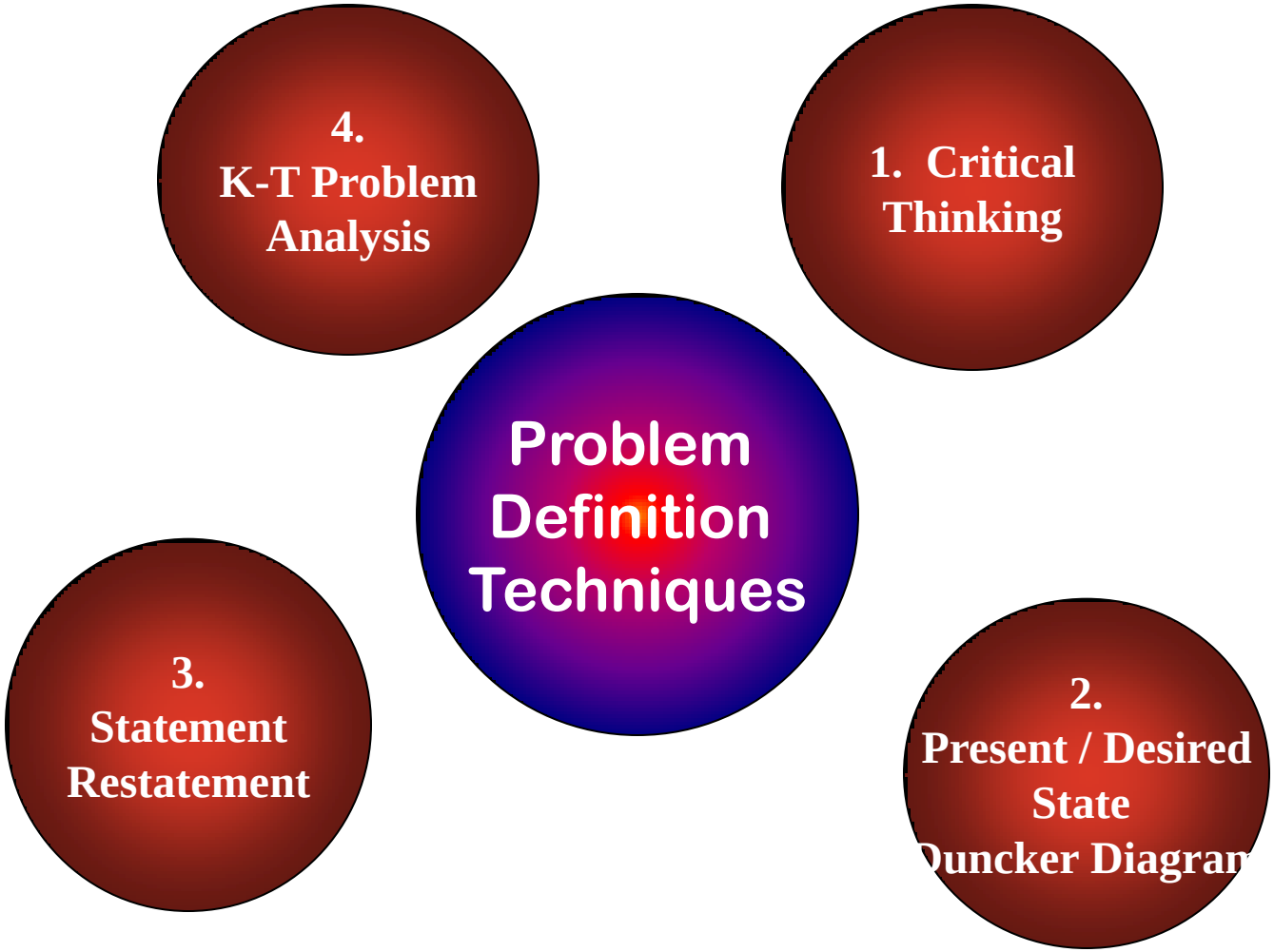
Quit teaching:

1. Find a new job:
    1. Office manager.
    2. Sales person.
2. Retire.

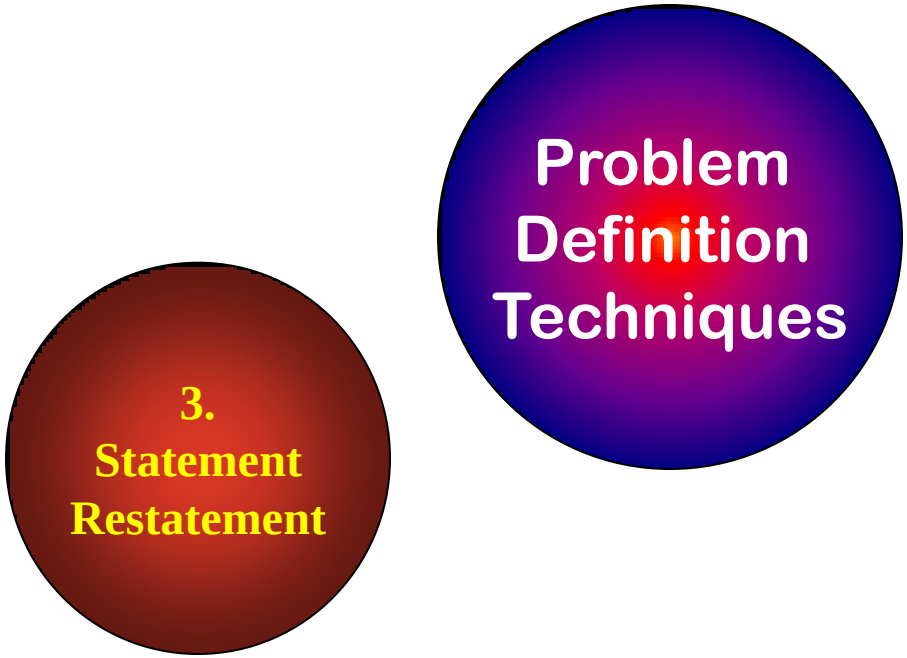
Make it OK not to quit:

1. More leisure time:
    1. teach alternate terms,
    2. teach half days.
2. Lower stress level:
    1. teach different grade,
    2. get more control over content.

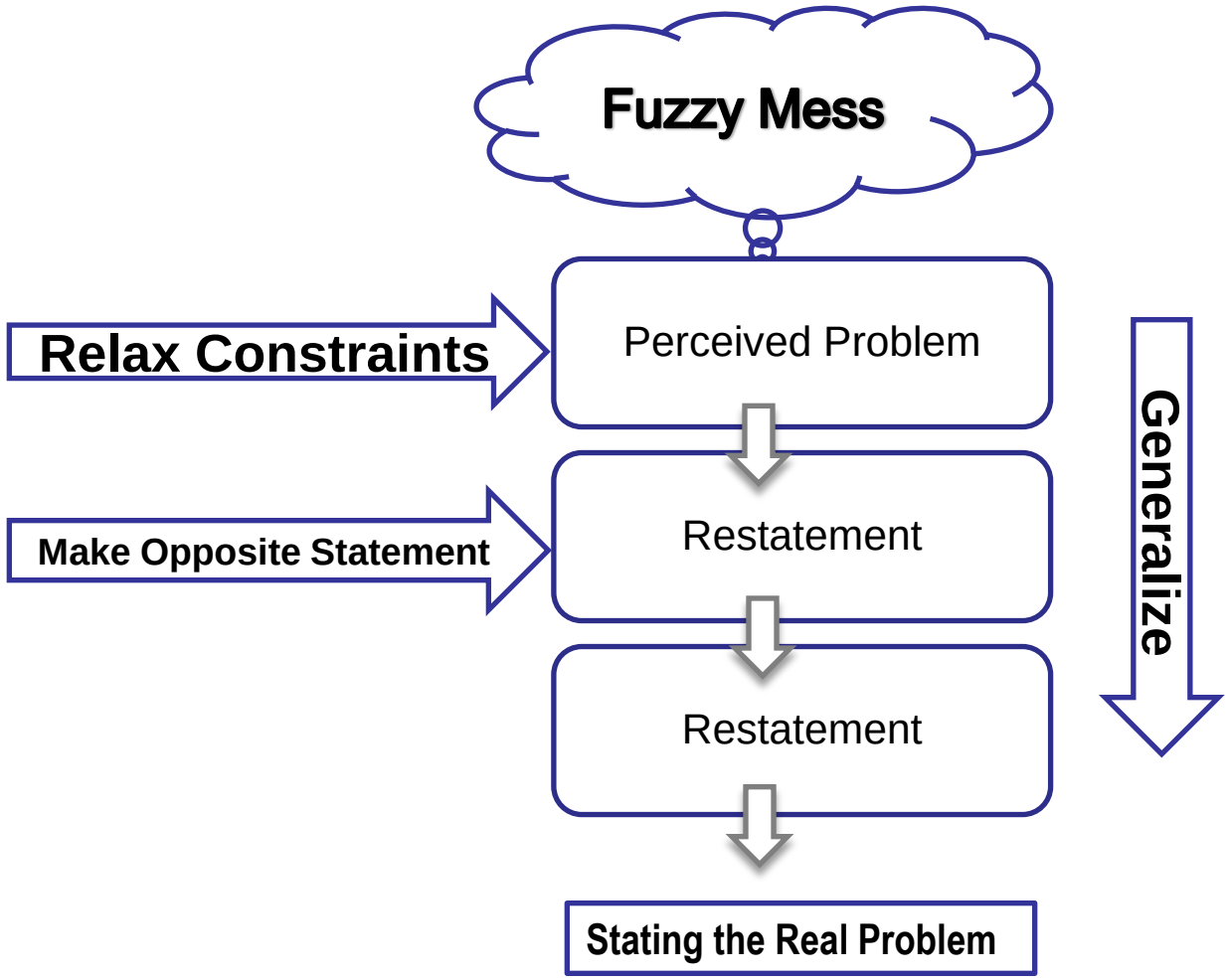
Problem Definition Techniques



Problem Definition Techniques



Statement Restatement Technique



Problem Statement Triggers

1. **Vary the stress pattern**—try placing emphasis on different words and phrases.
2. **Choose a** term that is defined **explicitly** and substitute the explicit definition in each place that the term appears.
3. **Make** an **opposite statement**, change positives to negatives, and vice versa.

Problem Statement Triggers

4. **Change** "every" to "some," "always" to "sometimes," "sometimes" to "never," and vice versa.
5. **Replace "persuasive words"** in the problem statement such as "obviously," "clearly," and "certainly" with the argument it is supposed to be replacing.
6. **Express** words in the form of an equation or picture, and vice versa.

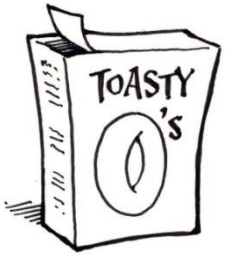
Using the Triggers

Original Problem Statement: Cereal not getting to market fast enough to maintain freshness

Trigger 1: Vary Stress Pattern

Read the sentence with emphasis on each of these words – what questions do they suggest?

- Cereal
- Getting
- Market
- Freshness



Using the Triggers

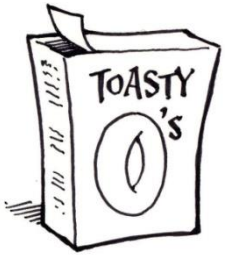
Original Problem Statement: Cereal not getting to market fast enough to maintain freshness

Trigger 1: Vary Stress Pattern

- ***Cereal*** not getting to market fast enough to maintain freshness .
  (Do other products we have get there faster?)

- Cereal not ***getting*** to market fast enough to maintain freshness.
  (Can we make the distance/time shorter?)

- Cereal not getting to market fast enough to maintain ***freshness***.
  (How can we keep cereal fresher, longer?)



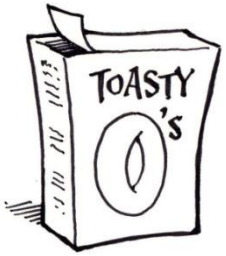
Using the Triggers

Original Problem Statement: Cereal not getting to market fast enough to maintain freshness

Trigger 3: Make an Opposite Statement

- How can we find a way to get the cereal to market ***so slowly*** that it will ***never*** be fresh?

  (Makes us think about how long we have to maintain freshness and what controls it?)



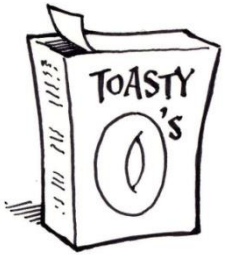
Using the Triggers

Original Problem Statement: Cereal not getting to market fast enough to maintain freshness

Trigger 4: Change "every" to "some"

- Cereal is not getting to market fast enough to **always** maintain freshness.

  (This change opens new avenues of thought. Why isn't our cereal **always** fresh?)



Using the Triggers

Original Problem Statement: Cereal not getting to market fast enough to maintain freshness

Trigger 5: Replace "persuasive" words

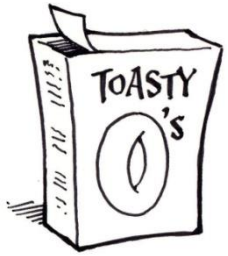
The problem statement implies that we **obviously** want to get the cereal to market faster to maintain freshness.

Thus, if we could speed up delivery freshness would be maintained.

Maybe not! Maybe the store holds it too long. Maybe it's stale before it gets to the store.

(This trigger helps us challenge implicit assumptions made in the problem statement.)

Challenge assumptions:
- "Clearly" suggests an assumption.
- Maybe cereal doesn't get to store fresh?
- Maybe the store holds it too long.
- Maybe it is stale before it leaves the factory.



Using the Triggers

Original Problem Statement: Cereal not getting to market fast enough to maintain freshness

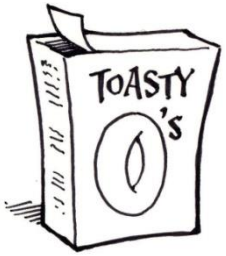
Trigger 6: Express the words in the form of an equation

- Freshness is inversely proportional to the time since the cereal was baked, i.e.

$$(Freshness) = \frac{k}{(\text{Time Since Cereal Baked})}$$

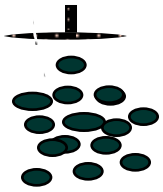
- What does the proportionality constant, ***k***, depend upon?

  storage conditions, packaging, type of cereal, additives, etc.



Asprin Coating

The Situation: To many people, taking aspirin tablets is a foul tasting experience. A few years ago, a number of companies making aspirin decided to do something about it. The instructions given by the manager to his staff to solve the perceived problem were: ***"Find a way to put a pleasant tasting coating on aspirin tablets."*** Spraying the coating on the tablets had been tried, with very little success. The resulting coating was very non-uniform and this led to an unacceptable product. Let's apply the triggers to this problem.



Asprin Coating

The instructions given by the manager to his staff to solve the perceived problem were:

“Find a way to put a pleasant-tasting coating on aspirin tablets.”

“Trigger” Statements

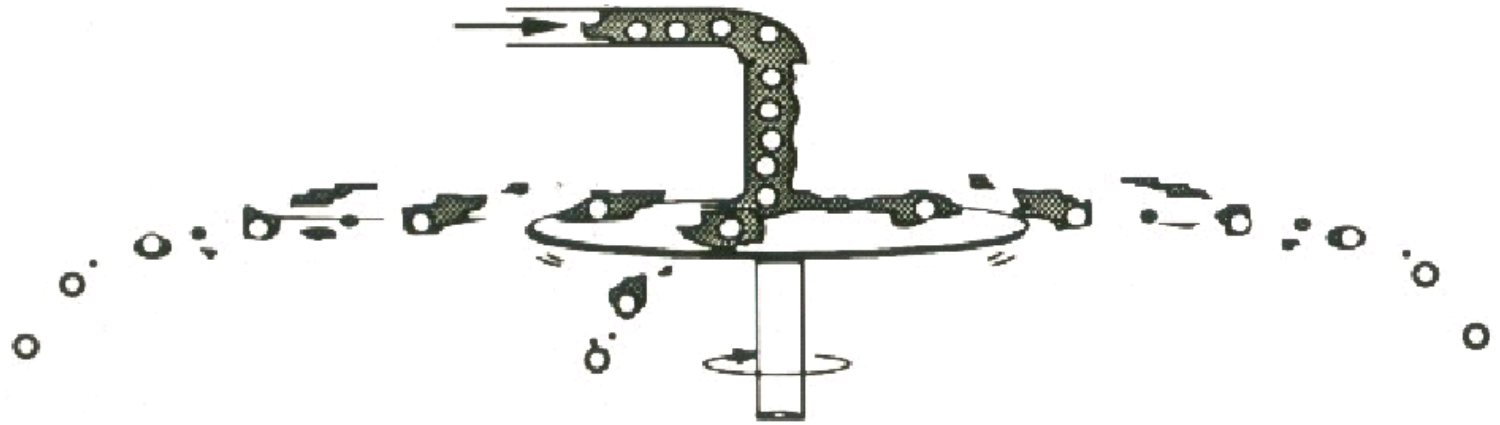
“Find a way to put a pleasant tasting coating on aspirin tablets.”

Trigger 1	Emphasize different parts of the statement
	1. **Put** coating **on** tablet.
Trigger 3	Make an opposite statement
	2. **Take** coating **off** tablet.

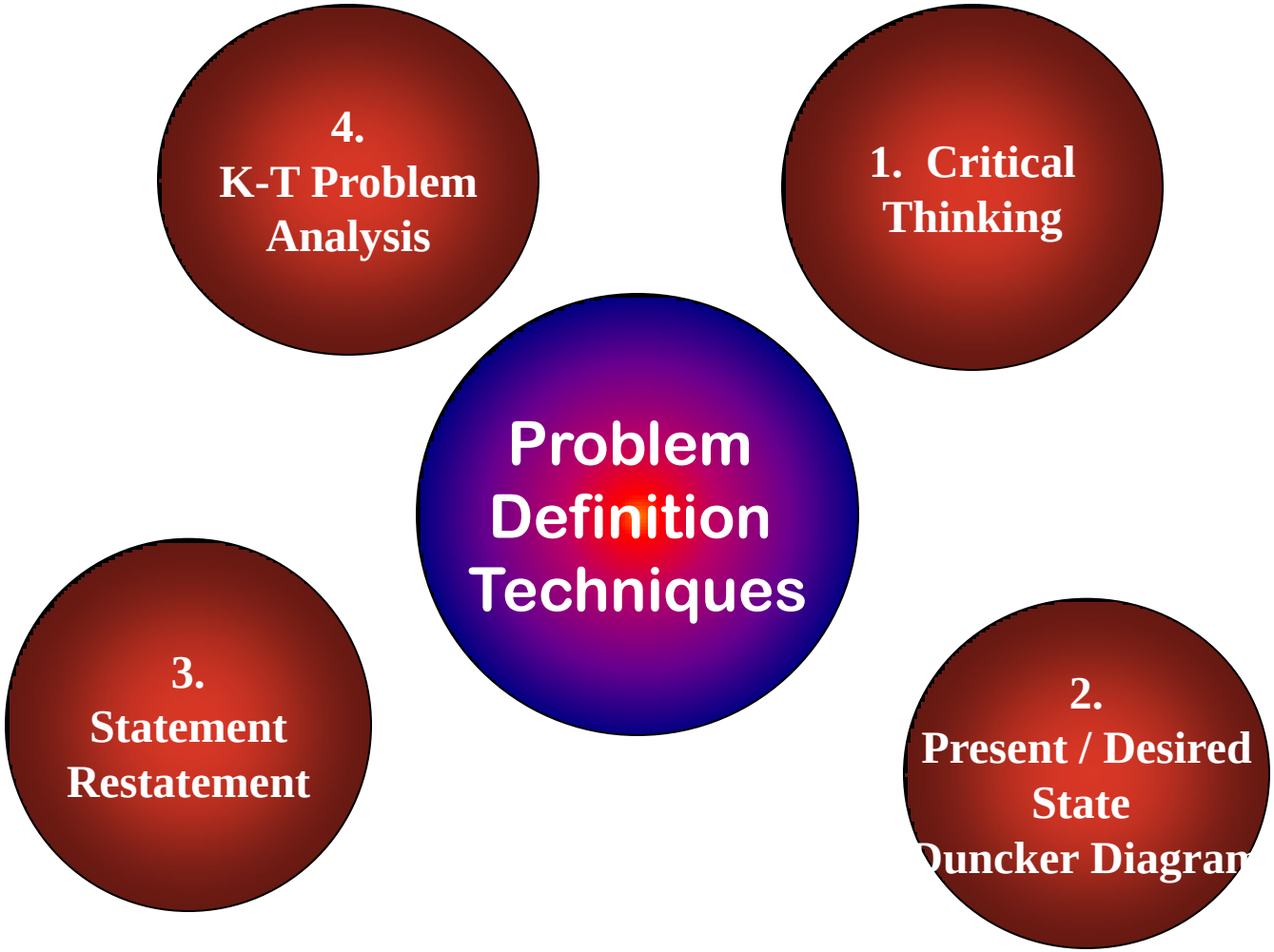
Making an Opposite Statement

This led to one of the newer techniques for coating pills.

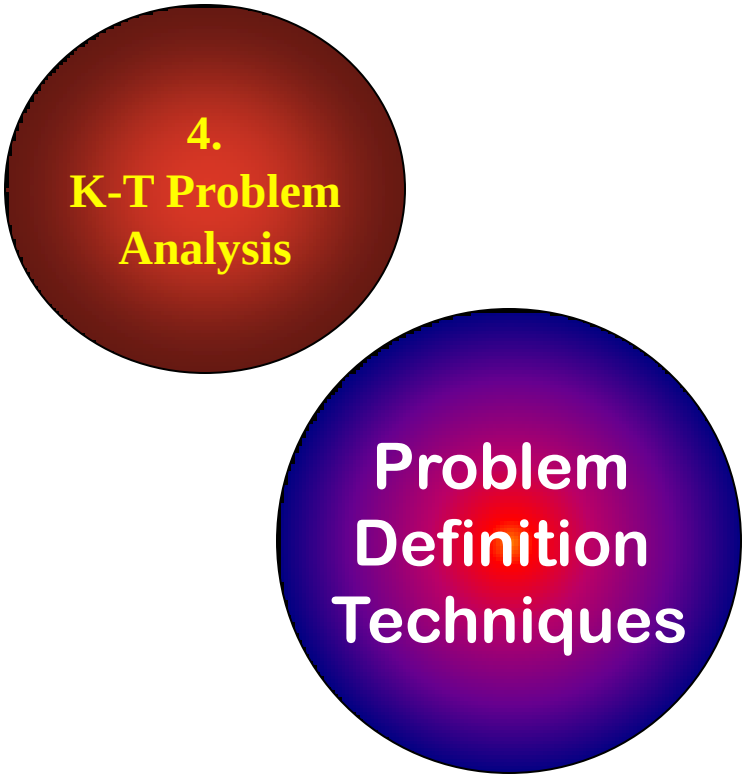
The pills are immersed in a liquid which id passed onto a spinning disk. The centrifugal force on the fluid and the pills causes the two to separate, leaving a nice thin coating around the pill.



Problem Definition Techniques



Problem Definition Techniques



Kepner-Tregoe Decision Making Strategy

Components

1. Situation appraisal.
2. Problem analysis.
3. Decision analysis.
4. Potential problem analysis.

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?

For more details on Kepner-Tregoe problem analysis technique refer to:
https://iancos.wordpress.com/2013/01/14/kepner-tregoe-problem-analysis/

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

Picking a Technique

Four strategies or procedures were discussed for defining the problem.

Which you actually use depends on the problem and your own style.

1. Problem Definition steps
2. Socratic Questioning
3. Dunker Diagrams
4. Statement/Restatement
5. Kepner-Tregoe (K.T.) Problem Analysis

You should consciously develop some process that addresses the major steps, which you use out of habit, to make sure that you do not end up solving the wrong problem.

Be proactive: think through whether the problem statement is correct before solving any problem.