Workshop
Problem Solving for
14 Feb 2017
Jan Willem Vernhout
Founder & Problem Solver @ CoThink
Program

1. Introduction
2. CoThink Event Map
3. “Exploding Urilift”
4. Problem Analysis
5. So, what happened?
Introduction

Set yourself a goal
Understand the basics
Practice, practice, practice….  
Don’t give up
Transfer your skills
Challenge the current situation
What goes wrong when solving problems?
“’t Reathuys” is a ★★★★★ restaurant with an excellent reputation. One day all visitors became sick.

What happened?
## Type of Questions

<table>
<thead>
<tr>
<th>Closed Questions</th>
<th>Open Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, No, I don’t know</td>
<td>*</td>
</tr>
<tr>
<td>• Begins with a verb <em>has, is, can, had,</em> etc?</td>
<td>Begins with Questionword: Who, what, where, when, why, which, how, how much?</td>
</tr>
<tr>
<td>• Answer / assumption must be in the question</td>
<td></td>
</tr>
<tr>
<td>Check or verify</td>
<td>Gather more information</td>
</tr>
<tr>
<td>Experts, people with content knowledge</td>
<td>Facilitators</td>
</tr>
<tr>
<td>Judgement, interrogation</td>
<td>Inviting</td>
</tr>
</tbody>
</table>
Content versus Process

**What / Content**

- knowledge
- experience
- information

**How / Process**

- method
- logic
- system

So, what happened?
### Common issues in problem solving

- Vague problem descriptions
- “Jumping to conclusions”
- “Jumping to solutions”
- Bad transfer of facts
- Dealing with symptoms instead of causes

### Consequences

- Resolution time too long
- Recurring problems
- Lower up-time
- Higher cost
- More risks, (f.e. cyber security)
- Etc.

**Structured approach to problem solving helps to solve problems more effectively and more efficiently with lower costs and a higher customer satisfaction**
## Importance problem solving skills

<table>
<thead>
<tr>
<th>Skills family</th>
<th>2015</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex problem solving skills</td>
<td>36%</td>
<td>36%</td>
</tr>
<tr>
<td>Social skills</td>
<td>20%</td>
<td>19%</td>
</tr>
<tr>
<td>Process skills</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>Systems skills</td>
<td>16%</td>
<td>17%</td>
</tr>
<tr>
<td>Resource management skills</td>
<td>14%</td>
<td>13%</td>
</tr>
<tr>
<td>Technical skills</td>
<td>14%</td>
<td>12%</td>
</tr>
<tr>
<td>Cognitive abilities</td>
<td>11%</td>
<td>15%</td>
</tr>
<tr>
<td>Content skills</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Physical abilities</td>
<td>5%</td>
<td>4%</td>
</tr>
</tbody>
</table>

*Bron: World Economic Forum, Future of jobs Survey*
Complex Problem Solving

Introduction

Event map

Urilift

Problem Analysis

So, what happened?
Complex Problem Solving

Introduction

Event map

Urillift

Problem Analysis

So, what happened?
Introduction

Event map

Urilift

Problem Analysis

So, what happened?

1. Polytelie
   - Multiple Goals

2. Interconnectedness
   - Information sources are connected

3. Intransparency
   - Information sources are connected, but the connection is not very clear

4. Dynamics
   - Situation/ information sources / goals are changing (continuously)
Introduction

Event map

Urilift

Problem Analysis

So, what happened?
RCA / Problem Solving methods

Problem Solving methods describe **HOW** to analyse (the way how to perform the steps)
A method for asking questions about cause & effect. The goal is to determine the Root Cause.

Developed by Sakicki Toyoda.

Used within the Toyota Motor Corporation during the evolution of the “Toyota Production System”.

Frequently used as part of “Kaizen”, “Lean Manufacturing” and “Six Sigma”.

Introduction 5 Why

Introduction

Event map

Urilift

Problem Analysis

So, what happened?
So, what happened?
Example 5 Why

Car can't be used

Car does no start

Batteries empty

Lights drained batteries

Driver forgot to turn off lights

Driver in a hurry

So, what happened?

Introduction
Event map
Urilift
Problem Analysis

Action?
A Problem Solving method to analyze and **visualize** all causes and circumstances of a problem

Based on 5 Why, Apollo, Barrière Analyse, Causal Factors and years and years of **experience**

**Support all phases** of problem solving regardless of actual status of the problem

Visualizes all consequences, causes contributing circumstances, broken barriers and possible, chosen, implemented and observed actions
Example 5 Why… supplemented with Event Map

Introduction
Event map
Urillift
Problem Analysis
So, what happened?

Chance: loss of new job
Driver to late for job interview
Car can't be used
Car does not start
Batteries empty
Lights drained batteries
Driver forgot to turn off lights
Driver in a hurry
No jumper cables available
Car not used for 10 hours
Subscription Triple A Expired
Lights indicator defect

?
Example 5 Why... supplemented with Event Map

Consequences

- Chance: loss of new job
  - Driver to late for job interview

Contributing circumstances

- Car not used for 10 hours
  - No jumper cables available
  - Car does not start
    - Batteries empty
      - Lights drained batteries
        - Driver forgot to turn off lights
          - Driver in a hurry

Broken barriers

- Subscription Triple A Expired
  - Lights indicator defect
    - Broken barriers?
Event Mapping questions

- What was the direct consequence?
- What else?
- What is the main problem (event)?
- What contributed?
- What else?
- What was the direct cause?
- What else?
- What should have prevented this?
- What else?
Example 5 Why… supplemented with Event Map

Chance: loss of new job

Driver to late for job interview

Car can’t be used

Car does not start

Batteries empty

Lights drained batteries

Driver forgot to turn off lights

Driver in a hurry

Car not used for 10 hours

No jumper cables available

Buy Jumper cables

Subscription Triple A Expired

Extend subscription

Automatically turning off lights after 10 minutes

Lights indicator defect

Fix indicator

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Event map
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Problem Analysis
So, what happened?
Example Event Map (technical problem)

**CoThink Event Map: Exploded swivel**

- **Event:** Swivel exploded
- **Effort:** Ball-bearing failed
  - **Context:** The Ampelmann is a hydraulic motion compensating gangway. Between high pressure hoses and hose rupture protectors, swivels are mounted with ball bearings, to protect the hose for too much torque.
  - **Location:** Example Event Map (technical problem)
  - **Author:** Wim van de Lagemaat
  - **Date of last update:** July 1st 2016
  - **Status description:** Analysis completed, chosen actions partly to be implemented

- **Swivel exploded**
  - **High pressure hose loose**
    - 15 liter of oil spilled “offshore”
  - **Amplaxman has X hours downtime**
  - **Probability of casualties**
  - **Parts of swivel flow around**

- **Ball-bearing failed**
  - **Ball-bearing exposed to accelerated wear**
    - Swivels only rotate with a maximum of 50°
  - **Sideways forces too high**
    - Swivels are designed for 90°

- **Installation of new type of swivels**
  - Ball-bearing exposed to accelerated wear
  - Preventive maintenance adjusted, timely replacement of swivels

- **Adjust design to make swivel unnecessary (costly solution)**

**Current Swivels**

- Swivel with plain bearing instead of ball bearing
- Plain bearing replaceable
- More robust design (3 kg instead of 1.5 kg) for better resistance to sideways forces
Example Event Map (safety issue)

CoThink Event Map: Can line incident

- 2 days LTA
- Operator injured
  - Operator hit by pallet
  - Pallet flipped over
  - Pallet flipped upwards by forklift
  - Pallet was stuck under platform
  - Pallet (tumed) outside the stack of layer pads
  - Pallet pushed on stack
  - Forklift driver did not pull pallet towards mast of forklift

- Build platform loading system
  - Install two extra vertical poles under platform

- No warning sign on the platform
- No formal instruction to pull pallet
- No appropriate consequences in place to support desired behaviour
- No consequent feedback in place

- Put warning sign on platform
- Put marks on poles for correct height of pallet
- Establish formal procedure for pulling & height
- Install consequences and feedback to support right behaviour

Context:
During normal operations, an operator was hit by a flipped pallet. Because this has led to a LTA, a RCA was mandatory to prevent future occurrences.

Location:
Deexte

Author:
Ron Vock

Date of last update:
1-7-2016

Status description:
RCA completed, actions partly implemented.
Example Event Map (technical problem)
Case Urilift

- Read the case
- Devide into groups
  - Who does the questions?
  - Who gives the info?
- About 20 minutes

Urilift

Introduction

Event map

Urilift

Problem Analysis

So, what happened?

Now What?
Example: “TV-channel has noise”

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Problem Analysis
So, what happened?

Action?
Apples and Pears

How many times do you need to reach inside a box to find out the contents of all boxes?

Facts:
- 1 box contains apples and pears
- 1 box contains apples
- 1 box contains pears
- The labels (pictures) do not match
Apples and pears

How many times do you need to reach inside a box to find out the contents of all boxes?

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>IS</td>
<td>IS NIET</td>
</tr>
<tr>
<td>pear</td>
<td>apple</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>IS NIET</td>
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1
Introduction “Problem Analysis”

- Based on psychological research
- Practiced and innovated by CoThink
- Effective convergent method for finding unknown causes
- Prevents “jumping to conclusions”
- Efficient finding of the root cause

Introduction
Event map
Urilt
Problem Analysis
So, what happened?
Example: “TV-channel has noise”

Switch channel
Reset decoder
Update modem

Turn TV on and off
Update decoder

Watch tv upstairs
Call service desk
Reset modem

Buy new tv
Hit tv with hammer…
TV has noise: the facts

**Problem Analysis**

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>TV Channel 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEVIATION</td>
<td>has noise</td>
</tr>
<tr>
<td>NORM</td>
<td>no noise</td>
</tr>
</tbody>
</table>

**DESCRIPTION (IS)**

- TV-channel 1
- has noise
- This morning 6:45
- continuously
- TV downstairs

**LIMITATION (IS NOT)**

- TV-channel 2
- no picture, no sound
- Yesterday 22:00
- one time
- TV upstairs, ipad

So, what happened?
### TV has noise: possible causes

#### Problem Analysis

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</tbody>
</table>

#### POSSIBLE CAUSES

<table>
<thead>
<tr>
<th>Modem defect</th>
<th>decoder defect</th>
<th>videocard defect</th>
<th>Problem with Channel 1</th>
<th>Possible cause 5</th>
<th>Possible cause 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### DESCRIPTION (IS) & LIMITATION (IS NOT)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Subject, object name, code</th>
<th>Date + time</th>
<th>First occurrence?</th>
<th>Subsequent occurrence(s)?</th>
<th>Location, process, pattern</th>
<th>Pattern or trend?</th>
</tr>
</thead>
<tbody>
<tr>
<td>This morning 6:45</td>
<td>TV channel 1</td>
<td>TV channel 1</td>
<td>TV-channel 2</td>
<td>No picture, no sound</td>
<td>Yesterday 22:00</td>
<td>TV upstairs, ipad</td>
<td></td>
</tr>
<tr>
<td>continously</td>
<td>TV downstairs</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Sometimes there are too few or too many possible causes.
Example: “Faded crops”

Field with crops

Possible causes?

Little critters?  
Decease?  
Damage by tractor?  
Too little water?  
Season change?  
Bad soil?  
?
Example: “Faded crops”

Field with crops, small stream in the middle

Possible causes?

Too much water?
Too little water?
Water pollution?
?
Example: “Faded crops”

Field with crops, small stream in the middle, since 2 weeks less water

Possible causes?

Draught?

So, what happened?

Introduction
Event map
Urilift
Problem Analysis
So, what happened?
Example: “Faded crops”

Field with crops

Field with crops, small stream in the middle

Field with crops, small stream in the middle, since 2 weeks less water

Possible causes?

Little critters?
Decease?
Damage by tractor?
Too little water?
Season change?
Bad soil?
?

Possible causes?

Too much water?
Too little water?
Water pollution?
?

Possible causes?

Draught?
?
### Problem Analysis

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<tr>
<td>NORM</td>
<td>no noise</td>
</tr>
</tbody>
</table>

#### Description (IS)

<table>
<thead>
<tr>
<th>Time</th>
<th>TV-channel 1 has noise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem</td>
<td>TV-channel 1 has noise</td>
</tr>
<tr>
<td>This morning 6:45</td>
<td>continously</td>
</tr>
<tr>
<td>TV downstairs</td>
<td></td>
</tr>
</tbody>
</table>

#### Limitation (IS NOT)

<table>
<thead>
<tr>
<th>Possible Causes</th>
<th>Modem defect</th>
<th>Decoder defect</th>
<th>VideoCard defect</th>
<th>Problem w/ Channel 1</th>
<th>Possible cause 5</th>
<th>Possible cause 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV-channel 2</td>
<td>X</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no picture, no sound</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yesterday 22:00</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>one time</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV upstairs, ipad</td>
<td>X</td>
<td>?</td>
<td>?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Most probable cause: TV-channel 1 has noise

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The use of problem Analysis converges possible causes and prevents jumping to conclusions and unnecessary actions!
Summary “Problem Analysis”

Introduction
Event map
Urillift
Problem Analysis
So, what happened?

Describe problem

<table>
<thead>
<tr>
<th>Description</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>Identity</td>
</tr>
<tr>
<td>W</td>
<td>Time</td>
</tr>
<tr>
<td>W</td>
<td>Location</td>
</tr>
<tr>
<td>E</td>
<td>Amount &amp; Size</td>
</tr>
<tr>
<td>E</td>
<td>Trends</td>
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</tbody>
</table>

Determine possible causes

<table>
<thead>
<tr>
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<th>C</th>
<th>t</th>
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</table>

Prove the cause

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td></td>
<td>?</td>
</tr>
</tbody>
</table>

Knowledge & expertise
- Brainstorming
- Fishbone diagram

Problem specification

Possible causes

Most probable cause
‘t Reathuys” is a ★★★★★ restaurant with an excellent reputation. One day all visitors became sick.

What happened?
More info...

- +31613140979
- CoThink.nl
- CoThink.com
- https://www.linkedin.com/in/jan-willem-vernhouw-5a13516/
KEEP CALM AND JUST ASK