Interactive training

a methodology for improving Safety Culture

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Background

- In 2008 SOGIN, the state company in charge of remediation of Italian nuclear sites and radioactive waste management, first set up, after a Safety Culture Survey, a training course at its Italian School for Radiation Protection, Safety and the Environment, focused on Safety Culture among workers and managers in order to improve knowledge about human and organizational factors related to conventional and nuclear safety.

- During these years, follow-ups of this course and feed-back from students have highlighted some interesting features that have changed the initial “classic” concept, where most of the time teachers explained the main topics and verified learning through questions and exercises, into a dynamic one, based on an interactive approach where teachers become coordinators of brainstorming sessions during which students, divided into work groups, participate in simulations aimed at making players aware of their roles in improving the organization’s Safety Culture.

- The training course lasts two and half days. Participants are around 15.

The new approach

- The teacher, becoming a group leader (coordinator), provides the students (now players) with “cards”, i.e. the concepts and the definitions that they will need in order to carry out simulations and role plays.

- Typical cards are:
  - Hazards: in terms of physical, chemical, biological and organizational agents that represent the risk sources
  - Probability: expressed as confidence level according to subjective approach
  - Risk: expressed as a decisional variable, function of probability and damage related to adverse events
  - Risk scenario: expressed as a combination of hazards, targets and exposure paths
  - Safety: expressed as risk control, according to operational approach
  - Other cards as human and organizational factors, context etc.

From teaching to leading

- After discussing former definitions (in particular, each worker's subjective perception of safety and risks), the more complex concept of Safety Culture is introduced from INSAG 4 to date.

- This leads us to the introduction of Schein's levels of organization culture and to Safety Culture characteristics with particular emphasis on clear leadership, clear accountability and learning driven safety (IAEA GS-G-3.1).

- At this point of the training course students are invited to talk about implicit and explicit aspects of their organization, focusing on:
  - Language and coding
  - Horizontal and vertical communication
  - Leadership and management
  - Statements and behavior
  - Declared values and beliefs
  - Individual and collective assumptions
  - Metaphor approach
  - Other aspects

The game begins

- Players observe a series of images representing usual and unusual workplaces. Each individual writes the sources of risk (hazards) they think or imagine could be found in the represented workplace. At the same time, they assign a risk index to each hazard to make a ranking list in terms of perceived likelihood and severity.

- Subsequently, they are grouped in homogeneous groups (according to task and/or worksite), where they perform the same evaluation together, merging individual results within each group in order to reach a common conclusion.

- By comparing individual results with group conclusions, the influence of group pressure on individual observation emerges and, in a more general way, the influence of background and experience on risk perception becomes apparent.

Examples

A typical kitchen in a home, a good starting point for safety evaluation. Be careful with household chemicals!

A car repair, a very common workplace. Watch out for entering cars!

A power station, a typical restricted area: unauthorized people must keep out! Beware of hornets and snakes!

First observations

- Typically, technicians show a strong awareness of physical or chemical hazards (e.g. electrical devices or toxic substances) while office workers and managers are more sensitive to general and context hazards (e.g. natural hazards, falls, fire etc.).

- This game allows players to gain awareness of the influence of group pressure on individual perception and of the importance of sharing knowledge and of developing communication skills in order to make colleagues aware of the hazards you recognize.

- Sometimes groups may give less importance to valid individual perception of hazards than to more standard group observations, for example in the case of chemical hazards in car repairs and kitchens or natural hazards in outdoor workplaces.

The game goes on

- In this second game individual players must accurately observe pictures and write down the differences between the two images in terms of safety

The solution

- Actually, there are no obvious differences between the two pictures, because, in fact, they are photos of the exact same image.

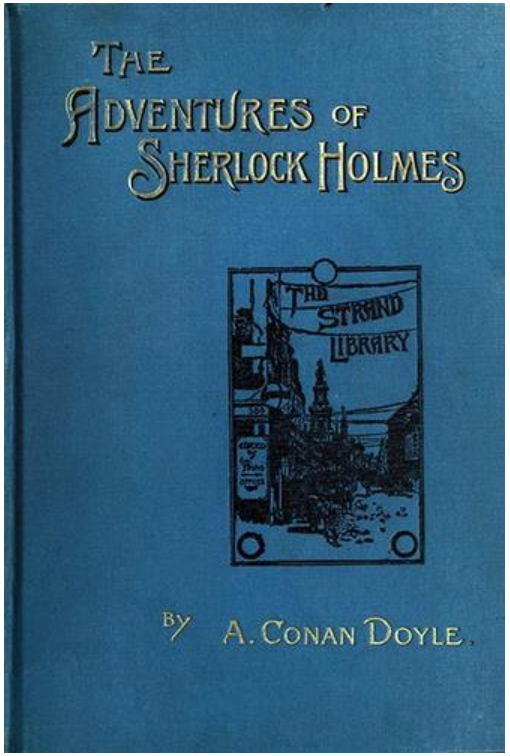
- The correct answer is “People…. and their Safety Culture”!

- The real difference is due to the Safety Culture of the organization and of the people operating in a work area. In fact, in the presence of identical technical hazards in the same plant, there could be a very big difference in the safety level due to human and organizational factors (training, communication, procedures, cooperation, stress and so on).

Ambrogio Lorenzetti, Effetti del Buon Governo, 1337-40, Palazzo Pubblico, Siena

Other observations

- This simple game shows that you can not assess safety by appearance only, but you need a third eye, the “mind’s eye”, capable of visualizing and evaluating Safety Culture
- Few player succeed in “observing” the real difference between the two images.
- As Holmes would say to Watson: “….you see but do not observe.” (Sir Arthur Conan Doyle, “The Adventures of Sherlock Holmes”, 1892)



A travel metaphor

- You are going to take a trip with some friends, and you will be driving.
- The road is curved and narrow, with unexpected obstacles and tunnels. Of course you may be a very skilled driver and have a very good car with up-to-date safety systems (ABS, Airbag etc.). It is important but it isn't enough.
- Before leaving, you should have a briefing with your travelmates (communication and knowledge sharing), check the map and the navigator (knowledge management), check safety and control systems (brakes, wheel, lights etc.).

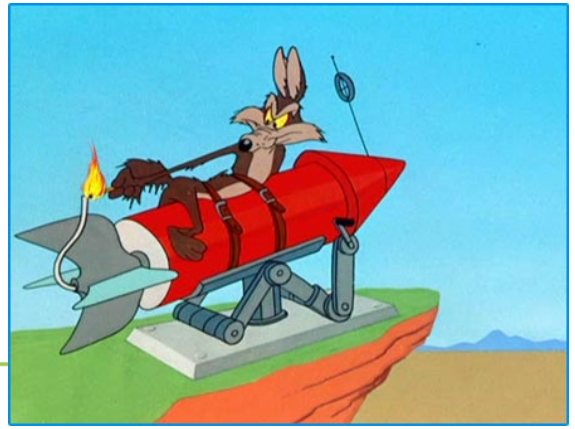
You should also clean the windshield and turn on the lights: Safety Culture requires clear vision

Someone said….

- “Know yourself” (Socrates, V century B.C.)→self-evaluation is the key to a strong safety culture!

- “The fundamental cause of trouble in the world is that the stupid are cocksure while the intelligent are full of doubt” (Bertrand Russell, XX century A.D.)→communication, questioning attitude, training and continuous learning on the part of organizations and people are the solution to a lot of troubles!

- “Vision without action is like a dream, action without vision is like a nightmare” (ancient oriental proverb)→Wile Coyote should apply Safety Analysis before making his decisions (anyway he believes in continuous improvement)!



Part 2

- Accident dynamics are not comparable if you just look at them from a technical point of view. Nuclear facilities are very different from chemical plants and industrial factories are very different from aerospace or railway systems.

- But things change if you apply Root Cause Analysis and consider the Safety Culture of the organizations involved. You may well find unexpected analogies and common causes related to human and organizational factors.

- For this reason, the second part of the course is focused on developing skills to look in depth at events that highlight the need to have a deeper and wider vision of safety, grasping the explicit and implicit connections among technological, social, human and organizational features. In a nutshell: a systemic vision.

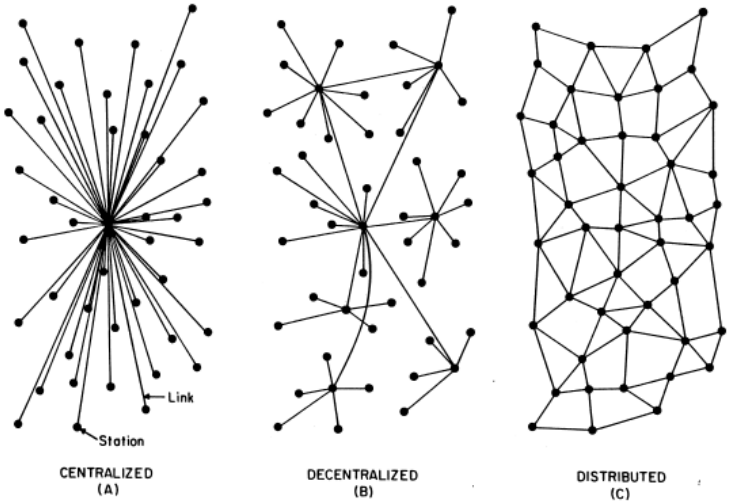
Investigation methodologies

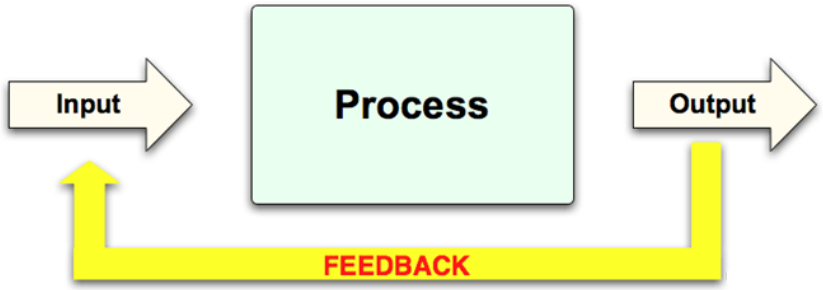
- Part 2 is a simulation of a Preliminary Safety Culture Evaluation regarding organizations which have been involved in transportation and industrial accidents.

- Fundamental concepts about complex systems and theory of organization are introduced
  - opened and closed systems
  - non-linear dynamics and feed-back
  - network structures and information flow
  - cognitive models
  - others

- Before initiating the simulation, the leader shows the players “the rules of the game”, i.e. advanced methodologies for safety assessment, safety review and root cause analysis.

Complex systems: tools for representation





Complex systems often have network structures. Local changes can influence global system behavior depending on the nodes and links. Effects can appear with unforeseeable delays.

Furthermore, complex systems contain a good amount of feedback to allow self regulation and the capacity of adapting to changes in context.

The assessment of culture within an organization requires in-depth knowledge of its internal dynamics

Beliefs genesis

- As is known, beliefs are the base of Schein's scheme. The combined use of concepts as cognitive heuristics and feedback can help people to better understand how certain beliefs are generated within a group, and to become aware of such influences on their own perception of reality.

- A typical example of belief genesis is represented by "urban myths", where a combination of "availability heuristic" (i.e. easiness of imagining a situation) and positive feedback (the more people repeat something, the "truer" it becomes) could generate a common belief, although science or statistics tell a different story.
- This can becomes very dangerous if it modifies the correct perception of risks.

The simulation

- At this point, players are ready to deal with the case-study by simulating an investigation on the immediate and root causes of one of the most severe industrial accidents: Bhopal.

- After a presentation by the coordinator on the sequence of events and on the socio-technological context in which the accident occurred, students are asked to identify root causes and their interdependancies.

- This time, students are divided into heterogenous groups to highlight the potentiality of brainstorming approaches and critical thinking and to show how important it is to correctly compare and integrate different points of view and backgrounds.

- Each group is usually made up of five people, thus there are three different groups that will separately analyze the data and evidence shown in the coordinator's presentation.

The analysis

- At the end of the analysis session, the coordinator starts a collective brainstorming session, during which each group shares results and observations with the other groups to reach a joint conclusion.

- The analysis of the root causes of the accident is made using the following criteria for classification:
  - Technological aspects (lay-out, equipment, materials, safety systems etc.)
  - Human factors (motivation, qualification, skills, procedures, communication, training etc.)
  - Organizational factors (policy, management, accountability, procedures, communication, training etc.)
  - General context (i.e. related to the external environment and socio-geographical features)

Thinking about results

- At the end of the brainstorming session, class outcomes are compared with the outcomes of experts that have carried out in-depth analyses of the Bhopal accident (Kalelkar, 1988; Sriramachari, 2004; Willey, Hendershot, Berger, 2006; Browning, 1993 et alii)

- Of course, this simulation does not claim to be a thorough or specialized examination but it is worth noting that the class generally identifies and classifies several causes and connections recognized by international experts.

- This simulation highlights the potentiality of brainstorming approaches and critical thinking and shows how important it is to correctly compare and integrate different points of view and backgrounds. As a result of these activities, students learn to recognize the hidden causes that determine severe accidents, for example, lack of clear leadership and accountability, communication problems etc.

Global learning

- At the end of the simulation, students acquire a global awareness that can be referred to any organization involved in complex systems management learning

- Bhopal was a chemical plant in decommissioning, Chernobyl was a nuclear reactor (RBMK type) undergoing testing, Fukushima an operating nuclear reactor (BWR type) subject to initiating events (earthquake → tsunami → LOSP)
  - Learning from different sectors is an excellent way to better understand your own field in terms of organizational inadequacies
  - Operational Experience Feedback from a “safety” point of view is technology-specific, while from a “Safety Culture” point of view, it is general and cross-sectional

Some golden nuggets

- **You can't leak what you don't have**
  - For instance reducing inventories in the case of storage of toxic substances, spent fuel, waste etc.
  - What is needed is awareness, responsibilty and farsightedness in design and operational choices

- **There is only one thing worse than not installing safety systems: installing them and not bothering to keep them running**
  - Keeping safety systems out of service are hardly decisions that operators take on their own. The managers take these decisions and thus show a lack of understanding and/or commitment

- **Lack of response is worse than a negative response**
  - Every warning about safety should be answered by management, even if the response is negative
  - In any case, management is ultimately accountable

Main outcomes

- At the end of the course, students take part in a collective discussion in which each of them expresses his/her feelings and opinions about simulations, role-playing and interactions with the other participants and the actions he/she is thinking of taking to contribute to the improvement of his/her organization's safety culture.

- Here are some very interesting comments we have had:
  - "I had the chance to observe problems from different points of view, putting myself in other people's shoes" (a supply manager talking about hazard recognition and case-studies)
  - "We especially enjoyed groupwork and brainstorming" (site maintenance and main office personnel)
  - "We became more and more aware of how much our decisions contribute in terms of safety for site workers" (procurement managers)
  - "I'm thinking about what I can do in my daily work to improve organization Safety Culture" (communication manager)

Conclusions

- The main goal of the course is to develop awareness of the importance of each individual's personal contribution to Safety Culture improvement among workers and managers

- The outcomes of this interactive training course are very useful for Safety Culture improvement in SOGIN and, after each course, feed-back and comments are processed by a qualified team of experts (psychologists, engineers etc.) to identify potential criticalities of the organizational safety management system and to indicate corrective actions.

Thank you for your attention and participation

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