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Facilitating Adequate Prioritization of Safety Goals in Distributed Teams at the Norwegian Continental Shelf

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Petroleum installation employees have to balance safety goals versus other types of goals as a part of their daily work activities. To reduce the risk for incidents and accidents, it is critical to obtain a better understanding of how to facilitate adequate prioritization of safety goals, i.e., prioritizations in accordance with the standards set by the company in charge. The first part of the paper provides a theoretical fundament for developing techniques and tools to support adequate prioritization of safety goals in a work context. It reviews theories on goal conflicts, and suggests a revised definition of the concept, which also includes the goal of the organizational level. The second part introduces a technology for risk visualization, called the IO-MAP, which is currently being designed. The purpose of the IO-MAP is to facilitate adequate prioritization of safety goals in maintenance planning processes performed by distributed teams.

INTRODUCTION

At petroleum installations on the Norwegian Continental Shelf, the standing order is that *safety should always be prioritized.* The presence of this order shows that the petroleum companies recognize that their employees – as employees in other high-risk industries (Rasmussen, 1997; Hollnagel, 2004) - have to balance safety goals versus other types of goals as a part of their work activities. The need for ensuring safety is also clearly emphasized in the petroleum companies' *standards of operation*, which document the requirements associated with task performance.

Regardless of petroleum companies' emphasis on the need for ensuring safety, incidents and accidents investigation reports reveal that *safety is not always prioritized in practice* (e.g., Petroleum Safety Authority Norway's home page). When looking at a cross-section of the investigation reports, it is clear that inadequate states of a set of safety-related factors recurrently are found to contribute to incidents and accidents. These factors include inadequate: work practices, operating procedures, staff training, and maintenance.

This paper addresses the question of how to facilitate adequate prioritization of safety goals at off-shore petroleum installations on the Norwegian Continental Shelf. The term 'adequate prioritization' is used in a broad sense to imply that safety goals are prioritized in accordance with the standards set by the company in charge. We start from the assumption that *employees at petroleum installations on the Norwegian Continental Shelf will not consciously make prioritizations, which they suspect may reduce the safety level unacceptably.* Consequently we, moreover, assume that the balancing of safety goals versus other types of goals looks different from the perspective of the employees, who make the trade-offs in real time and from the bird-eye view of accident investigators. We work from the hypothesis that the *application of technology can contribute to provide a suitable basis for adequate prioritization of safety goals in decision processes in work contexts, by facilitating the clarification of the risk factors associated with different courses of action.* The technology will make it easier for decision makers to switch between a dedicated focus on the task at hand and a bird-eye view on the overall operational state, and thus make it easier for decision makers in real time to obtain a nuanced understanding of the situation at hand, also in a hectic work situation.

The first part of this paper provides a theoretical foundation for developing techniques and tools to support adequate prioritization of safety goals in a work context. The second part, introduces a technology for risk visualization, called the IO-MAP, which is currently being designed. The purpose of the IO-MAP is to facilitate adequate prioritization of safety goals in maintenance planning processes performed by distributed teams.

THEORY

Goal Conflicts – a Psychological Construct

When addressing the issue of goal conflicts, it is useful first to consider why goals are important in terms of human performance. The concept *goal* can be defined as *the end toward which effort is directed* (Merriam Webster's Collegiate Dictionary, 1993). Goals are believed to impact human performance through four mechanisms (Locke, Shaw, Saari, and Latham, 1981; Locke and Latham, 2002):

1. Goals direct attention and effort toward goal-relevant activities - and away from goal-irrelevant activities.
2. Goals have an energizing function: In general, high goals lead to greater effort than low goals.
3. Goals affect persistence. When participants are allowed to control the time they spend on a task, difficult goals will generally imply a prolonged effort.
4. Goals affect action indirectly by leading to the arousal, discovery, and/or use of task-relevant knowledge and strategies (Woods and Locke, 1990). They contribute to ensure that people will adapt their knowledge and strategies to the best of their ability.

The concept *goal conflict* has traditionally been perceived as a *psychological construct*, i.e., as a state of mind of an individual. In psychological terms, a *conflict* refers to a situation "…in which oppositely direct, simultaneously acting forces, of approximately equal strength, work upon the individual" (Lewin, 1935, 122). In accordance with this understanding, Lee, Locke, and Latham (1989) state that a goal conflict exists when "...achieving one valued goal inhibits achieving another desired goal" (*ibid*., 300). This definition is neutral with respect to whether a goal conflict is intra-individual or inter-individual. Some authors reserve the term goal-conflict for intra-individual goal conflicts, i.e., situations where *one individual* holds mutually opposing goals (e.g., Wilensky, 1983). Other authors reserve the term goal conflicts for inter-individual goal conflicts, i.e. situations where *two or more people have different goals* (e.g., Cosier and Rose, 1977).

Frese and Zarp (1994) argue that the distinction between intra-individual and inter-individual goal conflicts is not readily applicable in an industrial context. They suggest that employees, by accepting and *internalizing* the task assigned from the organization, will take over a part of the organization's goals. This internalization process can be said to convert a goal, which at the starting point is external to the individual, into an intra-individual goal. The extent to which an individual has internalized the goals of the organization can be difficult to determine, and, accordingly, whether a goal conflict is intra-individual or inter-individual. In the remaining part of this paper, we will not distinguish between intra-individual and inter-individual goal conflicts, but will use the term to encompass both of these dimensions.

Goal Prioritization

People deal with dual task demands by prioritizing one of the goals (Erez, Gohper, and Arazi, 1990; Schmidt, Kleinbeck, and Brockman, 1984). To contribute to ensure that safety-goals are adequately prioritized vis-à-vis other types of goals, it is of key importance to understand the characteristics of the goals that are prioritized, when goal conflicts arise.

The *Valence-Instrumentality-Expectancy Theory* (Vroom, 1964) asserts that the force associated with taking a particular course of action (i.e. to fulfill a goal) can be defined by calculating the product of the individual's judgments of three variables: expectancy (i.e., the belief that a certain level of effort will lead to a certain performance level), instrumentality (i.e., the belief that a certain performance level will lead to other valued outcomes), and valence (i.e., the anticipated satisfaction to be derived from these other valued outcomes). In a situation where conflicts arise between goals, the Expectancy theory predicts that the individual will prioritize the goal associated with the highest force.

The *Goal-setting theory* (e.g., Latham and Locke, 2002) argues, based on a comprehensive set of empirical data, that the highest performance levels are associated with specific, difficult goals, rather than with easy, vague, or no goals. Erez and Zidon (1984) found that when a goal was specific and difficult, performance only decreased, when the individual reached the limits of his or her abilities, or when the individual's commitment to the task lapsed. In addition to *goal commitment*, other factors have been demonstrated to moderate (i.e. changes the impact of) the goal-performance relationship. These include *self efficacy*, *feedback* and *task complexity*. Overall, Goal-setting theory argues that the goal-performance relationship is strongest, when people are committed to their goals, and that higher levels of self-efficacy enhance goal commitment (Locke and Latham, 2002; Slocum, Cron, and Brown, 2002). The theory, further, argues that in order for goals to stimulate performance, people need feedback on performance progress. Finally, the Goal-setting theory emphasizes that people vary greatly in their ability to discover appropriate task strategies, and that the effect size for goal setting for this reason is smaller on complex tasks than on simple tasks (Locke and Latham, 2002).

Hollnagel (2004) addresses the need for balancing goals associated with efficiency and thoroughness in a *work context*. He refers to this balancing process as *efficiency-thoroughness trade-offs* (ETTOs). He argues that people genuinely will try to meet their internalized goals, and that they will do what they are supposed to do - or at least what they intend to do - as *thorough* as they believe is necessary, and as *efficient* as they can.

When employees' work activities are planned, four conditions are usually assumed (*ibid.*, 145): 1) Inputs to the work process are regular and predictable; 2) The demands and resources are within limits; 3) Working conditions in general fall within normal limits; and 4) Output complies with the expectations or norms. However, in practice these conditions are often not fulfilled. This implies that employees need to adjust their performance to get their jobs done. Hollnagel argues that people will adjust their performance by focusing their efforts on those aspects of a situation that are seen as more salient and important (e.g., valves that sometimes may get stuck), and by disregarding those aspects of a situation that are normally insignificant (e.g., valves that 'always' perform as they should). According to Hollnagel, human as a norm seeks to optimize their performance to save time and effort, using shortcuts, heuristics, and expectation-driven actions, and this performance approach often succeeds, because the work environment is relatively stable.

Hollnagel argues that ETTOs are carried out at three levels: the level of cognitive functioning, the level of individual work, and the organizational level. At the level of cognitive functioning, ETTOs are made based on traits of human cognition. They involve different type of heuristics, e.g., representativeness, availability, and anchoring (see, e.g., Tversky and Kahnemann, 1974), and are not the result of deliberate choices. At the level of individual work, ETTOs involve deliberate choices made by employees engaged in task performance. The most important ETTO rules at this level include (*ibid.*, 154-155): ”Normally OK, no need to check it now” and “It has been/will be checked by someone else before/later”. Also at the organizational level, ETTO involves deliberate choices made by employees, but at this level the choices are described at the group level. The most important ETTO rules at this level are (*ibid.*, 156): “Negative reporting”, “Reduction of redundancy”, and “Management double standards”. The criteria for making trade-offs are not fixed, but depend on the employees’ evaluation of the state of the work environment.

Based on Hollnagel (2004), the goals that employees’ will eventually come to prioritize can be predicted to depend on characteristics of the particular *employee* (e.g., experiences, and level of competence with respect to understanding the interrelations and risks of the work situation), the *task environment* (e.g., the usual state of environmental aspects, time pressure, support available, and colleagues’ expectations), and *organizational factors* (e.g., the incentive systems applied in the organization). This suggests that the issue of goal conflicts in work settings should be approached from a *systemic perspective*.

Goal Conflicts – An Extended Definition

When the concept *goal conflict* is defined as a psychological construct, the judgment of whether a goal conflict is present or not lies exclusively with the individual. If the individual does not perceive any goal conflicts, there will, per definition, be no goal conflicts. Still an accident investigator, analyzing the course of events that lead to the accident, *may* conclude that a goal conflict was actually present in the given situation – even though it remained unnoticed to the employees at the time. This may for example be the case, when prioritizations made by employees (e.g., to complete a task without checking the state of particular valves), implied that safety precautions required by the operational standards were violated. Even the employees, who took part in the original event, may agree with the conclusion of the accident investigator, when looking back at the course of events, although they did not recognize the goal conflict at the time the events unfolded.

The *practical consequences* that may follow from inadequate prioritization of safety goals will, however, be similar - and potentially fatal - regardless of whether a goal conflict was recognized by the employees, but inadequately dealt with, as the events unfolded (e.g., poor prioritizations due to lack of insights into the risks associated with task performance) - or not recognized by the employees, and thus not taken into consideration, when the employees made their decisions on how to proceed, as the events unfolded. For this reason, initiatives aimed at facilitating adequate prioritization of safety goals in *work settings* should be focused on both ensuring that safety goals are identified in real-time (i.e., situation assessment) and that safety goals are adequately prioritized. To support this, the concept goal conflict should be extended.

We argue that in *work settings*, the extent to which a goal conflict exists does not exclusively depend on how the individual in real time perceives the situation at hand. The safety requirements contained in an organization’s operational standards should also be considered as safety goals (as is, e.g., what an accident investigator does, when concluding that safety requirements are violated), which may exist in a situation, even if not perceived or misperceived by the employees as an event unfolds. This implies that goals both exist at the individual and the organizational level, and that goal conflicts should be approached from both perspectives.

We suggest that the concept goal conflict, when addressed in work settings, could be defined as *situations in which a (safety) goal is in conflict with one or more other desired goal(s), as judged by individual(s) in real time and/or as judged based on the safety standards of the organization.*

The reference to the standards of the organization does *not* imply the assumption that these standards will cover all possible safety-critical situations, and thus may provide perfect performance guidance. The reference implies the view that the standards of the organization comprise rules and guidelines for tasks performance, which are required by the law of the country in which operation takes place and/or defined based on the organization’s experiences with respect to what initiatives are needed to ensure adequate performance (including risk reduction). To the extent that the standards of the organization provide criteria for how to make trade-offs between a specific safety goal or/and other type of goals (e.g. prohibited or mandatory activities), the employees should *recognize* this *during* their task-performance process. In various situations, no trade-off criteria will be readily available, and the employees have to make prioritizations in real time, based on the overall principles in the standards, e.g., that safety concerns should be prioritized. In some situations, it might be reasonable for the employees to violate certain trade-off criteria, e.g., because the situation at hand has not been foreseen when the criteria were defined. However, it is important that the employees are aware of requirements of the standards, and reckon when they violate the standards (even in situations where the violations are part of the usual work practices, i.e. of the ETTOs applied in every day settings).

A Simple Goal Conflict Typology for Industrial Settings

Based on the extended definition of the concept *goal conflict*, a simple goal conflict typology has been developed (Skjerve, 2009). The typology covers four situations in which a goal conflict (as defined in the previous section), exists either because the employee (or team, depending on the level of analysis) perceives that a goal conflict exists, or because a goal conflict can be said to exist, based on the content of the organization’s standards (see Figure 1).

The first dimension is called *Team/individual perception*. It refers to whether or not an employee/team in real-time perceives that a safety goal conflicts with other goals. This dimension corresponds to classical definitions of the concept goal conflict. The second dimension is called *Trade-off criteria*. It refers to whether or not the standards of the company in question contain trade-off criteria, which specify how safety goals should be prioritized in the given situation.

Team/ Individual perception \ Trade-off criteria	No relevant trade-off criteria exist	Relevant trade-off criteria exist - but are not noticed.
A perceived safety-related goal conflict	Type I	Type II
No perceived safety-related goal conflict	Type III	Type IV

Figure 1. A simple goal-conflict typology for industrial settings.

Hypothesized Practical Implications

The simple goal conflict typology may serve to distinguish different types of initiatives for facilitating adequate prioritization of safety goals in work settings. In the following, we will first consider goal conflicts of types I and II, and the need for making the standards of the organization readily available to the employees. Then we will focus on goal conflict of types III and IV, and the need for supporting identification of safety concerns.

Type I goal-conflicts imply that an employee accurately perceives that a safety goal conflicts with another goal and accurately assesses that no specific trade-off criteria exists for how the situation should be handled. This type of situation may (depending on the content of the organization's standards) arise, e.g. when an employee is asked to achieve multiple conflicting outcomes (e.g., to perform a highly complex task fast *and* safely), or when two safety goals are in conflict (e.g., when the need for rescuing staff has to be balanced against the risks a rescue operation will imply for members of the rescue team). In these situations, the employee will have to prioritize the various tasks based on insights into the state of the current situation and the overall principles guiding performance in the organization. *Type II goal-conflicts* imply that an employee accurately perceives that a safety goal is in conflict with another type of goal, but is unaware that relevant trade-off criteria actually exist (if the individual is aware of the trade-off criteria he or she will not experience a goal conflict, but simply prioritize the goals involved in accordance with the requirements in the standards) This situation may arise, e.g., when the employee faces a situation with which he or she has limited familiarity, or when an order is misperceived to imply that multiple conflicting outcomes should be achieved. In these situations, the employee will experience unnecessary uncertainty. He or she may come to spend an excessive amount of time considering, how to prioritize the various goals, and may even – unintentionally – come to violate existing standards.

Tools and techniques aimed at increasing awareness of the content of the organization's standards can be expected to support adequate prioritization of safety goals, when goal conflicts of type I and II occur. When goal conflict type I occurs, it will contribute to ensure that the prioritizations made, will not come to violate existing standards (even though no specific trade-off criteria readily can be applied, an intervention plan will still have to adhere to requirements of the overall standards, e.g., prohibited and mandatory activities). Goal conflicts of type II would, in principle, be eliminated, as the trade-off criteria would effectively guide the employees prioritization of the safety goal involved.

Type III goal-conflicts imply that the employee does not experience a goal conflict in a situation where a goal conflict (as judged based on the organization's standards) exists, and where no trade-off criteria are available (or sought after) to guide performance. This type of situation essentially arises when an employee has not adequately considered the situation at hand from a safety perspective. A type III goal conflict may, e.g., arise when a situation is new or unexpected to the employee, or when the employee does not have sufficient time (given the means available) to establish an adequate situation overview. *Type IV goal-conflicts* refers to a similar situation, except that in this case trade-off criteria actually *do* exist, although the employee is not aware of or attending to this fact. Type IV goal conflicts may, e.g., arise when an employee routinely applies short cuts of the type: "Normally OK, no need to check it now", and across time forgets that this approach implies that safety goals are not adequately attended to.

Tools and techniques aimed at increasing situation awareness can be expected to support *identification* of safety goals, and thus contribute to overcome goal conflicts of type III and IV. The tools and techniques could, e.g., comprise the establishing work practices, which imply routinely effective strategies for identification of safety goals and/or the implementation of technology to support identification of safety goals and the organizational standards of relevance in the particular situation.

IO MAINTENANCE PLANNER

The *Integrated Operations Maintenance Planner* (IO-MAP) is a groupware technology under development to support a distributed team of maintenance planners working in the petroleum industry (Rindahl, Skjerve, Falmyr, Nilsen, Sarshar, Randem, and Braseth, 2009). Groupware technologies can be defined as "... software applications that are able to facilitate collaboration among groups of people over the Internet" (Blake and Rapanotti, 2004, 500), or – as in our case – over a restricted computer network.

The task of a distributed team of maintenance planners is to effectively develop maintenance plans, which adhere to the safety standards of their company. The IO-MAP is designed to facilitate that safety goals will be adequately prioritized in maintenance plans. The system seeks to achieve this goal by supporting visualization of risks associated with potential plans. The IO-MAP is designed with reference to the revised definition of the concept goal conflict presented above, and it particularly aims at overcoming goal conflicts of type III and IV. The IO-MAP will be used to test whether the application of technology can contribute to provide a suitable basis for adequate prioritization of safety goals in distributed decision processes in a work context, by facilitating the clarification of the risk factors associated with different courses of action.

The prefix IO refers to *integrated operation*. IO is an operational concept used by several of the petroleum companies that operate on the Norwegian Continental Shelf.

IO implies that the operation is carried out using information technology "to remotely control equipment and processes, and to relocate functions and personnel onshore." (Norwegian Ministry of Petroleum and Energy, 2003-2004). In more generic terms: "IO is the enabling of new ways of working in operations through implementation of innovative technologies" (Rindahl, Torgersen, Kaarstad, and Drøivoldsmo, 2009, 5). One of the consequences of the ongoing transition into IO on the Norwegian Continental Shelf is that work processes, teams and work practices are changed, and that several tasks and decisions, which were earlier accomplished either off-shore or at a dedicated location on-shore, now are performed by distributed teams in interactive digitally mediated sessions (Kaarstad, Rindahl, Torgersen, and Drøivoldsmo, 2009; Rindahl *et al.*, 2009).

The distributed teams working in the context of IO, i.e., IO teams, consist of members that are partly situated at geographically different locations. The team members hold different specialist backgrounds – and possibly differ in nationality, first language, organizational anchoring, and in their level of personal familiarity with each other. For this reason, the IO team members may tend to differ in what type of risks they most readily perceive, and to some extent in how they evaluate the criticality associated with the risks identified by the various members of an IO team.

IO teamwork is digitally mediated as a ground rule, and this opens up for the possibility of clarifying safety related goal-conflicts and trade-off criteria through *visualizations* in the *collaboration interfaces*. In this process, it should be possible to benefit from the diversity of the team members: Allowing the various members of an IO team to effectively share their perception of the risks associated with the situation at hand through collaboration technology should contribute to enhance the accuracy and completeness of the overall risk perception within the team.

Development of the IO-MAP application

The IO-MAP application will be a concept test bed, and thus exposed to iterative usability assessments throughout the design process. In the first prototype version, the IO-MAP will not include all features needed to facilitate the distributed team of maintenance planners, but the test bed will contain enough functionality to enable investigation of how the users, i.e. maintenance planners, perceive the present risks, when planning typical oil-platform related work. The first prototype version of the IO-MAP is shown in Figure 2.

On the upper left side of the display in Figure 2, the user can navigate through the oil platform and chose the deck of interest. The chosen deck area is displayed in the upper-middle part of the display. To the right is a list of planned and unplanned tasks. These are placed geographically on the area overview as dots and circles. On the bottom of the screen, information regarding a selected task is displayed and can be modified. The user can chose the type of information that should be displayed in this area.

Members of the IO team can add jobs to the IO-MAP at different stages of the planning process, ranging from *notifications* (someone has been made aware that a job probably needs to be done and reports it in for planning) to *permissions to work* (a job that has been planned and evaluated with respect to health, safety, and environment (HSE) standards, criticality and feasibility). The IO-MAP application will then automatically highlight several types *of risks associated with the jobs* and (if any) *risks associated with the combinations of jobs*, by comparing the implications of the potential plans with the safety standards of the organization in charge. If, e.g., a plan implies that a group of workers will come to work in an unsafe area (e.g., due to the risk for falling objects from the decks above), the conflict between the safety goal of maintaining staff safety and the efficiency goal of getting the required job done, will be highlighted on the system's display.

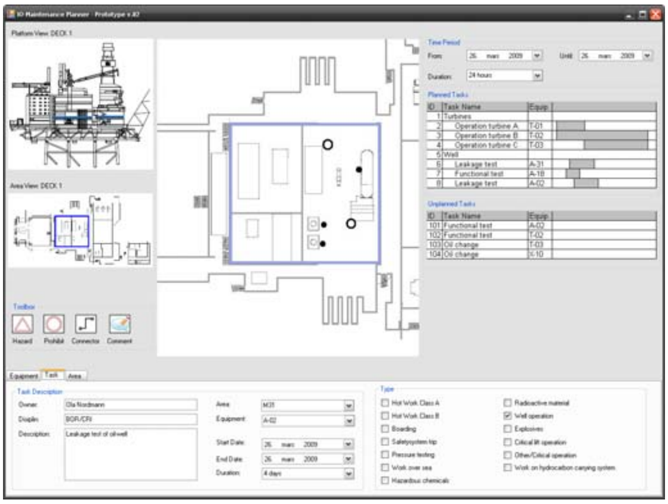

Figure 2. The IO-MAP prototype.

The risks associated with particular jobs can automatically be recognized and highlighted by the IO-MAP, to the extent that the risks can be defined based on the standards of the organization in charge. However, the IO-MAP will not automatically identify and highlight all the potentially hazardous situations that may arise in a complex off-shore environment. Neither will all risks be foreseen in organizational safety standards. For this reason, an important prerequisite is that the IO team must be able - and encouraged – to add potential threats to the safety goals in real time during the planning process, based on their own perception of the situation at hand. This option is also vital from a psychological perspective, as it encourages the team members to actively search for safety threats. Figure 3 shows the IO-MAP prototype with enlarged view area and the toolbox with risk icons, which the planners can place on the display.

In the display shown in Figure 3, the detail level for each task has increased. The jobs are now illustrated with signs, indicating if there are risks or comments related to them. The user can *drag and drop* hazards and connections using the risk icon tool box shown at lower left-hand side of the display, and insert comments in relation to any task or equipment on the deck.

The option of adding risks in real time is of key importance, as the standards will not cover all the potential safety challenges that may arise.

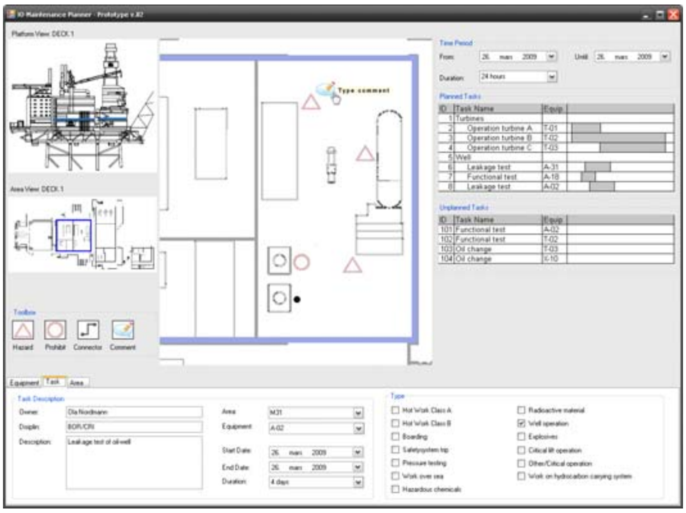

Figure 3. The IO-MAP prototype with enlarged view display.

The IO-MAP display will make all risks identified readily visible to all members of the planning team, and may thus *serve as a common frame of reference for understanding of risks during the planning process* (see Figure 4).

Figure 4. The IO-MAP may serve as a common reference for identification of risks associated with maintenance planning.

An important requirement to the test bed is the documentation of a meeting's decisions, including postponed or down-prioritized actions and tasks delegated to team members for clarification or execution. This is to ensure *traceability*, and that history is part of future decisions. In situations with Type IV goal conflicts, such visualization functionality could concretize issues that are often down prioritized or not attended to because "somebody else" will do it "later", forcing these back on to the agenda through their persistent visual presence in the collaboration surfaces. Risk-related information entered into the IO-MAP during the planning process will also be available for other teams later in the work process. The visualization will thus also contribute to prevent that threats identified by one team are later forgotten.

Planning sessions are in general efficient meetings of short duration, and the additional requirement of combining simplicity and intuitive interfaces with salient and clear visualization of safety impacts is therefore put on the IO-MAP test bed. Icons and highlights must in such a situation be few and unambiguous, as shown by Larni, Koskinen, Salo, Norros, Braseth, and Nurmilaukas (2009). On the other hand it is important that all necessary information is easily available and it must therefore require little effort to move between different levels of detail in aggregated information. If an application is more complex than perceived necessary by the users or in general difficult to use, it will probably not be used in work sessions of this kind.

ROUNDING OFF

A test-bed version of the IO-MAP will be ready for the first in a series of planned usability tests in the late April 2009. ISO 9241-11 (1998) defines usability as the "Extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (*ibid.*, 2). This definition will serve as basis during the testing process.

The first usability test will focus on issues associated with *operation* of the IO-MAP, i.e., the use of buttons, menus, navigation features and maps, as well as the extent to which the users readily understand the automatically displayed risks, and are able to enter risks into the system. The test will, moreover, be designed to clarify whether the display is adequately organized, and whether critical and/or desirable system functions are lacking. The outcome of the test will be used to improve the usability of the IO-MAP.

The first user test will be performed with one *maintenance planner* at the time. Even though the IO-MAP is designed to be a groupware technology, this approach is used, based on the assumption that an adequate level of individual usability is needed, before the IO-MAP can come to fulfil its purpose in a team context.

The first test is planned to involve 5-7 representative users, as this number of participants has been found to disclose around 80% of the usability problems (Downey, 2007). In a team setting, each team member will hold a *specialized function*, i.e., possess specialist competencies and skills that are needed for the team to achieve its goal (Brannick and Prince, 1997). To accommodate this fact, the scenarios applied in the first user test will be designed to mainly involve the specialist competence possessed by the individual test subject. In general, the scenarios will involve situations with varying degree of challenges (e.g., well-known easily observable risks to less well-know risks and not necessarily readily observable risks).

In late 2009, the plan is to perform the first usability test involving a distributed team of planners. Here we foresee to use the *metrics of collaboration* suggested by Gutwin and Greenberg (2000), and later revised and expanded by Pinelle, Gutwin, and Greenberg (2003), as a basis for the assessment. This implies that the assessment will come to focus explicitly on usability issues associated with the teamwork processes.

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