

An Explorative Study of Nuclear Operators' Perception of Groupthink

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ABSTRACT

Operators in nuclear power plant (NPP) control rooms work together as a team where each team member has specific roles and areas of responsibility. In some situations, the crew dynamics are poor, and the group's effectiveness will be reduced. A phenomenon that often has been linked to poor crew dynamics is called groupthink. Due to potential negative outcomes of groupthink, it is important to gain more knowledge about the concept. In this paper we ask: How do NPP operators perceive causes, symptoms and consequences of groupthink and possible ways to avoid it? To explore this question, we conducted a study with NPP operators. Findings from the explorative study, as well as recommendations for further work, are presented in this paper.

Keywords: Explorative study, Groupthink, Nuclear control room teams

INTRODUCTION

The operators in a nuclear power plant (NPP) control room work together as a team where each team member has specific roles and areas of responsibility. Teams and workgroups are a significant resource for organizations and are used as a means of managing difficult interdependent, stressful, and complex tasks. According to Moreland (2010), groups have the possibility to make achievements far greater than any individual. However, teamwork outcomes are sometimes dependent on the team dynamics. When the dynamic in the team is positive, the group will work well together, and their decision-making provides the opportunity to generate information, knowledge, and different perspectives (Robbins, 2001). If, on the other hand, the dynamics are poor, the group's effectiveness will be reduced, and the group has the potential to produce negative outcomes (Klug & Bagrow, 2016). One phenomenon that has been linked to poor crew dynamics is called groupthink (Janis, 1972; 1982). Janis defined groupthink as: "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action" (Janis, 1982, p. 9). In some previous empirical studies performed in the Halden Man Machine Laboratory (HAMMLAB) at the OECD NEA Halden Human-Technology-Organisation (HTO) project, we have seen indications of groupthink and that groupthink in some situations influenced performance negatively. We therefore decided to explore this phenomenon further and more systematically.

An on-going research activity at the HTO project, is to study crew factors and their impact on performance. A specific objective within this research activity is to establish knowledge regarding group processes, such as groupthink in teams, and investigate factors that cause groupthink to occur, and how groupthink could be prevented in nuclear power plant control rooms.

BACKGROUND

Within the Halden HTO Project, we carry out several research studies related to the safe operation of nuclear power plants in our research simulator (HALden Man Machine LABORatory, HAMMLAB). In some of these studies, we make observations that are not part of the study's original research questions. In one such study, reanalysis of data showed that crews who worked from their respective workstations had significantly better performance than crews who gathered in front of a workstation (Skraaning, 2016). Another study showed that when the shift supervisor (SS) and shift technical advisor (STA) worked next to each other, they often formed a small, separate unit and operated as an island. This seemed to lead to performance deficiencies in the crews (Kaarstad, 2019). In these studies, it also seemed that when operators were close together, they tended to not question each other to the same extent as when they were located farther away from each other – possibly due to a closer co-location leading to a more similar way of thinking (Kaarstad, 2019).

It was difficult to know whether the observed performance effects were methodological artifacts or actual findings, as these studies were designed to investigate other research questions (*ibid.*). To explore these observations further, a simulator study was conducted in HAMMLAB. Five crews of licenced nuclear operators who normally work together at their home plant, participated. Each crew ran through six complex scenarios and we varied the location of one of the crew members, the STA, in the following ways: 1) STA was located right next to the shift supervisor; 2) STA was located at a separate desk in the same room as the crew; 3) STA was located in a room separated from the rest of the crew (Kaarstad, Nystad, McDonald, Odén, 2023). In all conditions the STA had access to process information and could see and hear the conversations and process manipulations by the other operators. No performance effects of the STA location were found in this study. However, process expert evaluations found that the STA performed his (all were male) role as an independent advisor better when located in condition 3 than in condition 1 and 2. Groupthink was observed in all conditions, but most often in condition 1 and 2 (Kaarstad et al., 2023).

As the groupthink situations in this study occurred in a limited period, in one of several independent events in the scenarios, it is not surprising that the overall performance, based on all events in the scenario, was not affected by the individual groupthink situations. Although there were no effects of groupthink on performance for the study, previous events have shown that groupthink situations can potentially have serious consequences for performance if left undetected. One of the main causes of the Challenger accident in

January 1986 has been related to the groupthink phenomenon, more specifically, to the illusion of unanimity (Murata, Nakamura, Karwowski, 2015). The illusion of unanimity means that the group's decision conforms to the opinion of the majority. Furthermore, the main cause of the meltdown at TMI in March 1979 was that the operators did not remember to open the valve of an auxiliary feed water pump after maintenance (Murata et al., 2015). It took the operators some time to detect the increase of the reactor core temperature, which led to the meltdown of the reactor (Murata et al., 2015). This was probably because the operators did not analyze and identify the cause of the event but instead sought confirmation of their interpretation of the situation and disregarded contradictory information (Murata et al., 2015).

In a nuclear power control room, the STA plays a central role in providing independent advice and oversight to the team, which may support the operators in avoiding groupthink. As groupthink occurred in all conditions investigated in the study by Kaarstad et al. (2023), physical location alone is probably not enough to prevent groupthink from happening. Thus, additional investigations are needed to better understand the effects of groupthink, as well as how to prevent or counteract groupthink.

Janis (1972) developed a model to explain groupthink - how the phenomenon occurs, its symptoms and possible consequences. There is little previous research on the groupthink phenomenon within the nuclear domain. We wanted to investigate what aspects of the groupthink model is most relevant in NPP teams and to get initial insight into operators' considerations on how to prevent groupthink. Asking NPP operators with first-hand experience is an important first step in this regard. In this study we investigated whether NPP operators' perception of groupthink corresponds to the description in Janis' model. By gaining insight into operators' perception of groupthink within NPP, we will come one step closer to understand the groupthink phenomenon within NPP teams, which may support further research related to preventing or mitigating groupthink in this domain. In this paper we present an explorative study that was performed to gain information from NPP operators regarding their perceptions of the concept of groupthink, as well as their views on how to prevent it. In this paper we ask: How do NPP operators perceive causes, symptoms, consequences of groupthink and possible ways to avoid it? The paper will present findings from the explorative study, as well as recommendations for further work.

THE GROUPTHINK THEORY

Irving Janis (1918–1990) developed the theory of groupthink a half century ago (Janis, 1972; 1982), and since its appearance, the theory has been an influential model in behavioural science and has inspired empirical studies and critical views (Peterson, Owens, Tetlock, Fan, Martorana, 1998).

Janis created the term “groupthink” to describe how a group, in certain situations, can be satisfied with a decision that turns out to be ineffective, and defined groupthink as: “a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative

courses of action" (Janis, 1982, p. 9). Janis was interested in the practical significance of research (t'Hart, 1991), and the formulation of the groupthink model was grounded in the discipline of group dynamics. Analysis of four different policy decisions which resulted in fiascos provided the basis for the groupthink theory (Janis, 1972): Pearl Harbor, the Korean war, the invasion of Cuba at the Bay of Pigs, and the Vietnam war (Janis, 1972). Janis' model of groupthink propose that certain antecedent conditions need to be present for groupthink to occur. Those conditions can lead to symptoms of groupthink, which again results in observable consequences, and a low probability of a successful outcome. Perhaps more important than to identifying symptoms, Janis also made recommendations, on how to prevent groupthink from occurring. These aspects of the groupthink model are presented in Table 1.

Table 1. Different factors of the groupthink model, as described by Janis (Janis, 1972).

Antecedents	Symptoms	Outcome	Avoidance
A highly cohesive group	Illusion of invulnerability	Incomplete survey of alternatives	Each member should be a critical evaluator of the group's course of action
Insulation of the group	Belief in member superiority	Incomplete survey of objectives	An open climate of giving and accepting criticism should be encouraged
Lack of impartial leadership	Collective rationalisation	Failure to examine risks of preferred choice	Leaders should be impartial and refrain from stating personal preferences at the outset of a group discussion
Lack of norms requiring methodical procedures	Stereotypes of out-groups	Failure to reappraise initially rejected alternatives	Split the team into subgroups to assess feasibility and effectiveness of proposals
Homogeneity of members' social background and ideology	Self-censorship	Poor information search	Each member should privately discuss issues with trusted associates outside the group
High stress from external threats	Illusion of unanimity	Selective bias in processing information at hand	From time to time, bring in outside experts to challenge the views of the core members
Low self-esteem in the group	Direct pressure on dissenters Mindguards	Failure to work out contingency plans	There should be one or more devil's advocates during every group meeting/ crew brief In conflict situations, extra time should be devoted to construct alternative scenarios Reconsider the decision before implementing it

Three possible interpretations of the groupthink theory have been proposed (Turner, Pratkanis, Probasco and Leve, 1992). A rigorous interpretation holds that groupthink occur only when all the antecedent conditions are present. An additive interpretation suggests that groupthink become more

noticeable as the number of antecedent conditions increases. A third interpretation suggests that groupthink outcomes will depend on the situational properties by the specific antecedent conditions found in each groupthink situation. Esser and Lindoerfer (1989) suggested that the overall pattern of antecedents and symptoms, rather than presence of each individual element, identifies the groupthink syndrome.

The groupthink model was developed for policy decisions, and it is likely that only a subset of the factors is relevant for nuclear operation. The study referred in this paper was performed in two steps. The first step was a distribution of a questionnaire to get a first impression of operators' perception of groupthink, and their perception of the importance of the different factors in Janis' groupthink model. As preventing groupthink is of particular importance, a second step was to dive more specifically into groupthink prevention by conducting a group interview on this topic.

METHOD

To shed light on the research question, questionnaires and interviews were conducted with workers from NPPs. The workers normally work together at their home plant. The average NPP operation experience of all participants was 20,4 (SD 9,5) years, and their average age was 39 (SD 8,7) years.

Questionnaire: The questionnaire was answered individually by 22 licensed NPP operators (21 male, 1 female). A researcher was present when the operators filled in the questionnaires and could answer questions regarding the item formulations.

The questionnaire was developed based on the groupthink model of Janis. It contained an introductory text, explaining the purpose of the study, and how the data would be stored, analysed, and used. The data was collected anonymously. In the questionnaire we asked the operators the following 4 questions: "Which of the factors below do you consider important for groupthink to occur?" Below we listed the antecedents from Janis' model (see Table 1). "Which of the factors below do you consider important symptoms of groupthink?" Below we listed the symptoms from Janis' model (see Table 1). "Which of the factors below do you consider important of defective performance resulting from groupthink?" Below we listed the outcome factors from Janis' model (see Table 1). "Which of the factors below do you consider important for avoiding groupthink?" Below we listed the avoidance factors from Janis' model (see Table 1). The operators were asked to mark one or several of the factors listed below each question. No ranking of the items was done. We did not include the possibility to add additional factors in the questionnaire.

Interview: The interviews were conducted as a short group interview with two crews (5 workers in each) of licensed NPP operators from a pressurized water reactor. Each group interview lasted for 20–30 minutes, focusing on how it is possible to avoid or break a groupthink situation. An advantage with group interviews, is that the participants can be stimulated by something the other participants mention, making it easier to keep the discussion going. A disadvantage with group interviews is that some participants may dominate

the discussion, and it may be difficult for others to express their opinions. This was counteracted by addressing the individual crew members directly. Before the interviews were conducted, the participants filled in a consent form and was briefed about the purpose of the study, what data was to be collected, and how it would be stored and reported. The interviews were videotaped and transcribed.

FINDINGS

The answers in the questionnaires showed that some of the factors from the groupthink model were perceived as more important than others. Table 2 below list the factors that the operators perceived as most important, factors that were rated most often by the operators. Not all factors from Janis' model (Table 1) were perceived as important. For antecedents, Lack of impartial leadership, Lack of norms requiring methodological procedures and High stress from external threats were seen as the main contributors for groupthink to occur in nuclear power plant operation. Regarding symptoms of groupthink, the operators found Collective rationalisation, Direct pressure on dissenters and Mindguards as the most prominent symptoms. The potential negative outcomes from groupthink, were considered to be: Incomplete survey of alternatives, Failure to examine risks of preferred choice, and Selective bias in processing information at hand. The operators further rated four factors as important for avoiding groupthink in nuclear power plant operation: Each member should be a critical evaluator of the group's course of action, An open climate of giving and accepting criticism should be encouraged by the leader, Leaders should be impartial and refrain from stating personal preferences at the outset of a group discussion, and From time to time, bring in outside experts to challenge the views of the core members. As we did not include the possibility to add additional factors, there may be other, additional factors that are important in NPP operation related to groupthink. This could be a consideration for further work.

Table 2. Factors from Janis' groupthink model that was perceived by operators as most important (rated most frequently) in NPP operation.

Antecedents	Symptoms	Outcome	Avoidance
Lack of impartial leadership	Collective rationalisation	Incomplete survey of alternatives	Each member should be a critical evaluator of the group's course of action
Lack of norms requiring methodical procedures	Direct pressure on dissenters	Failure to examine risks of preferred choice	An open climate of giving and accepting criticism should be encouraged
High stress from external threats	Mindguards	Selective bias in processing information at hand	Leaders should be impartial and refrain from stating personal preferences at the outset of a group discussion From time to time, bring in outside experts to challenge the views of the core members

The aspects that were discussed in the group interviews related to avoiding groupthink, was leadership, physical location of different roles, role awareness, training, crew briefs, and peer checks. In the interviews, we started by discussing a little loosely what can lead to groupthink. Both shift teams believed that it was easy to fall into groupthink and highlighted crew management as an important factor for groupthink to occur. One operator expressed concern that blind trust in the leader's position could make it difficult to come up with views that conflict with the leader. In both interviews the operators said that leaders with a team-oriented personality will facilitate multiple, conflicting ideas to be pursued and fleshed out, whereas a result-oriented driven manager will want decisions to be made quickly.

One crew commented that although a strong leader can be a contributor to groupthink, perhaps indecisiveness in leaders can be worse. If no one can or wants to step up to make a recommendation that leads to a decision to act, rationalization and a bias toward inaction may exist. Furthermore, they said that a strong leader must, however, also create an environment where opinions, observations and recommendations from all team members are welcomed and encouraged. In many cases, simply stating something as a given or a fact with too much confidence can be enough to close the minds of the rest of the team to explore alternatives contrary to the claim. To avoid this, it was suggested that the leader should speak last or not at all in the discussion in order to more easily prevent groupthink. For a leader, it was therefore considered important to be strong in oneself, but also open to the input of others.

Next, the participants were prompted to start discussing what can be done to avoid groupthink. Some operators thought that location related to each other could be important, while others thought that location and distance to each other would not necessarily make a big difference. Both crews believed that shift supervisors, STAs as well as other crew members must be self-aware and try to maintain an independent role to avoid groupthink.

Another aspect that was emphasized during the interviews was that through training it should be reinforced that one should not get into groupthink situations. It was also emphasised that many of the antecedents and suggestions for how to avoid groupthink, referred in Table 2 are already included in simulator training at different plants. During simulator training, crews are trained on communication protocols, briefs, and to keep all informed about decisions and bases of decisions, which are considered as means to prevent groupthink. With regard to crew briefs, it was specifically mentioned that this was a great way to get everyone aligned and to have an opportunity to express their own mental models that do not necessarily fit the others. Crew briefs were considered as a chance to voice opinions and make sure all are aligned, as well as a possibility to pause, think, and to gather extra information.

Regarding peer checks, the crew members discussed involving more colleagues where possible. Both operations, engineering and maintenance can be involved to take a separate look and, in this way, avoid groupthink.

CONCLUSION

An exploratory study of operators' perception of groupthink has been carried out. It is important to specify under which conditions groups may demonstrate the dysfunctional processes associated with groupthink. Understanding what can lead to groupthink is important, but perhaps even more important is understanding how groupthink can be prevented. It may happen that groupthink symptoms and groupthink causes differ in different domains. In this study, it seems like operators perceive some of the causes, symptoms, consequence and how to avoid groupthink different from the original groupthink model. We have through this explorative study gained initial insight of how NPP operators perceive groupthink. This can be used as a first step to understand how groupthink occurs, how it manifests itself, what potential consequences groupthink can have, and how one can break or prevent groupthink in the nuclear domain. The knowledge gained can be used to explore this topic further.

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