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| Programme of Study: | Business Analytics and Decision Science | | | | | | | | | |
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# Introduction

Many decisions are made by groups, such as parliamentary decisions, the jury in court, the shareholders' meeting of business organisations, and so on. On the one hand, group decision making has a number of recognized advantages but on the other hand, researchers have also identified a number of issues and challenges in this way of decision making. For example, one of the reported advantages is that the overall level of knowledge of the group is higher than that of individuals (Janis, 1972). There may be experts in the group about the issues being discussed, so the combined knowledge is better which should lead to better decision making . On the contrary, Abeyrathne and Jayawardena (2014) found that teams are often more likely to seek extreme risk than when making decisions individually, which can lead to terrible choices. Considering the ideas that group members can contribute, the richness of expertise and the diversity of experience, group decisions can often solve problems better than those who think independently, and are more likely to come up with more viable alternatives when making decisions (Macleod, 2011); However, considering its weaknesses and limitations, Janis (1972) listed eight shortcomings of collective decision making which is explained in detail in the literature review section.

In some cases we do not have enough time to think carefully and evaluate alternatives but the accuracy of the decision is very important. For example, the decision of a management team on whether to enter the new market or product range may determine the survival of the company. The Attentional Focus Model (AFM) proposed by Karau and Kelly (1992) shows that under limited time conditions, the performance of group decision-making is related to the complexity of decision-making content. When the content of the decision is simple, the efficiency of decision making can be improved because of time pressure, restrictive communication and increased consensus pressure. However, as discussion content becomes more complex, time pressure can cause members to ignore important clues, resulting in poor decisions. The two topics of time pressure and groupthink are often studied separately, and there is little research on how group decision-making is influenced by groupthink under time pressure.

Based on the groupthink model proposed by Janis (1972), this paper further hypothesizes and tests how groupthink affects group decision making under time-limited conditions. Before discussing the hypotheses presented in detail, we review the previous literature related to time pressure and group decision making, and discuss some important related models. The research methods and experimental design are then presented, and the experimental results are discussed in detail. Finally, the conclusions including many valuable information found in this study are summarized, while some existing deficiencies are discussed and the direction for future research is provided.

# Literature review

Collective decision-making is a sub-area of collective behaviour, involving how groups make decisions. The collective decision-making process comes from a social feedback network within the group (Planas-Sitjà et al., 2015). The key to decision making in all groups is the existence of social reinforcement. Individuals show strong preferences for other people's choices (such as strong endorsement or opposition), and these preferences increase as the number of people in other groups increases. This reinforcement can be expressed in terms of a social response function, which means the probability that an individual chooses an option depends on the number of other individuals who previously selected it (Mann, 2018). The purpose of this research is to investigate the impact of groupthink on collective decision-making. Therefore, the individuals’ initial preferences for choices and the process of preferences change with various factors should also be considered.

## Perceived benefits of group decision making

Solomon (2006) argues that the key to collective decision - making better than other methods is that it is a more effective way to tap the wisdom of the crowd. A group decision determines group’s perspective from the group and brings together the data that each member of the group has. In this way, the speed of the group responding to all data is much faster than when making decisions individually.

On the basis of Solomen, Wray (2014) made further research on the social epistemology of science, especially the understanding of cooperative research. According to his research, the benefits of teamwork arise when scientists try to evaluate the various proposals that have emerged and determine the action plan. This is one of the important reasons why collective decision-making is widely used in scientific researches, which increases the need for us to study it.

Another researcher, Christos (2017), explored the collective wisdom of animal groups and found that larger groups tend to perform better when solving cognitive tasks than smaller or lonely groups. It is because larger groups are more likely to include better decision makers who can lead collective decision making in a good direction.

Therefore, in our research, whether leaders appear in the collective decision-making process and how these leaders influence team decisions is one of the research questions. Zafeiris et al. (2017) studied teams that sought the best answers to questions and also demonstrated the importance of experts in collective decision making. They presented many independent sub-questions to the groups being tested and proved that the group with best results had at least one expert on each sub-question, Another less intuitive result of Zafeiris's research was that those groups who found the best solution need to be involved in areas beyond the questions they instructed to discuss.

This indicates that in our research process, we need to consider whether the participants have some knowledge beyond the given problem, because the overall knowledge level of the tested group may affect the accuracy of the experimental results.

## Groupthink

Janis (1972) researched policy decisions such as the Bay of Pigs invasion, the Cuban missile crisis and the escalation of the Vietnam War, and thus created the term "groupthink". The Oxford Dictionary of Politics and International Relations interprets groupthink as:

*“Situation where committees, cabinets, or other groups make sub-optimal decisions, occurring when considerations of cohesiveness override a fully rational examination of the situation.”* (Garrett W Brown et al., 2018).

Janis (1997) believed that when people are involved in connected “in-groups”, groupthink is a way of thinking that they may use, and at that time they seek consensus without considering other ideas or actions. Other researchers also defined groupthink, for example, Shirey (2012) referred groupthink as“the tendency to seek collusion”.

Janis proposed the famous groupthink model where he proposed five prerequisites necessary for collective thinking to occur:

1. Strong cohesion between group members (always from co-operation);
2. Isolation (intervention from outside the group is very Less);
3. Guiding leadership (a leader of a ruling group);
4. Lack of established procedures for searching and evaluating information;
5. Low confidence in finding alternative solutions advocated by leaders.

Janis also summarized the eight characteristics of collective decision-making, which we can also understand as eight shortcomings:

1. The invulnerability leading to extreme risk taking;
2. The collective rationalization leading to neglect of warnings;
3. The belief in the inherent morality that leads to neglect of important moral issues;
4. The negative perceptions leading to underestimate the power of opponents;
5. The peer pressure that reduces alternative views;
6. The self-censorship prevents them from expressing doubts;
7. The "mind guards" pointing to themselves;
8. The consistent illusions.

Based on the research of Janis, a lot of works related to groupthink were developed. Although later works had some criticism of Janis's theory above, the concept of groupthink has a huge impact on social and organizational psychology. Yetiv (2003) argued that under groupthink, policymakers try to merge other perspectives rather than calculate and consider decisions. Michelle, David and Jan (2019) discussed the issues about mental health nursing, and they suggested that groupthink occurs when certain members of the group influence group culture to a certain extent, such as when other people's views cannot be considered. This may mean that when the dominant members try to speak, they will take precedence over other members; at the same time disregarding others, ignoring the others’ opinions or automatically taking a negative position on others' views (Fernandez, 2007). Although groupthink has some shortcomings as a way of working, it sometimes provides powerful help for collective decision-making. Shirey (2012) explained that in the case where groupthink becomes a mode of operation, the group may encode limited data for discussion and decision-making, but further research has found that this can lead to the group to neglect the questioning assumptions, and ignore to use the “bigger picture” approach to seek expert advice or identify solutions that lead them to consider only choices. The following four factors may be the antecedents of groupthink: high cohesion, structural defects, contextual background, and time constraints (Janis, 1997; Shirey, 2012). Among these four factors, cohesion is considered to be the most influential and potentially dangerous premise in group thinking (Henningsen et al., 2006). Groupthink occurs not only in highly cohesive groups, but also in groups with false cohesive perceptions (Heinemann et al., 1994). There are also well-known cases in this real life. For example, groupthink was also interpreted as an important factor of failure for companies such as Enron and WorldCom, decisions related to the second Iraq war, and financial crisis that occurred in previous years. According to the US Senate Intelligence Committee (Newell & Lagnado, 2007), when the United States decided to invade Iraq, the policy makers did not explicitly consider the risks involved, and one of the important reasons for this result was group thinking. According to reports, the intelligence community collectively speculated that Iraq had a positive and growing plan for weapons of mass destruction, and explained many ambiguous evidences accordingly, and then used it as a collective instruction to invade Iraq. These examples show that group thinking is closely related to us. Group thinking invisibly influences decision makers from small things like people's daily life to world-class devastating wars, which proves the importance of this research in practical level.

It is also one of the purposes of this study to provide useful suggestions for reducing the negative impact of groupthink on decision accuracy under the condition of time pressure. In response to the four antecedents of the groupthink mentioned above, Shirey (2012) provides some strategies that may be applied to counter these antecedents. With active confrontation, there is a high probability that groupthink is prevented. To reduce the negative effects of high cohesion, Shirey (2012) pointed out that the attributes needed to determine group membership can be considered to ensure group diversity. It may also be useful to bring together multiple independent groups to solve a problem, or to divide an existing group into sub-groups to determine the pros and cons of the problem. In addition, it is helpful to involve individual panellists in critical assessment decisions (Michelle et al., 2019). In order to resolve structural faults, we can hire external professionals to manage the decision-making process, or consult with experts on relevant issues to find feasible alternatives; normative decision-making processes, leaders retaining views, and the rewards of “truth speakers” in groups are very helpful in resolving structural errors; at the same time, it may also have a positive impact to rotate the roles and responsibilities of group members (Shirey, 2012). Diversity is the key to organizational success because it provides a rich and useful diversity of ideas (Fernandez, 2007). A diverse group (such as background, professional and life experience) can generate collaborative, creative and entrepreneurial motivation when sharing personal opinions, and the diversity of ideas that such a group possess can provide an opportunity for dialectical discussion before action, and these processes help to avoid groupthink. Therefore, it is crucial for effective and productive decision making to encourage constructive input, evaluate alternatives at the appropriate level of agreement, and try to avoid one-dimensional thinking as a default position (Macleod, 2011).

## Time – limited case

Time-limited case studies are an attractive part of the collective decision-making field, and a large amount of research has been carried out in this area. In real life and the financial environment, we often don't have enough time to analyse and discuss the issues carefully, but the decisions made in these cases are sometimes important. Time pressure affects the performance on many cognitive tasks (Roskes et al., 2013). Sometimes we need to change the strategy of decision making because time pressure makes the time available to search and evaluate relevant information very limited (Park, Iyer & Smith, 1989).

As for the collective decision-making in the case of time pressure, Karau and Kelly (1992) proposed the Attentional Focus Model (AFM). The model shows that time pressure is very helpful for narrowing the focus of group members on key issues and tasks. As time pressure increases, the importance of features required to complete a task may increase relatively significantly, while features with lower correlation may decrease. In their next experiment (Karau & Kelly, 1999), they found that initial preferences were the main determinant of group decision making. The impact of time pressure on the quality of decision-making is related to the strength of the initial preference and the content of the group interaction. As time pressure increases, members are more likely to focus on task-related information in terms of task relevance. This is consistent with the resource allocation model of people under time pressure, which states that members no longer focus on information that is not related to each other (such as each other's appearance), but assign fairly consistent attention to information that they consider important (Baumann, 1998). This suggests that in addition to the indirect effects expected from the reduced social interactions observed in previous experiments (Karau and Kelly, 1992), time pressure has also a direct impact on the awareness of group members; The team may produce cautious and well evaluated decisions, taking into account the impact of time (Shirey, 2012). According to the AFM model, group members are more likely to focus on task-related information under time pressure, which may lead to increased group cohesion, which leads to groupthink more likely to occur, further affecting the accuracy of group decision making, and this is also the one of the aspects to be studied.

Maruping's field study (Maruping et al., 2015) of 111 project teams proved the importance of group leaders. Their research showed that the relationship between perceived time pressure and group performance was non-linear, which was regulated by the group's temporal leadership. Under the strong temporal leadership, the indirect impact of perceived time pressure on group performance is mostly positive, while under weak temporal leadership, the indirect impact is positive at low levels of perceived time pressure and negative at medium and high levels. Maule and Summers (2016) also studied the impact of leaders on collective decision making under time pressure conditions. Through experiments and field research, they found that leaders can adjust different strategies to adapt to time pressure; time pressure can induce higher levels of negative and positive effects, and can be evaluated as obstacles to reduce the quality of decision-making or challenges that are conducive to decision-making. However, whether the influence of groupthink on decision accuracy is related to the activities of temporal leaders in the decision-making process has not been studied, which will be included in the discussion of this paper. On the other hand, Bowman and Wittenbaum (2012) researched the impact of time pressure on team decision-making processes and performance. They designed some experiments in which members of three-person groups read information about two hypothetical cholesterol-lowering drugs and collectively chose the better drug under high or low time pressure. The results showed that low time pressure groups selected the better drug more frequently than high time pressure groups, especially when groups had access to information. Such results are inconsistent with the information mentioned in the AFM model (Karau and Kelly, 1992) that increased time pressures contribute to the increased interest of group members in useful information), from which we can speculate that despite the increasing attention of group members to useful information, there are still some other reasons leading to the greater negative effects of time pressure on group decision-making. The specific reasons for this will be analyzed in the experimental results of this paper.

# Overview and Predictions

Janis' groupthink theory and other previous studies provide the basic support for this research. The purpose of this research is to investigate how groupthink affects the accuracy of collective decision making when time is limited. Firstly, we aim to verify that groupthink is more likely to occur under time constraints, and this is achieved by validating the antecedents of the collective thinking mentioned in Janis' groupthink theory. Secondly, we wanted to prove that groupthink leads to the illusion of extreme risk adoption and unanimity, thus affecting the accuracy of collective decision-making. This question is tested by analyzing the experimental questionnaire data.

1. *Groupthink is more likely to happen under time pressure (leader, established procedure, cohesion and confidence to find alternative solution)*
2. *Groupthink lead to extreme risk taking because of the limited time.*
3. *Groupthink lead to illusion of unanimity that some members have no time to convince others.*

A same-sex trio was asked to act as a survivor of a plane crash in the desert, and they were asked to rank 15 useful items by importance to increase their chances of survival.

First, the participants were arranged to complete the sorting tasks independently, and all participants were given the same length of time in the process. The three participants were then asked to discuss the given problem and get the group’s unanimous results at the end of the discussion. We set different time pressure levels by controlling the duration of the group discussion, and we will investigate participants’ feelings of time pressure in the questionnaire at the end of the experiment to ensure the effectiveness of the control. There were pre - experiments before the start of the formal experiment, in order to find the most reasonable ranking task completion time for individuals and groups. At this most reasonable time, the participants would not feel that the time is not enough, or the time is too loose. On this basis, we adjusted the time to achieve the purpose of controlling the time pressure. After the instructions were completed, the researcher exited the room without any intervention in the discussion process. After the group discussion was completed, each participant was asked to fill out a questionnaire about the personal feelings and other related issues during the discussion. The task completion quality of individuals and groups is represented by their ranking result scores. The specific score algorithm formula is explained in detail in the next section.

# Method

## Participants and Design

Participants are 60 college students in Beijing University (30 males and 30 females) who are about to graduate with an aim to enter social work. In order to research the performance of participants under different time pressures and whether the test results are related to gender, the study employs a 3 × 2 between-groups design. Three time limits (according to the pre-experiment described later, the three time limits were set to: 10 minutes, 15 minutes, no time limit), and two gender compositions (groups of 3 women or 3 men) were used.

## Selection of task

Desert Survival Situation is a case study that is widely used to research collective decision making. It is often used to measure whether a team achieves synergy. In our study, it can demonstrate the quality of group decisions under time pressure quickly and objectively through score calculations, thus providing data supporting for further analysis to test our hypotheses.

Desert Survival Situation describes a scenario in which a flight just crashed in the Sonoran Desert in the southwestern United States around 10 o’clock in the morning on a mid-August day. Except for some items that can still be used that were salvaged from the aircraft, there are only barren desert environments around the survivors. Participants were asked to play roles as survivors, ranking the 15 items salvaged from the plane in order of importance to the survival of the team. (Details can be found in the "Desert Survival Activity" in the appendix)

## Pre-experiment

The purpose of the pre-experiment is to find the most reasonable time for task completion, which means the participants will not feel pressure due to lack of time, nor will they feel that the time is too redundant when they are required to complete the task within this given time.

Four groups of participants (two groups of men and two groups of women) participated in the pre-experiment. When they were required to complete the task of ranking 15 items in the Desert Survival Exercise alone, they were told that there was enough time to complete the form, but it should be as fast as possible. The table showing the time taken by the 12 participants to complete the sorting task is as follows:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Participant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Time (min) | 12 | 17 | 13 | 13 | 14 | 18 | 17 | 16 | 14 | 15 | 16 | 15 |

Table 1 Time to complete the task independently

As can be seen from Table 1, the most reasonable time to complete the sorting task alone is 15 minutes (mean=15, median=15).

The four groups of participants conducted the group discussion after completing the ranking task independently. They were asked to agree on the order of importance of the items within a certain period of time. Again, they were told that there was enough time to discuss and complete the form, but it should be as fast as possible. During their discussion, the researcher did not implement any intervention, but only recorded the time spent by each group from the start of the discussion to the end of the discussion. The table presenting the time spent by the four groups to complete the discussion and the form is as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | 1 | 2 | 3 | 4 |
| Time (min) | 17 | 18 | 25 | 19 |

Table 2 Time to complete the task by group discussion

As can be seen from Table 2, the most reasonable time for group discussion should be around 20 minutes (mean=19.75). In the formal experiment, the time pressure was set to three levels (low time pressure, high time pressure, no time pressure), and the artificial control of time pressure is based on the most reasonable discussion time in the pre-experiment, which is explained in detail below.

## Time pressure Manipulation

Time pressure manipulation is based on the results of pre-experiments. In order to divide the time pressure into three levels of high time pressure, low time pressure and no time pressure, we set the time limits for the group discussion to 10 minutes, 15 minutes and no time limit. At the same time, the question "To what extent do you feel the pressure of time?" was set in the questionnaire at the end of the experiment to confirm that the purpose of time pressure differentiation was achieved.

In the pre-experiment we found that participants tended to ignore subtle time-stress scenarios, so in addition to the necessary introductions about the situation, the following information was presented to the group under time pressure during the formal experiment:

*We would like to simulate the pressures felt under real desert survival scenarios. Therefore, we hope that you can imagine that you are a real member trapped in the desert because of an airplane accident., and the choice of your group will determine the chances of survival for the entire group. The desert environment is dangerous, so it makes sense for your team to come to a decision as quickly as possible.*

## Procedure

Participants volunteered to participate in a study called “Desert Survival Activity”, which was described as a study that participants should rank 15 items by importance to increase the likelihood of survival. Same-sex volunteers were randomly divided into eight groups (including eight groups of men and eight groups of women), three in each group. Three male trios were assigned to high-time stress conditions; three male trios were assigned to low-time stress conditions; the remaining two male trios were assigned to no-time stress conditions as control groups. The allocation process was random. The eight female trios were assigned in the same way as men.

Once the participants were seated, they were informed information about the entire experimental process, which explained that they would play the role being trapped in the desert because of a plane crash, and the main task was to rank the related items. They were told that they had the right to stop or withdraw at any time if they felt any discomfort before the start of the experiment and during the discussion. At the same time, the anonymity of participation and the confidentiality of experimental data were also guaranteed to participants. In order to prevent participants from losing patience during the experiment and affecting the results of the experiment, they were told that the whole process would last for about half an hour before the experiment started.

Each participant was given a piece of material detailing some of the practical information, the plane crash, the desert environment, and the resources available around. The document also described the task that the participants needed to accomplish, sorting out 15 items that had been salvaged from the wreckage of the aircraft. Participants were given 15 minutes to complete the sorting form independently and were told that they could not communicate with each other during the period.

When all the participants completed the personal sorting form, they began to enter the group discussion session. The groups assigned to the high time stress condition were given a discussion time of 10 minutes, while the groups assigned to the low time stress condition were given 15 minutes to discuss. The control groups did not have a time limit and were told that "you can spend enough time to discuss until the final result is reached." All the groups were told that "you should be rational and objective in your discussions, not be easily convinced by others, but you should not blindly stick to your own opinions; in addition, the decisions of you and your group are crucial to whether you can survive in the desert." Once the discussion began, the investigator no longer intervened in the discussion process until the end of the given discussion time. Finally, participants were asked to complete a questionnaire that included the participant's group number, gender, participants' perceptions during the discussion, and process recall. Then the participants are dismissed.

# Results

We collected individual and group rankings from 16 trio groups (including 8 male groups and 8 female groups), as well as the questionnaires. All questionnaire data were analysed at the group level. After presenting the manipulation checks, we organized the findings around the three hypotheses presented above. T-test and univariate analyses of variance (ANOVAs) were used to analyse the outcomes.

## Manipulation checks

The questions in the questionnaire completed by participants at the end of the experiment help us test the manipulation of time pressure. Participants were asked to report how much time pressure they felt . There were five dimensions: “1” for the least time pressured and “5” for the most time pressured. The table about comparison of group time pressures under different time limits is as follows:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 10 min | | | 15 min | | | No time limits | |
| male | 3.42 | 4.13 | 3.91 | 2.95 | 2.19 | 1.32 | 1.33 | 1.00 |
| female | 3.51 | 2.35 | 4.31 | 3.11 | 2.37 | 2.91 | 1.00 | 1.00 |

Table 3 Comparison of group time pressures under different time limits

As can be seen from the above table, participants under time-limited conditions did feel higher time pressure (M = 3.12) than participants who were under no time-limited conditions (M = 1.08), p-value < 0.001. Furthermore, the less time they were given, the greater the time pressure they felt (M = 3.61 and M = 2.48, p-value < 0.001). There was no difference between the male and female groups in the three conditions (10 min: M\_male = 3.82, M\_female = 3.39, p-value > 0.5; 15 min: M\_male = 2.15, M\_female = 2.80, p-value > 0.2; no time limits: M\_male = 1.17, M\_female = 1, p-value >0.4).

Participants were also asked how confident they were to convince others if there was no time limit from “1” (very little) to “5” (very much). Participants in high time pressure conditions showed significantly greater confidence (M = 3.83) than those who were under low time pressure conditions (M = 2.67) and without time stress conditions (M = 2.17) to convince other members in their groups (p-value < 0.001).

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Figure 1 Boxplot of confidence to convince other members in different time pressure

## Hypotheses testing

According to the AFM model, the outcome of a decision often depends on the content of the discussion (Karau and Kelly, 1997). Therefore, we present the findings related to hypotheses before the outcome of decisions.

### Hypothesis 1: Groupthink is more likely to happen under time pressure (leader, established procedure, cohesion and confidence to find alternative solution)

We judged whether groupthink occurred in a group discussion process based on the five antecedents of Janis' groupthink model. First, after the discussion began, the researchers no longer intervened, so the group was free to discuss, which means the discussion process was completely isolated, and there was no interference from the outside world. Second, the questionnaire data showed that 83.33% (10/12) of the groups under time pressure reported that leaders emerged during the discussion, while only 50% (2/4) of the teams without time pressure claimed that the leader appeared. According to the questionnaire data, these leaders either had a great influence on the team's views or dominate the team's decision-making process. The distribution of the two modes of influence showed no significant difference in the data. At the same time, three-quarters of the groups lacked effective rules or procedures to search and evaluate information during the discussion. We set up a question in the questionnaire that asked “To what extent do you think there is strong cohesion among your group members?” from “1” to “5” (“1” for the weakest cohesion and “5” for the strongest cohesion). Groups under time pressure reported significantly stronger cohesiveness (M = 3.67 for high time pressure groups; M = 3.05 for low time pressure groups) than groups without time stress (M = 2.28, p-value < 0.001). The confidence that looking for alternatives in the antecedents of groupthink model does not apply to the discussion used in this experiment. Therefore, we do not consider it as one of the criteria for judging whether groupthink is happening. The above data supports Janis's antecedent theory, so we can think that groupthink is more likely to occur under time pressure conditions.

### Hypothesis 2: Groupthink leads to extreme risk taking because of the limited time.

Janis suggested that one of the characteristics of groupthink is invulnerability, which leads groups to make more risky choices. In this experiment, we consider the option “trying to maximize the probability of being discovered, including signalling devices” as the riskiest option. 66.67% (4/6) of the teams in low time pressure and 33.33% (2/6) of the groups in high time pressure conditions selected this option, while 50% (2/4) who were in no time pressure conditions selected this option. The data here is not enough to support our hypothesis because the insufficient sample size leads it inappropriate to use ANOVA and there is no obvious contrast between the experimental groups. Furthermore, when asked “If there is no time limit (for example, you have time to rethink now), will you still stick to this choice?”, 66.67% (8/12, p < 0.1) of participants from the low time pressure group reported that they would not stick to the original choice, which means that time pressure has an impact on the decision-making of participants.

### Hypothesis 3: Groupthink leads to illusion of unanimity that some members have no time to convince others.

Under time pressure, people often choose to retain their opinions because of the task priority or the pressure from peers (Janis, 1972), which creates the illusion that all group members reach consensus on the final result. This phenomenon also occurred in this experiment. The final question in the questionnaire is "Do you still have objections to the final order given by your team?". The chi-square distribution is used to analyze the data obtained on this issue and we found that 69.44% (25/36, p-value < 0.01) of the participants under time pressure reported that they still disagreed with the final ranking of their groups after the discussion and 52% (13/25, p > 0.1) of the participants gave up their views because of time. In contrast, groups with no time pressure have significantly different answers on this issue. Only three of the 12 (p-value < 0.1) participants in no time limit condition were still dissatisfied with the team's final decision. This provides support for Hypothesis 3.

## Group decision quality

The quality of decision - making performance of individuals and teams was revealed by their scores, and the scores were calculated by the difference between their ranking and expert ranking. The detailed calculation formula is as follows:

The score calculated according to the above formula refers to the degree of deviation between individual or group decision and expert decision, which means the lower the score, the more accurate the decision.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | *High time pressure* | | *Low time pressure* | | *No time pressure* | |
|  | *Ave* | *Group* | *Ave* | *Group* | *Ave* | *Group* |
| *male* | 78.67 | 78 | 80 | 80 | 71.33 | 65 |
|  | 82.33 | 75 | 76.45 | 75 | 85.10 | 76 |
|  | 81.45 | 80 | 77.47 | 72 |  |  |
| *female* | 74.41 | 75 | 83.18 | 81 | 73.34 | 68 |
|  | 81.33 | 78 | 81.25 | 76 | 84.23 | 75 |
|  | 84.17 | 78 | 77.43 | 75 |  |  |

Table 4 individual and group ranking score in different time pressure condition

The individual and group ranking scores were analyzed by chi-square distribution. Since the chi-square distribution required that all the analyzed values were non-negative finite values, we filled the male and female data in no time limit condition with the average of the other two sets of data under the same pressure conditions. We found that there was no significant difference (χ2.1753, df = 10, p-value > 0.1) in the average individual scores of the groups, because the individual rankings were completed independently within a given 15 minutes , and the difference was caused by the individual, regardless of the time pressure. Under the three kinds of time pressure conditions, the group error scores were less than the average individual scores, and there was no significant difference between the male groups and the female groups (χ3.8223, df = 10, p-value > 0.1). What is different from our expectation is that the improvement of the accuracy of decision-making from individual to group was not related to the degree of time pressure. There was no significant difference between the group's performance under high time stress and the group under low time stress (M\_high = 77.33, M\_low = 76.50, p-value >0.1). However, the group error score was significantly lower than the average individual score when there was no time pressure ( M\_ave = 78.5, M\_group = 71.0, p-value < 0.1), which means that the decision accuracy was significantly improved. Groups under time stress generally performed better without time-limited groups, indicating that time pressure did have an impact on the quality of team tasks.

## Discussion

This study clearly demonstrates that groupthink is more likely to occur under time pressure, and the group is likely to choose the option with extreme risk. At the same time, due to time constraints, the illusion of consensus on the final decision of the team often occurs, therefore, the accuracy of team decision-making is affected. Groups under time-poor conditions did not perform better than groups with sufficient time, which was consistent with the findings of Karau and Kelly (1992) in this area, but our research goals were in time pressure conditions, so the control groups were set to have no time limit, thus impact of the appropriate discussion time and excess discussion time on the quality of team decision-making was not discussed in depth. For the same task, teamwork could greatly improve the accuracy of decision-making compared to individual completion quality, but the different time stress conditions had no significant effect on team performance in this experiment, which was different from our expectations. This may be related to the task we used in this experiment, because the outcome of the decision often depends on the content of the discussion (Karau and Kelly, 1997).

The probability of groupthink occurring under time pressure conditions is greater, and experimental data supported this view. On the one hand, time constraints made the leaders in the team appear quickly, so that team members could use limited time more effectively, such as quickly summarizing useful relevant information, and timely returning the deviating communication process (the exchange of irrelevant information) back on track, coordinating the allocation of tasks and mediate the contradiction of members. On the other hand, high cohesion is another cause of groupthink. Cohesiveness exhibited by group members increased as time pressure increased. Karau and Kelly (1992) suggested that due to the shortage of time, group members tended to pay more attention to the information related to the completion of tasks, while some irrelevant information such as other members’ appearance would be relatively ignored. Frequent communication and joint efforts for the target in a short period of time can bring more sense of belonging to the members, thus stronger team group cohesion is reflected. The tension caused by time pressure often makes it difficult for members to find the right rules to solve the problem in a short time. However, it is not good for team decision-making if there are no effective rules or procedures to help search and evaluate information. Commonly used rules include voting choices, majority obedience, unanimous consent, and who has the loudest voice. Some groups might use one or more rules on one or two sub-questions during discussions, but most of them did not systematically use the one that was most effective for searching for evaluation information, which greatly increased the probability of groupthink. Another cause of groupthink that Janis (1972) showed was that there was little or no confidence in finding alternative solutions for the proposed solution from leaders. This blind trust in the leaders or lack of confidence in oneself due to peer pressure made the alternative solution limited, so that the optimal solution could be missed. However, this antecedent was not involved in this experiment because the task content did not correspond.

Under time pressure, people are often considered to be more risk-averse rather than risk-seeking (Shors and Wood, 1995), because it is difficult to choose under time pressure, and they want to avoid picking up what they might regret later (Dhar and Nowlis, 1999). However, there is evidence that when the expected value (EV) for monetary gamble is positive, people under time pressure become risk-seeking (Dror, Busemeyer, & Basola, 1999). At the group level, Janis believed that the invulnerability of groupthink led groups to be more likely to pursue extreme risks. For the decisions made by the group, even if it leads to bad results, each participant only needs to bear a small part of the responsibility that is divided, so in this case they are more likely to risk seeking. Based on the data obtained from this experiment, the impact of time pressure on team risk seeking is not enough to be clearly displayed. One reason is that the risk option setting was artificial and could be biased; the other reason is that the small amount of data obtained from the insufficient samples was not enough to clearly display the qualitative relationship between variables.

Groupthink led to the illusion that team members agreed on the outcome of the discussion (Janis, 1972), and time pressure increased the chances of this illusion. Due to the scarcity of time, some members often choose to silence because the opinions of the majority differ from their own, in order to achieve the so-called avoidance of wasting time by unnecessary arguments; If there are members who disagree with others in this situation, their opinions will often be ignored directly. Another scenario is that the group may adopt decision rules that minority are subject to majority, while a few objections are forced to be retained. For each sub-question, some members are forced to obey the opinions of the majority, so the final decision made by the group is likely to be disapproved by most members, but because there is not enough time to carefully debate each sub-question, the final result is thus determined. When different from the group's point of view, group members are likely to change their minds because of time pressure, because there is a lack of time for careful thinking, and their attention is mostly concentrated on reaching the consensus conclusion as soon as possible, and will be easily convinced by the leader or other group members. When asked if there is enough time to convince other team members, a large number of people gave a positive answer, which also shows that groupthink caused by time pressure reduced the confidence of members in proposing alternative solutions.

# Conclusion

This study hypothesized and tested the mechanism by which groupthink affects the accuracy of group decisions under time-stress conditions, and obtained a lot of valuable information. Time pressure has a certain impact on the accuracy of group decisions. Teams in a time-critical situation can perform worse than those that have sufficient time to discuss. Moreover, Groupthink is more likely to occur under time pressure conditions. In the absence of outside intervention, compared to groups without time pressure, leaders will quickly emerge within groups under the time pressure to help the group decision-making process or unified views; at the same time, limited time promotes frequent communication and cooperation among team members, which enhances the cohesiveness between teams; and it is unrealistic to find suitable established procedures to search for information and evaluation programs in scarce time. According to Janis (1972)'s antecedent theory, groupthink is more likely to occur in the above conditions. The illusion of consensus by members often occurs in team decision-making scenarios. This kind of illusion is one of the shortcomings of groupthink, and time pressure makes this illusion appear more frequently, which is one of the reasons for the reduced accuracy of team decision-making under time shortage.

However, there are still some shortcomings in this study, and there are a number of limitations for future researchers to continue their efforts. An important aspect is the manipulation and testing of time pressure. This study was mainly to artificially set different discussion durations to control different levels of time pressure, and use the questionnaire at the end of the experiment to investigate the feedback of manipulation. Future research can use more objective manipulations, have a more scientific design of the time required for different decision-making content and different time pressure requirements, and try to avoid the bias caused by such recall feedback. On the other hand, the experiment in the form of a group discussion used in this study requires a larger sample size to obtain a more significant qualitative relationship between variables. The sample size currently used may bias the results when studying certain sub-problems (for example, whether groupthink leads the team to be more prone to extreme risk under time pressure). Moreover, since most of the relevant literature is currently only focused on qualitative relationships, future research can also focus on quantitative research on problems related to groupthink, which will be a new and valuable research field.

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# Appendix A Questionnaire

Dear Participant,

You are invited to participate in a research study from a graduate student at the University of Leeds titled “How can groupthink influence the quality of collective decision-making in a time-limited case?.” This questionnaire is anonymous and the data obtained will be used for academic purposes only. Your participation is completely voluntary, and you have the right to withdraw at any time. We will do our best to keep your participation confidential.

Thank you!

Group number:\_\_\_\_\_.

1. What’s your gender?

○Male ○Female

1. To what extent do you feel the pressure of time? (“1” for lowest time pressure and “5” for highest time pressure)

○1 ○2 ○3 ○4 ○5

1. Does a leader emerge or not during the discussion? (If you choose “Yes”, turn to question “4”; otherwise turn to question “6”)

○Yes ○No

1. How the leader exhibit this leadership?

○He / She has more influence on opinion decision.

○He / She has more influence on the process of decision making.

1. How much confidence do you have to convince others if time is not limited? (“1” for very few and “5” for very much)

○1 ○2 ○3 ○4 ○5

1. Is any rule or procedure used to reach a consensus during the discussion? (e.g. voting, majority, unanimity, he who shouts the loudest, etc.)

○Yes ○No

1. Did your group set objectives?

○Yes, we decided to stay put and wait to be rescued.

○Yes, we tried to increase the chances of staying alive by reducing the speed of dehydration.

○Yes, we tried to maximize the chances of being seen, including signaling devices.

○No, we didn’t set objectives.

1. If there is no time limit (for example, you have time to rethink now), will you still stick to this choice?

○Yes ○No

1. To what extent do you think there is strong cohesion among team members? (“1” for the weakest cohesion and “5” for the strongest cohesion)

○1 ○2 ○3 ○4 ○5

1. Is your initial ranking consistent with your group's final ranking? (If you choose “yes”, turn to question “11”; otherwise turn to question “10”)

○Yes ○No

1. What is the reason for your change of ranking?

○Time pressure ○Other reasons

1. Do you still have objections to the final order given by the team?

○Yes ○No

# Appendix B Instrument for Experimental Research

**Desert Survival Activity**

Please read the following situation and then rank all the items in terms of their importance, giving 1 to the most important and 15 to the least important. Do this individually, without discussing with anyone else.

**THE SITUATION**

It is approximately 10.00am in mid August and you have just crash-landed in the Sonora Desert in south western USA. The light twinned engine plane, containing the bodies of the pilot and co-pilot, has completely burned out. Only the frame remains. None of the rest of you has been injured

The pilot was unable to notify anyone of your position before the crash. However, he had indicated before impact that you were 70 miles south-west from a mining camp which is the nearest known habitation, and that you were approximately 65 miles off the course that was filed in your VFR flight plan.

The immediate area is quite flat and except for occasional barrel and saguaro cacti, appears to be rather barren. The last weather report indicated that the temperature would reach 110 degrees Fahrenheit, which means that the temperature at ground level will be around 130 degrees. You are dressed in lightweight clothing – short sleeved shirts, lightweight trousers, socks and shoes. Everyone has a handkerchief. Collectively, your pockets contain $2.83 in change, $85.00 in notes, a pack of cigarettes and a ball point pen.

**YOUR TASK**

Before the plane caught fire your group was able to salvage the 15 items listed. Your task is to rank these items according to their importance for survival, starting with ‘1’ for the most important to ‘15’ for the least important. You must rank all items.

You may assume:

* The number of survivors is the same as the number of people in your team
* You are the actual people in the situation
* The team has agreed to stick together
* All items are in good condition

Step 1: Please rank the importance of each item given your current situation. Do not discuss the situation or problem with anyone else until you have finished the ranking.

**ITEMS**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Your ranking  *(do this individually)* | Group ranking | Expert ranking |
| Flashlight (4 battery size) |  |  |  |
| Jack-knife |  |  |  |
| Sectional air map |  |  |  |
| Plastic raincoat (large size) |  |  |  |
| Magnetic compass |  |  |  |
| Compress kit with gauze |  |  |  |
| .45 calibre pistol (loaded) |  |  |  |
| Parachute (red & white) |  |  |  |
| Bottle of salt tablets (1,000) |  |  |  |
| 2 pints of water per person |  |  |  |
| Book entitled ‘Edible animals of the desert’ |  |  |  |
| A pair of sunglasses per person |  |  |  |
| 4 pints of 180 proof vodka |  |  |  |
| 1 top coat per person |  |  |  |
| A cosmetic mirror |  |  |  |

Please **DO NOT** discuss this exercise until instructed to do so.

Thank you.

# Appendix C Data Analysis Script

[insert any script used for analysing data]

URL for uploaded data